

# MATHEMATICS A

Paper 4HR

2015 — Winter 2019

|            |                                         |          |
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**1** - (4MA0-S 2015-Paper 4HR-Q2) - *NUMBER*

The distance from Kyoto to Hakata is 638 kilometres.

The train journey from Kyoto to Hakata takes 2 hours 45 minutes.

Work out the average speed, in kilometres per hour, of the train from Kyoto to Hakata.

..... km/h

**(Total for Question 1 is 3 marks)**



2 - (4MA0-S 2015-Paper 4HR-Q3) - NUMBER

Amit invests 15 000 rupees.

At the end of one year, his investment has increased by  $7\frac{1}{2}\%$

(a) Work out the value of Amit's investment at the end of one year.

..... rupees  
(2)

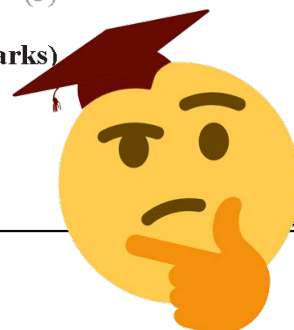
Priya invests a sum of money at an interest rate of 8% per year.

At the end of one year, the interest she receives is 1800 rupees.

(b) Work out the value of Priya's investment at the end of one year.

..... rupees  
(3)

(Total for Question is 5 marks)



**3** - (4MA0-S 2015-Paper 4HR-Q8) - *NUMBER*

Flaky pastry is made using flour and fat in the ratio 9:7 by weight.  
Cassie makes some flaky pastry.  
She uses 175 grams of fat.

(a) Work out the weight of flour Cassie uses.

..... grams  
(2)





Sweet pastry is made using flour, fat and sugar in the ratio 27:14:9 by weight.

Luke makes some sweet pastry.

The total weight of flour, fat and sugar he uses is 400 grams.

(b) Work out the weight of flour Luke uses.

..... grams

(2)

Elisha makes some flaky pastry and some sweet pastry.

She uses the same weight of flour for the flaky pastry as she does for the sweet pastry.

(c) Work out the ratio of the weight of fat she uses in the flaky pastry to the weight of fat she uses in the sweet pastry.

.....  
(2)

(Total for Question is 6 marks)



4 - (4MA0-S 2015-Paper 4HR-Q14) - NUMBER

$V$  is inversely proportional to the square of  $t$

$V = 28$  when  $t = 2.5$

(a) Express  $V$  in terms of  $t$

.....  
(3)

(b) Work out the value of  $V$  when  $t = 6.25$

$V =$  .....  
(2)

(Total for Question is 5 marks)



5 - (4MA0-W 2015-Paper 4HR-Q1) - *NUMBER*

Eric travels from the UK to India every year.

In 2010, the exchange rate was £1 = 67.1 rupees.

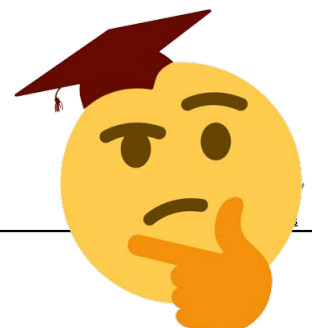
In 2012, the exchange rate was £1 = 82.5 rupees.

In 2010 Eric changed £600 into rupees.

How many pounds (£) did Eric have to change to rupees in 2012 to get the same number of rupees as he did in 2010?

£ .....

(Total for Question is 3 marks)



6 - (4MA0-W 2015-Paper 4HR-Q5) - NUMBER

Here are some rows of a number pattern.

| Row number | Column 1         | Column 2 | Column 3 |
|------------|------------------|----------|----------|
| 1          | $1 \times 3 + 1$ | 4        | $2^2$    |
| 2          | $2 \times 4 + 1$ | 9        | $3^2$    |
| 3          | $3 \times 5 + 1$ | 16       | $4^2$    |
| ⋮          |                  |          |          |
|            |                  | 676      |          |
| ⋮          |                  |          |          |
| $n$        |                  |          |          |

(a) Write down the Row number of the row that has 676 in Column 2

.....  
(1)

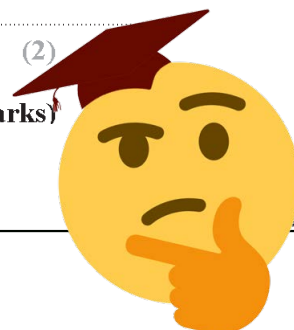
(b) For Row number  $n$ ,

(i) write down an expression, in terms of  $n$ , that should go in Column 1

.....  
(ii) write down an expression, in terms of  $n$ , that should go in Column 3

.....  
(2)

(Total for Question is 3 marks)



7 - (4MA0-W 2015-Paper 4HR-Q8) - *NUMBER*

- (a) Write 224 as a product of powers of its prime factors.  
Show your working clearly.

.....  
(3)

- (b) Write down 3 **different** factors of 224 with a sum between 99 and 110

.....  
(2)

(Total for Question is 5 marks)



8 - (4MA0-S 2016-Paper 4HR-Q3) - NUMBER

There were 2.1 million people living in Dubai in 2013  
1.75 million of these people were not born in Dubai.

- (a) Work out 1.75 as a percentage of 2.1  
Give your answer correct to 1 decimal place.

..... %  
(2)

The unit of currency in Dubai is the dirham.  
The exchange rate is £1 = 5.52 dirham.

The cost of a pair of running shoes in Dubai is 343 dirham.  
The cost of an identical pair of running shoes in the UK is £54.99

The pair of running shoes is more expensive in Dubai than in the UK.

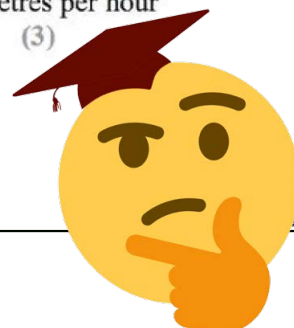
- (b) How much more expensive?  
Give your answer to the nearest dirham.

..... dirham  
(3)

A plane flies a distance of 5522 km from London to Abu Dhabi in 7 hours 24 minutes.

- (c) Work out the average speed of the plane.  
Give your answer in kilometres per hour, correct to 3 significant figures.

..... kilometres per hour  
(3)



9 - (4MA0-S 2016-Paper 4HR-Q8) - NUMBER

Louis makes a model of a plane.

The wingspan of the model is 50 centimetres.

The wingspan of the real plane is 80 metres.

- (a) Work out the scale of the model.  
Give your answer in the form 1:  $n$

1: .....  
(2)

The length of the real plane is 72 metres.

- (b) Work out the length of the model.  
Give your answer in centimetres.

..... centimetres  
(2)



10 - (4MA0-S 2016-Paper 4HR-Q13) - *NUMBER*

(a) Write 250 000 in standard form.

.....  
(1)

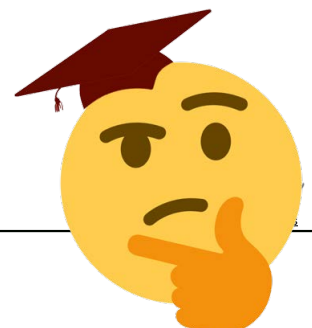
The radius of the planet Jupiter is  $6.99 \times 10^7$  metres.

The radius of the Earth is  $6.37 \times 10^6$  metres.

The volume of Jupiter is  $k$  times the volume of the Earth.

(b) Assuming that both planets are spheres, calculate the value of  $k$ .  
Give your answer correct to 3 significant figures.

.....  
(3)





11 - (4MA0-W 2016-Paper 4HR-Q1) - NUMBER

Here is a list of ingredients needed to make 16 cookies.

| Ingredients for 16 cookies |
|----------------------------|
| 120 g butter               |
| 150 g sugar                |
| 240 g flour                |
| 170 g chocolate            |
| 1 egg                      |

Max wants to make 40 cookies.

(a) How much flour does Max need?

..... g  
(2)

Abby made cookies to sell at a school fair.  
She used 600 g of butter.

(b) How many cookies did she make?

.....  
(2)

(c) Find the ratio of the weight of sugar to the weight of flour in the list of ingredients.  
Give your answer in the form 1:  $n$

1 : .....  
(2)

(Total for Question 11 is 6 marks)



**12** - (4MA0-W 2016-Paper 4HR-Q3) - *NUMBER*

Show that  $\frac{3}{4} + \frac{4}{5} = 1\frac{11}{20}$

(Total for Question is 2 marks)



**13** - (4MA0-W 2016-Paper 4HR-Q8) - *NUMBER*

Ying eats some yoghurt.

The yoghurt contains 192 mg of calcium.

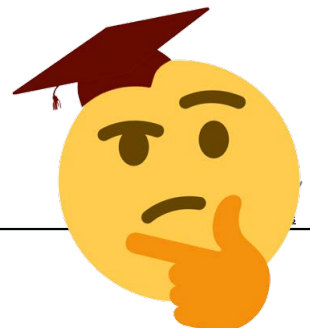
This is 16% of the total amount of calcium that Ying should have each day.

Work out the total amount of calcium that Ying should have each day.



..... mg

(Total for Question 13 is 3 marks)



**14** - (4MA0-W 2016-Paper 4HR-Q9) - *NUMBER*

A plane flew from Bogotá to Quito.

The distance the plane flew was 725 km.

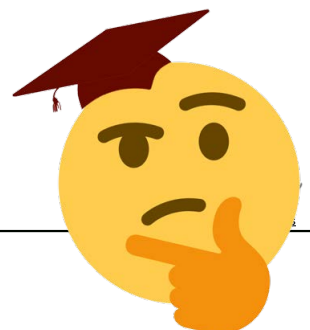
The time taken by the plane was 1 hour 24 minutes.

Work out the average speed of the plane.

Give your answer correct to 3 significant figures.

..... km/h

**(Total for Question is 3 marks)**



15 - (4MA0-W 2016-Paper 4HR-Q10) - NUMBER

The table gives the surface areas, in square kilometres, of five seas.

| Sea               | Surface area in square kilometres |
|-------------------|-----------------------------------|
| Mediterranean Sea | $2.97 \times 10^6$                |
| East China Sea    | $1.25 \times 10^6$                |
| Baltic Sea        | $4.22 \times 10^5$                |
| Red Sea           | $4.38 \times 10^5$                |
| Okhotsk Sea       | $1.59 \times 10^6$                |

- (a) Write  $1.59 \times 10^6$  as an ordinary number.

.....  
(1)

- (b) Work out the difference, in square kilometres, between the largest surface area and the smallest surface area for these five seas.  
Give your answer in standard form.

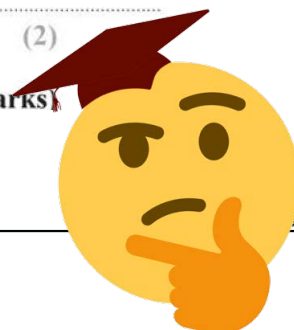
..... km<sup>2</sup>  
(2)

The surface area of the East China Sea is  $k$  times the surface area of the Baltic Sea.

- (c) Work out the value of  $k$ .  
Give your answer to the nearest whole number.

$k =$  .....  
(2)

(Total for Question ... is 5 marks)



**16** - (4MA0-W 2016-Paper 4HR-Q15) - *NUMBER*

Use algebra to show that the recurring decimal  $0.2\dot{6} = \frac{4}{15}$

(Total for Question is 2 marks)



17 - (4MA0-W 2016-Paper 4HR-Q16) - NUMBER

$Q$  is inversely proportional to  $t^2$

$Q = 320$  when  $t = 0.5$

Find a formula for  $Q$  in terms of  $t$

.....  
(Total for Question    is 3 marks)



**18** - (4MA0-S 2017-Paper 4HR-Q1) - *NUMBER*

Here is a list of ingredients to make 12 chocolate cupcakes.

**Chocolate cupcakes**

Ingredients for **12** cupcakes

110 g butter

100 g sugar

75 g flour

25 g cocoa

2 eggs

James wants to make exactly 30 cupcakes.

(a) How much butter does James need?

..... g  
(2)

Sophie made some chocolate cupcakes for a party.  
She used 375 g of sugar.

(b) How many cupcakes did Sophie make?

.....  
(2)





**19** - (4MA0-S 2017-Paper 4HR-Q3) - *NUMBER*

(a) Work out the value of  $\frac{17.7 \times 5.8}{\sqrt{3.4 + 5.3}}$

Write down all the figures on your calculator display.

.....  
(2)

(b) Give your answer to part (a) correct to 3 significant figures.

.....  
(1)



**20** - (4MA0-S 2017-Paper 4HR-Q10) - *NUMBER*

$2.2 \times 10^7$  passengers passed through Beijing Capital International Airport in 2014.

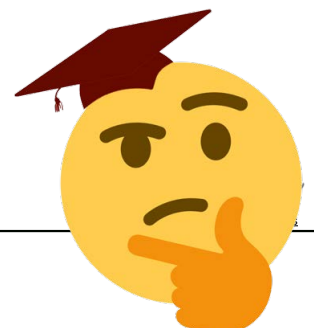
(a) Write  $2.2 \times 10^7$  as an ordinary number.

.....  
(1)

950 000 tonnes of cargo traffic passed through Tokyo International Airport in 2014.

(b) Write 950 000 as a number in standard form.

.....  
(1)



**21** - (4MA0-S 2017-Paper 4HR-Q11) - *NUMBER*

Mabintou invested \$7500 for 3 years at 4% per year compound interest.

Calculate the value of her investment at the end of 3 years.

\$ .....

**3 marks**



22 - (4MA0-W 2017-Paper 4HR-Q1) - NUMBER

Here is a list of ingredients for making 24 Rocky Road Crunchy Bars.

**Rocky Road Crunchy Bars**

Ingredients for 24 bars

|               |              |
|---------------|--------------|
| 125 grams     | butter       |
| 300 grams     | chocolate    |
| 3 tablespoons | syrup        |
| 200 grams     | biscuits     |
| 100 grams     | marshmallows |
| 2 teaspoons   | icing sugar  |

Silvester wants to make 30 Rocky Road Crunchy Bars.

(a) Work out the amount of marshmallows he needs.

..... grams  
(2)

Nigella makes some Rocky Road Crunchy Bars.

She uses 850 grams of chocolate.

(b) Work out the number of Rocky Road Crunchy Bars she makes.

.....  
(2)

(Total for Question is 4 marks)



**23** - (4MA0-W 2017-Paper 4HR-Q3) - *NUMBER*

In a sale, normal prices are reduced by 35%  
The normal price of a bed is \$1200

Work out the sale price of the bed.

\$ .....

(Total for Question is 3 marks)



24 - (4MA0-W 2017-Paper 4HR-Q10) - NUMBER

$$m = 3^4 \times 5^3$$

$$n = 3^3 \times 5^2 \times 11$$

(a) Find the Lowest Common Multiple (LCM) of  $m$  and  $n$ .

.....  
(2)

(b) Find the Highest Common Factor (HCF) of  $5m$  and  $3n$ .

.....  
(2)

(Total for Question is 4 marks)



**25** - (4MA0-S 2018-Paper 4HR-Q4) - *NUMBER*

Charlotte earns £8.50 per hour.

She gets a pay rise of 6%

Work out how much Charlotte earns per hour after her pay rise.

£ .....

(Total for Question is 3 marks)



**26** - (4MA0-S 2018-Paper 4HR-Q6) - *NUMBER*

A plane flew from Sydney to Wellington.

The distance the plane flew was 2240 km.

The average speed of the plane was 805 km/h.

Work out the time taken by the plane to fly from Sydney to Wellington.

Give your answer in hours and minutes, correct to the nearest minute.

..... hours ..... minutes





**27** - (4MA0-S 2018-Paper 4HR-Q10) - *NUMBER*

- (a) Write 280 as a product of its prime factors.  
Show your working clearly.

.....  
(3)

- (b) Find the Highest Common Factor (HCF) of 280 and 630

.....  
(2)



**28** - (4MA0-S 2018-Paper 4HR-Q13) - *NUMBER*

(a) Write 0.000 037 in standard form.

.....  
(1)

(b) Write  $234 \times 10^7$  in standard form.

.....  
(1)

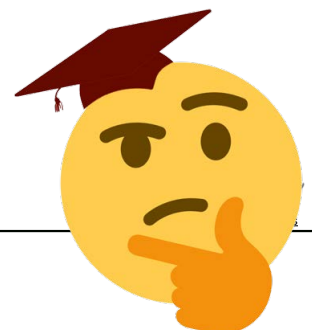
The population of China is  $1.4 \times 10^9$

The population of Morocco is  $3.5 \times 10^7$

The population of China is  $k$  times the population of Morocco.

(c) Work out the value of  $k$ .

.....  
(2)



**29** - (4MA0-S 2018-Paper 4HR-Q20) - *NUMBER*

Use algebra to show that the recurring decimal  $0.2\dot{7}\dot{8} = \frac{46}{165}$

(Total for Question is 2 marks)



**30** - (4MA0-S 2018-Paper 4HR-Q25) - *NUMBER*

A box is in the shape of a cube of side 11.5 cm, correct to 1 decimal place.

A solid spherical ball has radius 5.1 cm, correct to the nearest millimetre.

The ball is placed inside the box and the box is closed.

Work out the upper bound for the volume of the box that is **not** occupied by the ball.

Use  $\pi = 3.142$

Show your working clearly.

Give your answer correct to the nearest whole number.

.....cm<sup>3</sup>

(Total for Question . is 4 marks)



**31** - (4MA0-W 2018-Paper 4HR-Q1) - *NUMBER*

In a sale, normal prices are reduced by 12%

The normal price of a shirt is \$36

(a) Work out the sale price of the shirt.

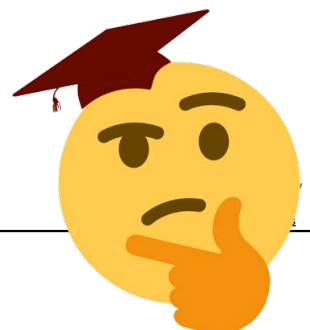
\$.....  
(3)

180 items were sold in the sale.

81 of these items were shirts.

(b) Express the number of shirts sold as a percentage of the number of items sold in the sale.

.....%  
(2)



**32** - (4MA0-W 2018-Paper 4HR-Q4) - *NUMBER*

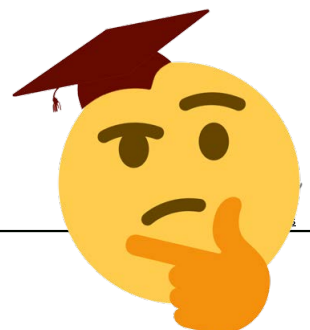
A bag contains only red marbles and green marbles.

The bag contains a total of 400 marbles.

The ratio of the number of red marbles to the number of green marbles is 5 : 3

How many more red marbles are there than green marbles in the bag?

.....  
(Total for Question is 3 marks)



**33** - (4MA0-W 2018-Paper 4HR-Q9) - *NUMBER*

$$1426 = 2 \times 23 \times 31$$

(i) Find all the factors of 1426

.....  
(3)

(ii) Write 713 as a product of its prime factors.

.....  
(1)



34 - (4MA0-W 2018-Paper 4HR-Q10) - NUMBER

The table gives information about the population of four countries in 2016

| Country        | Population         |
|----------------|--------------------|
| China          | $1.38 \times 10^9$ |
| India          | $1.32 \times 10^9$ |
| United Kingdom | $6.50 \times 10^7$ |
| United States  | $3.24 \times 10^8$ |

- (a) Write  $3.24 \times 10^8$  as an ordinary number.

.....  
(1)

- (b) Which of the four countries had the least population in 2016?

.....  
(1)

- (c) Work out the total population of all four countries.  
Give your answer in standard form.

.....  
(2)

The population of Delhi in 2016 was  $1.87 \times 10^7$

In 2016, the ratio of the population of Delhi to the population of India was  $1 : n$

- (d) Find the value of  $n$ .  
Give your answer correct to 2 significant figures.

.....  
(2)





**35** - (4MA0-W 2018-Paper 4HR-Q18) - *NUMBER*

$ABCD$  is a rectangle.

The perimeter of  $ABCD$  is 64 cm, correct to the nearest centimetre.

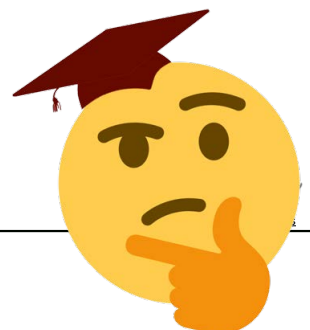
$AB = 17$  cm, correct to the nearest centimetre.

Calculate the lower bound of the length of  $AD$ .

Show your working clearly.

.....cm

(Total for Question    is 3 marks)



36 - (4MA0-W 2019-Paper 4HR-Q1) - NUMBER

Yulia normally lives in Russia.  
She buys a car in Cyprus.

The cost of the car is 15 400 euros.

The exchange rate is 1 euro = 63.21 Russian rubles.

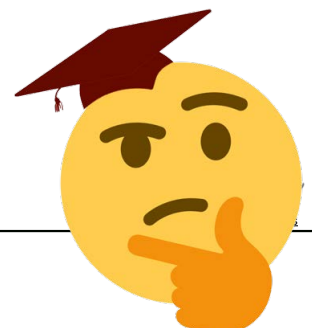
(a) Change 15 400 euros into Russian rubles.

Russian rubles  
(2)

The cost of insuring the car is 240 euros.

(b) Express 240 as a percentage of 15 400  
Give your answer correct to 2 decimal places.

(2) %



**37** - (4MA0-W 2019-Paper 4HR-Q3) - *NUMBER*

An aeroplane takes 11 hours 40 minutes to fly from London to Mauritius.  
The aeroplane flies a distance of 9720 kilometres.

Work out the average speed of the aeroplane.  
Give your answer in kilometres per hour, correct to the nearest whole number.

kilometres per hour



**38** - (4MA0-W 2019-Paper 4HR-Q4) - *NUMBER*

The length of a car is 472 centimetres.

Mikhail makes a scale model of the car using a scale of 1 : 20

(a) Work out the length of the scale model.

centimetres  
(2)

Alis makes a scale model of a bus.

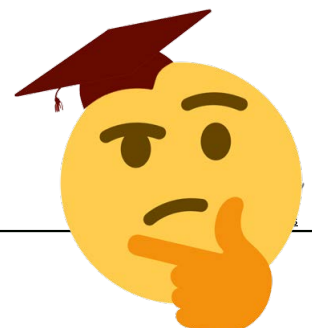
The length of the real bus is 10.8 metres.

The length of the scale model is 60 centimetres.

Alis uses a scale of 1 :  $n$  where  $n$  is a whole number.

(b) Find the value of  $n$ .

$n =$   
(3)



**39** - (4MA0-W 2019-Paper 4HR-Q7) - *NUMBER*

Show that  $2\frac{1}{4} \times \frac{5}{6} = 1\frac{7}{8}$



**40** - (4MA0-W 2019-Paper 4HR-Q9) - *NUMBER*

Eugenia bought 120 watches at 50 dollars each.

She sold  $\frac{3}{4}$  of the watches at 80 dollars each.

She then sold all the remaining watches at 40 dollars each.

Work out her percentage profit.

%



1 - (4MA0-S 2015-Paper 4HR-Q9) - ALGEBRA

(a) Expand  $5(2p - 3)$

.....  
(1)

(b) Solve the inequality  $9 - 2x < 3$

.....  
(2)

(c)  $y = x^3 - kx + 5$

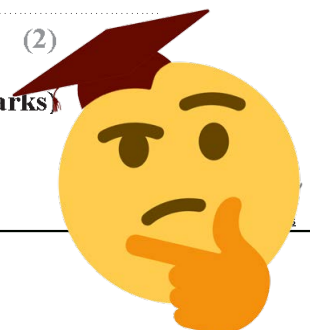
Work out the value of  $k$  when  $y = 6$  and  $x = -2$

$k =$  .....  
(3)

(d) Solve  $\frac{1}{f+2} = 3$

$f =$  .....  
(2)

(Total for Question 1 is 8 marks)



2 - (4MA0-S 2015-Paper 4HR-Q19) - ALGEBRA

$$\frac{1}{5^3} = 5^p \quad 1 = 5^q \quad \sqrt{5^3} = 5^r$$

(a) Write down the value of

(i)  $p$ 

$$p = \dots\dots\dots$$

(ii)  $q$ 

$$q = \dots\dots\dots$$

(iii)  $r$ 

$$r = \dots\dots\dots$$

(3)

(b) Show that  $\frac{14}{\sqrt{245}} = \frac{2\sqrt{5}}{5}$ 

You must write down each stage of your working.

(2)

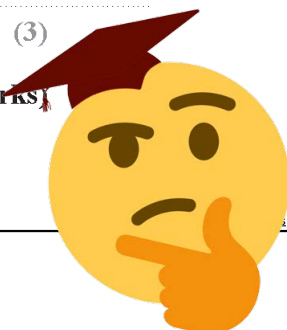
 $(e - 2\sqrt{3})^2 = f - 20\sqrt{3}$  where  $e$  and  $f$  are integers.(c) Find the value of  $e$  and the value of  $f$ 

$$e = \dots\dots\dots$$

$$f = \dots\dots\dots$$

(3)

(Total for Question is 8 marks)





**3** - (4MA0-W 2015-Paper 4HR-Q4) - ALGEBRA

Solve  $x + 2y = 3$

$$x - y = 6$$

Show clear algebraic working.

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

**(Total for Question is 3 marks)**



4 - (4MA0-W 2015-Paper 4HR-Q11) - ALGEBRA

$$t^n = \frac{1}{t^3}$$

(a) Write down the value of  $n$ .

$$n = \dots\dots\dots (1)$$

(b) Simplify  $\frac{6xy^5}{3xy^2}$

$$\dots\dots\dots (2)$$

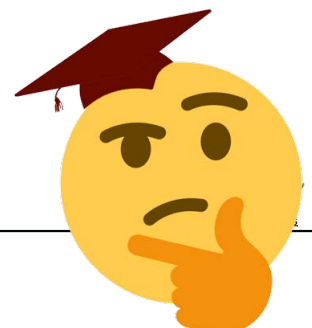
(c) Expand and simplify  $(3x - 2y)(x + 2y)$

$$\dots\dots\dots (2)$$

(d) Factorise  $4x^2 - 7x - 2$

$$\dots\dots\dots (2)$$

(Total for Question is 7 marks)



5 - (4MA0-W 2015-Paper 4HR-Q12) - ALGEBRA

$$I = kT^4$$

$$k = 5.67 \times 10^{-8}$$

$$T = 5800$$

(a) Work out the value of  $I$ .

Give your answer in standard form correct to 3 significant figures.

$$I = \dots\dots\dots$$

(2)

(b) Rearrange the formula  $I = kT^4$  to make  $T$  the subject.

$$\dots\dots\dots$$

(2)

(Total for Question    is 4 marks)



6 - (4MA0-W 2015-Paper 4HR-Q14) - ALGEBRA

(a) Solve  $x^2 - 4x - 1 = 0$

Show your working clearly.

Give your solutions correct to 3 significant figures.

.....  
(3)

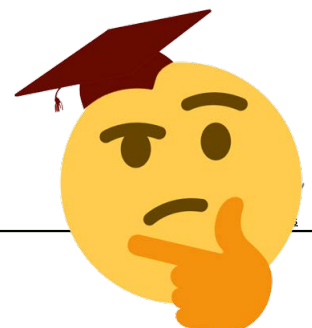
Hence, or otherwise,

(b) solve  $(x + 3)^2 - 4(x + 3) - 1 = 0$

giving your solutions correct to 3 significant figures.

.....  
(1)

(Total for Question is 4 marks)



7 - (4MA0-W 2015-Paper 4HR-Q17) - ALGEBRA

(a) Show that  $(3 + 2\sqrt{2})(4 - \sqrt{2}) = 8 + 5\sqrt{2}$

Show your working clearly.

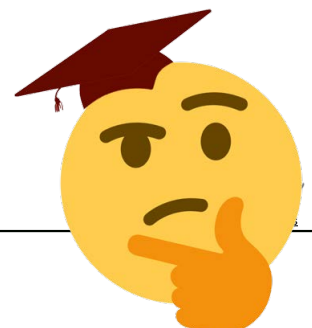
(2)

(b) Rationalise the denominator and simplify fully  $\frac{10 + 3\sqrt{2}}{\sqrt{2}}$

Show your working clearly.

.....  
(2)

(Total for Question is 4 marks)



8 - (4MA0-W 2015-Paper 4HR-Q20) - ALGEBRA

(a) Factorise  $4x^2 - 1$

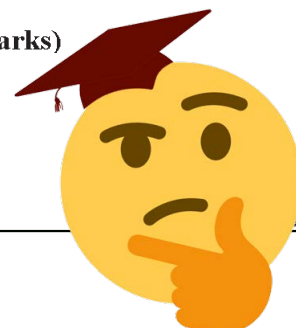
(b) Solve  $\frac{4}{2x+1} + \frac{1}{4x^2-1} = 3$

Show clear algebraic working.

.....  
(2)

.....  
(4)

(Total for Question is 6 marks)



9 - (4MA0-S 2016-Paper 4HR-Q2) - ALGEBRA

- (a) Solve  $6t - 5 = 2t + 9$   
Show clear algebraic working.

$$t = \frac{\dots\dots\dots}{(3)}$$

- (b) Expand and simplify  $3(2y + 2) + 2(y - 4)$

$$\frac{\dots\dots\dots}{(2)}$$

- (c) Simplify fully  $4wxy \div (8xy)$

$$\frac{\dots\dots\dots}{(2)}$$



**10** - (4MA0-S 2016-Paper 4HR-Q10) - ALGEBRA

Solve  $4x + 3y = 6$

$$3x + 5y = -1$$

Show clear algebraic working.

$x =$  .....

$y =$  .....

**4 marks**





11 - (4MA0-S 2016-Paper 4HR-Q14) - ALGEBRA

(a) Solve  $2y + \frac{2-3y}{4} = \frac{1}{4}$

Show clear algebraic working.

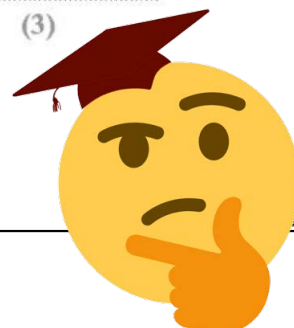
$y = \dots\dots\dots$   
(3)

(b) Factorise  $3x^2 - 8x - 3$

$\dots\dots\dots$   
(2)

(c) Expand and simplify  $4x(x+3) - (2x-3)^2$

$\dots\dots\dots$   
(3)



**12** - (4MA0-S 2016-Paper 4HR-Q16) - ALGEBRA

Solve  $2x^2 - 6x + 3 = 0$

Give your solutions correct to 3 significant figures.  
Show your working clearly.

**3 marks**



13 - (4MA0-S 2016-Paper 4HR-Q21) - ALGEBRA

$$y = at^2 - 2at$$

$$x = 2a\sqrt{t}$$

Express  $y$  in terms of  $x$  and  $a$ .

Give your answer in the form

$$y = \frac{x^p}{ma^3} - \frac{x^q}{na}$$

where  $p$ ,  $q$ ,  $m$  and  $n$  are integers.

4 marks



**14** - (4MA0-W 2016-Paper 4HR-Q6) - ALGEBRA(a) Simplify  $x^7 \times x^2$ 

---

  
(1)(b) Simplify  $y^9 \div y^3$ 

---

  
(1)(c) Expand and simplify  $4(2d + 3) - 2(3d - 5)$ 

---

  
(2)(d) Solve  $9y - 3 = 5y + 2$  $y =$  

---

  
(2)(e) Solve  $\frac{7x - 1}{5} = x$ 

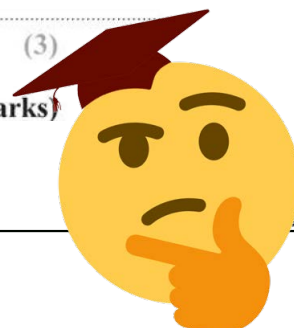
Show clear algebraic working.

 $x =$  

---

  
(3)

(Total for Question is 9 marks)



**15** - (4MA0-W 2016-Paper 4HR-Q12) - *ALGEBRA*

Simplify fully  $(2x + 3)^2 - (2x - 3)^2$

.....  
(Total for Question    is 3 marks)



**16** - (4MA0-W 2016-Paper 4HR-Q19) - *ALGEBRA*

Make  $g$  the subject of  $3e + 4g = 7 + 9eg$

.....  
(Total for Question    is 3 marks)



17 - (4MA0-W 2016-Paper 4HR-Q20) - ALGEBRA

Express  $\frac{3}{x+2} - \frac{6}{2x+5}$  as a single fraction.

Simplify your answer.

(Total for Question \_ is 3 marks)



**18** - (4MA0-W 2016-Paper 4HR-Q22) - ALGEBRA

$$(a + \sqrt{b})^2 = 49 + 12\sqrt{b} \quad \text{where } a \text{ and } b \text{ are integers, and } b \text{ is prime.}$$

Find the value of  $a$  and the value of  $b$

$a =$  .....

$b =$  .....

(Total for Question    is 3 marks)





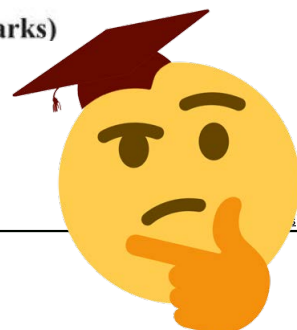
**19** - (4MA0-W 2016-Paper 4HR-Q24) - ALGEBRA

Solve the simultaneous equations

$$\begin{aligned}y &= 3x + 2 \\ x^2 + y^2 &= 20\end{aligned}$$

Show clear algebraic working.

(Total for Question is 6 marks)



20 - (4MA0-S 2017-Paper 4HR-Q4) - ALGEBRA

The diagram shows a cuboid and a triangular prism.

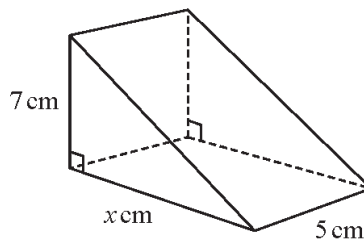
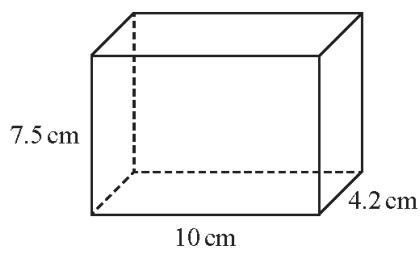
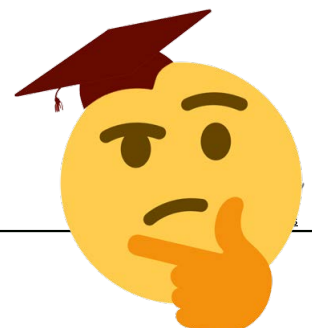


Diagram **NOT**  
accurately drawn

The volume of the cuboid is equal to the volume of the triangular prism.

Work out the value of  $x$ .

.....  
**4 marks)**



**21** - (4MA0-S 2017-Paper 4HR-Q5) - ALGEBRA

(a) Expand  $4(3 - 7c)$

.....  
(1)

(b) Factorise  $y^2 + 8y$

.....  
(1)

(c) Expand and simplify  $(x + 7)(x - 3)$

.....  
(2)

(d) Solve  $5p - 9 = 3p$

$p =$  .....  
(2)

(e) Simplify  $y^7 \times y^4$

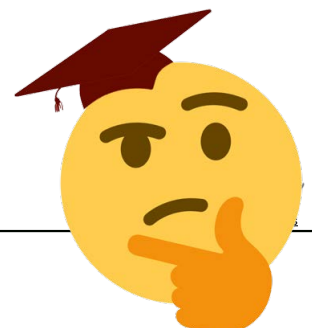
.....  
(1)

(f) Simplify  $h^{12} \div h^4$

.....  
(1)

(g) Simplify  $(e^5)^3$

.....  
(1)

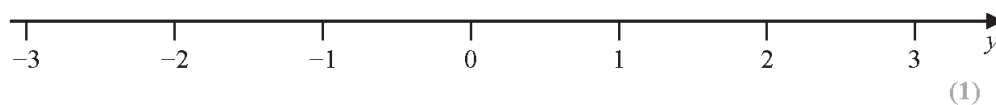


22 - (4MA0-S 2017-Paper 4HR-Q7) - ALGEBRA

(a) Solve the inequality  $4x + 13 \geq 27$

.....  
(2)

(b) On the number line, represent the inequality  $y \geq -1$



$n$  is an integer.

(c) Write down all the values of  $n$  that satisfy  $-3 < n \leq 2$

.....  
(2)



**23** - (4MA0-S 2017-Paper 4HR-Q9) - ALGEBRA

Solve the simultaneous equations.

$$5x - 2y = 9.5$$

$$4x + 2y = 13$$

Show clear algebraic working.

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

**3 marks)**



**24** - (4MA0-S 2017-Paper 4HR-Q14) - ALGEBRA

Solve  $\frac{5-x}{2} - \frac{x-1}{3} = 1$

Show clear algebraic working.

4 marks)



**25** - (4MA0-S 2017-Paper 4HR-Q17) - ALGEBRA

Solve  $11x^2 - 3x - 5 = 0$

Show your working clearly.

Give your solutions correct to 2 decimal places.

.....  
**3 marks)**



**26** - (4MA0-S 2017-Paper 4HR-Q18) - ALGEBRA

$A$  is directly proportional to  $x^2$

$A = 480$  when  $x = 5$

Find the value of  $A$  when  $x = 1.5$

.....  
**3 marks)**





**27** - (4MA0-S 2017-Paper 4HR-Q23) - ALGEBRA

$$t = \frac{v - u}{a}$$

$v = 27.3$  correct to 3 significant figures.

$u = 18$  correct to 2 significant figures.

$a = 9.81$  correct to 3 significant figures.

Work out the lower bound for the value of  $t$ .

Show your working clearly.

Give your answer correct to 3 significant figures.

.....  
(3 marks)



28 - (4MA0-W 2017-Paper 4HR-Q7) - ALGEBRA

(a) Expand  $3(4p + 5)$ 

(1)

(b) Factorise  $6r + 14$ 

(1)

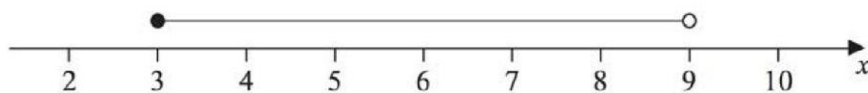
(c) Work out the value of  $y^2 - 3y$  when  $y = -5$ 

(2)

(d) Simplify  $\frac{w^5 \times w^8}{w^4}$ 

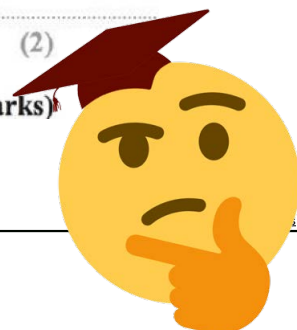
(2)

(e) Write down the inequality shown on the number line.



(2)

(Total for Question is 8 marks)



29 - (4MA0-W 2017-Paper 4HR-Q13) - ALGEBRA

$P$  is inversely proportional to the square of  $q$ .

When  $q = 2$ ,  $P = 12.8$

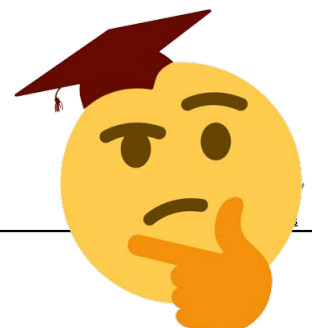
(a) Find a formula for  $P$  in terms of  $q$ .

.....  
(3)

(b) Find the value of  $P$  when  $q = 8$

.....  
(1)

(Total for Question is 4 marks)



30 - (4MA0-W 2017-Paper 4HR-Q15) - ALGEBRA

(a) Factorise  $y^2 - 2y - 48$

.....  
(2)

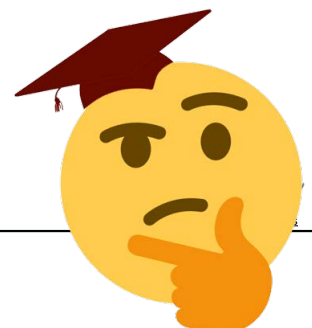
(b) Solve  $\frac{4}{e-3} = 5$

$e =$  .....  
(2)

(c) Simplify fully  $\frac{3}{x+1} - \frac{2}{x-1}$

.....  
(3)

(Total for Question is 7 marks)



31 - (4MA0-W 2017-Paper 4HR-Q20) - ALGEBRA

$$(3 + \sqrt{c})(2\sqrt{c} - 3) = 1 + k\sqrt{c}$$

where  $c$  and  $k$  are prime numbers.

(a) Find the value of  $c$  and the value of  $k$ .

$$c = \dots\dots\dots k = \dots\dots\dots$$

(3)

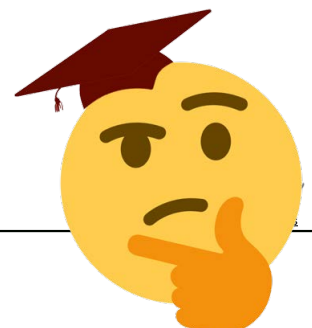
$$p^m = \frac{1}{p \times \sqrt[3]{p^2}}$$

(b) Find the value of  $m$ .

$$m = \dots\dots\dots$$

(3)

(Total for Question    is 6 marks)



**32** - (4MA0-S 2018-Paper 4HR-Q7) - ALGEBRA

Solve the simultaneous equations

$$\begin{aligned}y &= 4x \\ 7x - y &= -13.5\end{aligned}$$

Show clear algebraic working.

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

(Total for Question is 3 marks)



**33** - (4MA0-S 2018-Paper 4HR-Q9) - ALGEBRA(a) Simplify  $(3a^2b^4)^3$ 

.....  
(2)

(b) Expand and simplify  $4(g - 2h) + 5(2g - 3h)$ 

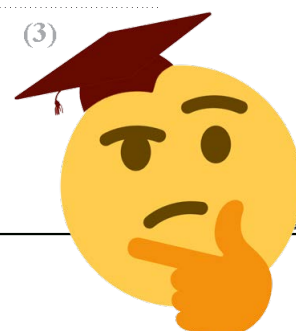
.....  
(2)

(c) Expand and simplify  $(y - 7)(y + 5)$ 

.....  
(2)

(d) Solve the inequalities  $-5 \leq 2p + 3 < 13$ 

.....  
(3)



**34** - (4MA0-S 2018-Paper 4HR-Q12) - ALGEBRA

Solve  $\frac{5x - 2}{3} + \frac{3 - 5x}{4} = 2$

Show clear algebraic working.

$x = \dots\dots\dots$

(Total for Question    is 4 marks)





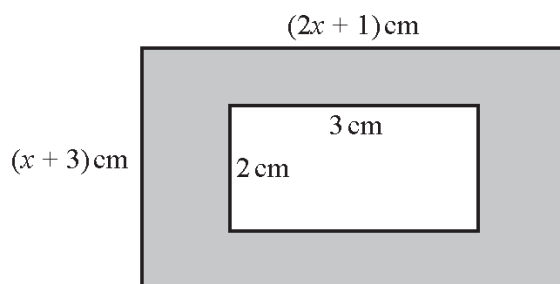
**35** - (4MA0-S 2018-Paper 4HR-Q16) - ALGEBRA

Make  $w$  the subject of the formula  $p = \sqrt{\frac{w+4}{w-2}}$

.....  
(Total for Question is 4 marks)



36 - (4MA0-S 2018-Paper 4HR-Q19) - ALGEBRA

Diagram **NOT**  
accurately drawn

The diagram shows a rectangular piece of card with length  $(2x + 1)$  cm and width  $(x + 3)$  cm.

A rectangle of length 3 cm and width 2 cm is cut out of the card.

The area of card that remains, shown shaded in the diagram, is  $45 \text{ cm}^2$

(a) Show that  $2x^2 + 7x - 48 = 0$

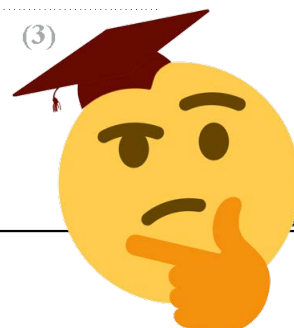
(2)

(b) Find the value of  $x$ .

Show your working clearly.

Give your value of  $x$  correct to 3 significant figures.

(3)



**37** - (4MA0-S 2018-Paper 4HR-Q21) - ALGEBRA

Express  $\frac{x+3}{x-4} - \frac{x+4}{x-3}$  as a single fraction.

Simplify your answer.

.....  
(Total for Question    is 3 marks)



**38** - (4MA0-S 2018-Paper 4HR-Q22) - ALGEBRA

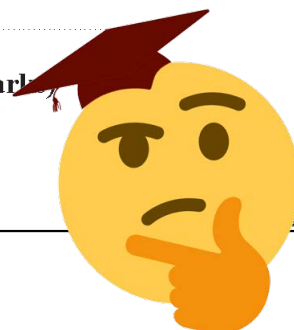
$$\frac{5^{n^2}}{5^6} \times \frac{5^{n^2-5n}}{5^3} = 125 \text{ where } n > 0$$

Work out the value of  $n$ .

Show clear algebraic working.

$n = \dots\dots\dots$

(Total for Question is 5 marks)



39 - (4MA0-W 2018-Paper 4HR-Q7) - ALGEBRA

(a) Factorise  $4ab + 7a^2 - a$

(2)

(b) Solve the inequality  $4 - 8p > 11$

(2)

(c) Expand and simplify  $(x + 3)(x - 6)$

(2)

(d) Simplify  $\frac{y^{12}}{y^4}$

(1)

(e) Simplify  $(3e)^2$

(2)



40 - (4MA0-W 2018-Paper 4HR-Q11) - ALGEBRA

(a) Simplify  $2a^3b^4 \times 4a^2b^5$

$$c^k = \frac{1}{\sqrt[4]{c^2}}$$

(b) Work out the value of  $k$

(c) Simplify fully  $\frac{4(x+2)^2}{6(x+2)}$

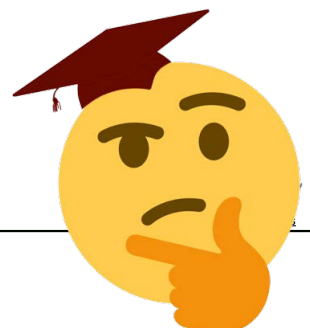
(d) Factorise completely  $3x^2 - 75y^2$

(2)

(2)

(2)

(2)



**41** - (4MA0-W 2018-Paper 4HR-Q14) - ALGEBRA

$P$  is directly proportional to the square of  $Q$ .

$P = 180$  when  $Q = 12$

(a) Find a formula for  $P$  in terms of  $Q$ .

.....  
(3)

(b) Find the value of  $P$  when  $Q = 30$

$P =$  .....  
(1)



**42** - (4MA0-W 2018-Paper 4HR-Q19) - ALGEBRA

The four angles, in degrees, of quadrilateral  $ABCD$  are

$$\text{angle } A = (x^2 - 105)$$

$$\text{angle } B = (x^2 - 65)$$

$$\text{angle } C = (470 - 30x)$$

$$\text{angle } D = (510 - 30x)$$

Show that  $ABCD$  is a trapezium.

Show clear algebraic working.

(Total for Question is 6 marks)





43 - (4MA0-W 2019-Paper 4HR-Q5) - ALGEBRA

- (a) Solve  $5x - 2 = x + 8$   
Show clear algebraic working.

$$x = \quad (3)$$

- (b) Factorise  $3t - 5ty$

(1)

- (c) Simplify  $k^5 \times k$

(1)

- (d) Simplify  $\frac{5}{2h} - \frac{1}{h}$

Give your answer as a single fraction in its simplest form.

(2)



**44** - (4MA0-W 2019-Paper 4HR-Q11) - ALGEBRA

The first four terms of a sequence are

11      21      31      41

(a) Write down an expression, in terms of  $n$ , for the  $n$ th term of the sequence.

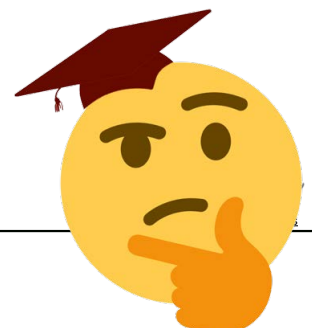
(2)

(b) Factorise  $x^2 - 7x + 6$

(2)

(c) Expand and simplify  $(2e - 3f)(3e - 4f)$

(2)



**45** - (4MA0-W 2019-Paper 4HR-Q16) - *ALGEBRA*

Solve the inequality  $2x^2 - 32 < 0$   
Show clear algebraic working.



**46** - (4MA0-W 2019-Paper 4HR-Q19) - *ALGEBRA*

Solve the simultaneous equations

$$y = 8 - 2x$$

$$x^2 + y^2 = 29$$

Show clear algebraic working.



47 - (4MA0-W 2019-Paper 4HR-Q20) - ALGEBRA

Find the value of  $n$  such that  $4^n \times 8^{n+1} = 16$   
Show clear algebraic working.

$n =$



48 - (4MA0-W 2019-Paper 4HR-Q22) - ALGEBRA

$$a = 2x + 1$$

$$b = 3x - 2$$

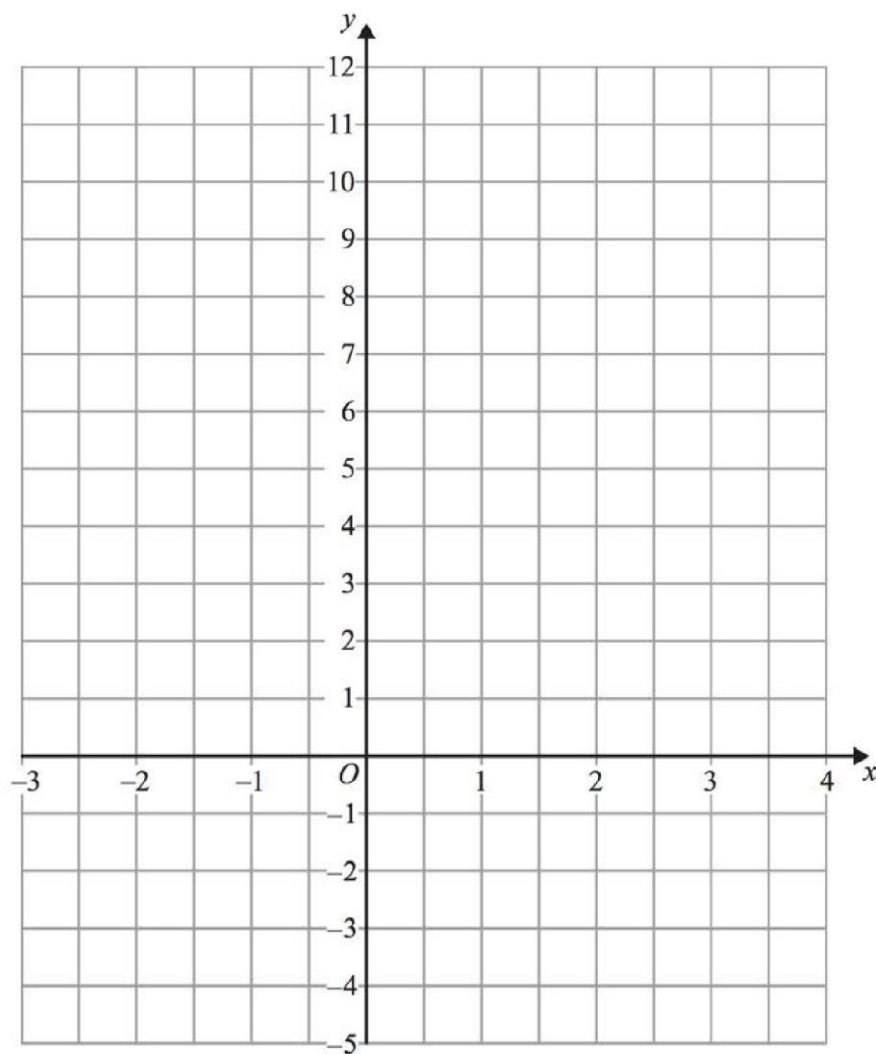
$$c = x - 1$$

Express  $1 - \frac{a + \frac{1}{b}}{a + \frac{1}{c}}$  in the form  $\frac{1}{px^2 + qx}$  where  $p$  and  $q$  are integers.



1 - (4MA0-S 2015-Paper 4HR-Q4) - FUNCTIONS & GRAPHS

(a) On the grid, draw the graph of  $y = 3x + 2$  for values of  $x$  from  $-2$  to  $3$



(3)

(b) Mark with a cross (×) a point on the grid that satisfies both the inequalities

$$x > 2 \text{ and } y > 3x + 2$$

Label this point  $P$ .

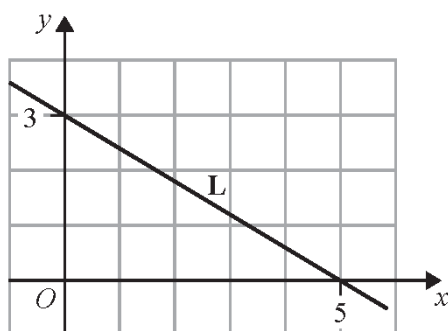
(2)

(Total for Question is 5 marks)



2 - (4MA0-S 2015-Paper 4HR-Q12) - *FUNCTIONS & GRAPHS*

The straight line **L** is shown on the grid.



Find an equation of **L**.

.....  
(Total for Question    is 3 marks)





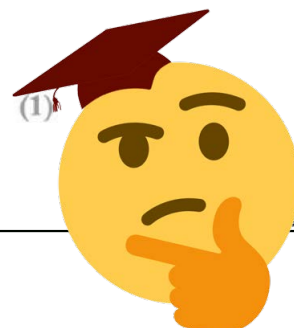
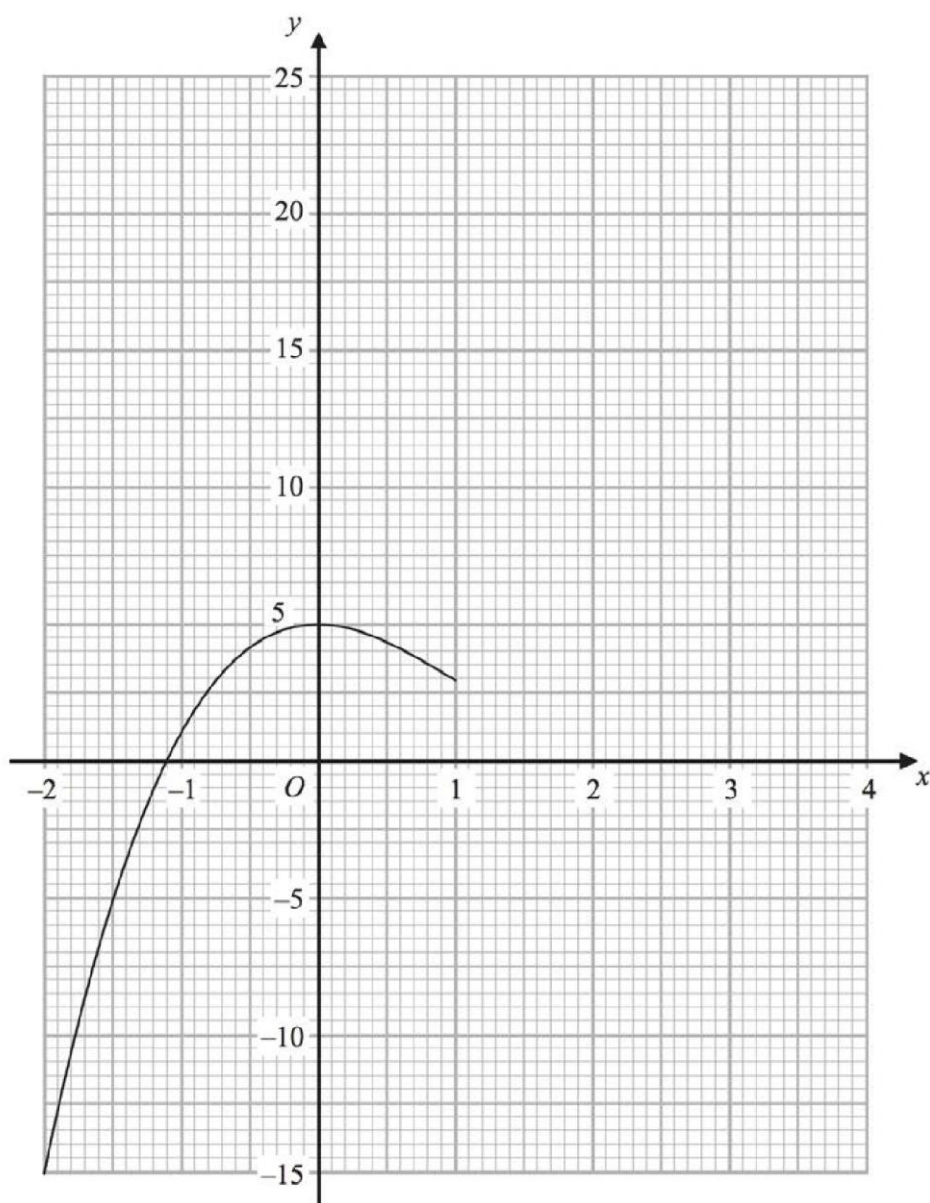
3 - (4MA0-S 2015-Paper 4HR-Q15) - FUNCTIONS & GRAPHS

(a) Complete the table of values for  $y = x^3 - 3x^2 + 5$

|     |     |    |   |   |   |   |   |
|-----|-----|----|---|---|---|---|---|
| $x$ | -2  | -1 | 0 | 1 | 2 | 3 | 4 |
| $y$ | -15 | 1  | 5 | 3 |   |   |   |

(1)

(b) On the grid, complete the graph of  $y = x^3 - 3x^2 + 5$  for  $-2 \leq x \leq 4$



(c) Use the graph to find an estimate for the solution of the equation  $x^3 - 3x^2 + 5 = 0$

$x = \dots\dots\dots$   
(1)

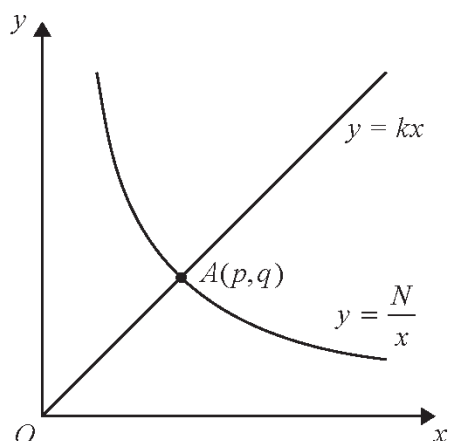
(d) By drawing a suitable straight line on the grid, find an estimate for the solution of the equation  $x^3 - 3x^2 + 2x + 4 = 0$

$x = \dots\dots\dots$   
(3)

**(Total for Question is 6 marks)**



4 - (4MA0-W 2015-Paper 4HR-Q19) - FUNCTIONS &amp; GRAPHS



The diagram shows the straight line with equation  $y = kx$  intersecting the curve with equation  $y = \frac{N}{x}$  at the point  $A(p, q)$ .

(a) Find  $p$  and find  $q$ .

Give each answer in its simplest form, in terms of  $k$  and  $N$ .

$$p = \dots\dots\dots$$

$$q = \dots\dots\dots$$

(3)

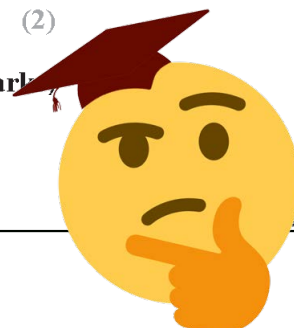
Given that  $p = 2q$

(b) find the value of  $k$ .

$$k = \dots\dots\dots$$

(2)

(Total for Question is 5 marks)

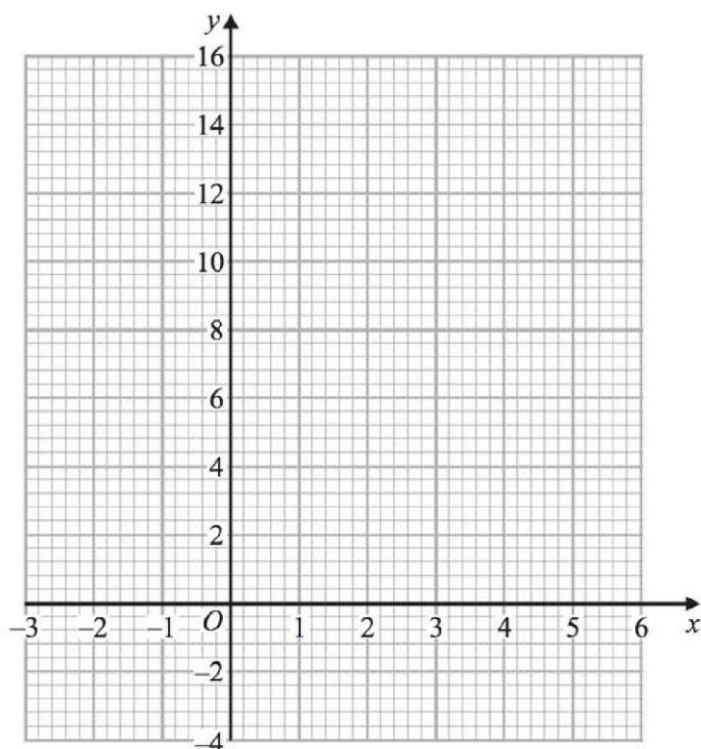


5 - (4MA0-S 2016-Paper 4HR-Q5) - FUNCTIONS &amp; GRAPHS

(a) Complete the table of values for  $y = x^2 - 4x + 2$ 

|     |    |    |   |   |   |    |   |   |
|-----|----|----|---|---|---|----|---|---|
| $x$ | -2 | -1 | 0 | 1 | 2 | 3  | 4 | 5 |
| $y$ | 14 |    | 2 |   |   | -1 | 2 |   |

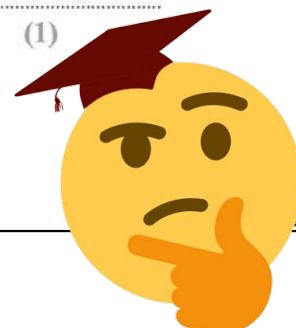
(2)

(b) On the grid, draw the graph of  $y = x^2 - 4x + 2$  for values of  $x$  from -2 to 5

(2)

The point  $P(k, 4)$  where  $k > 0$  lies on the graph of  $y = x^2 - 4x + 2$ (c) Use your graph to find an estimate for the value of  $k$ .

(1)

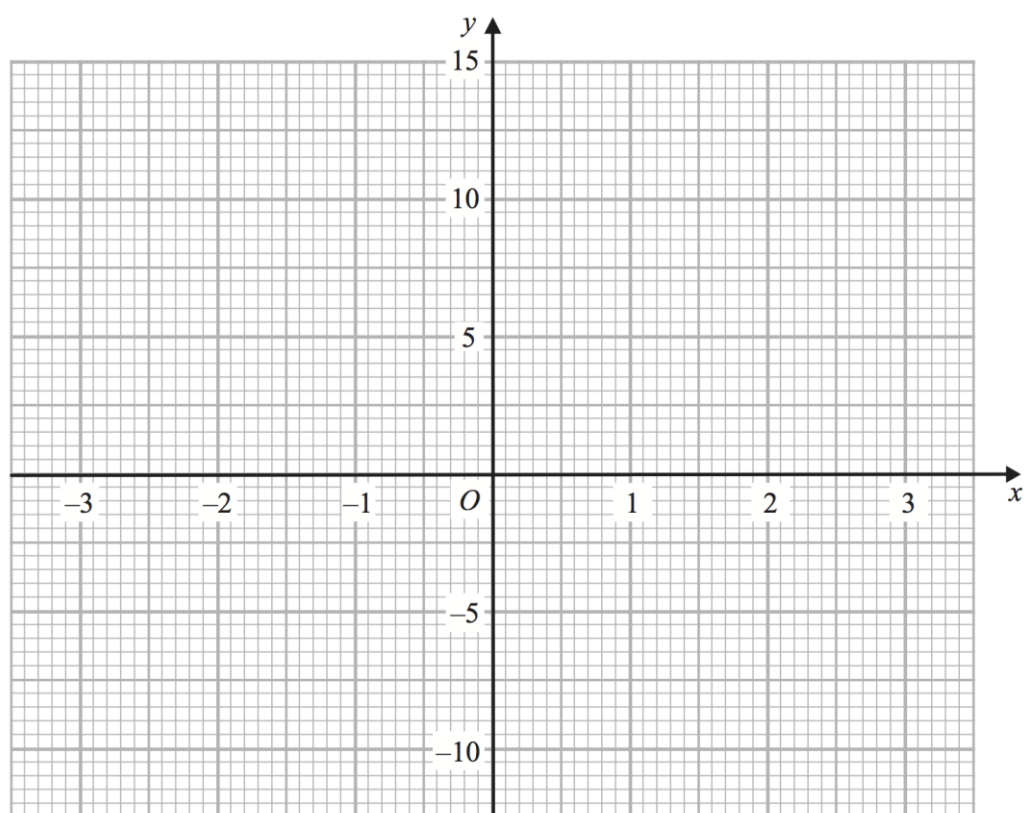


6 - (4MA0-W 2016-Paper 4HR-Q14) - FUNCTIONS &amp; GRAPHS

(a) Complete the table of values for  $y = x^3 - 5x + 2$ 

|     |    |    |    |   |    |   |    |
|-----|----|----|----|---|----|---|----|
| $x$ | -3 | -2 | -1 | 0 | 1  | 2 | 3  |
| $y$ |    | 4  |    |   | -2 |   | 14 |

(2)

(b) On the grid, draw the graph of  $y = x^3 - 5x + 2$  for  $-3 \leq x \leq 3$ 

(2)



The equation  $x^3 - 6x + m = 0$ , where  $m$  is an integer, has one negative solution and two positive solutions.

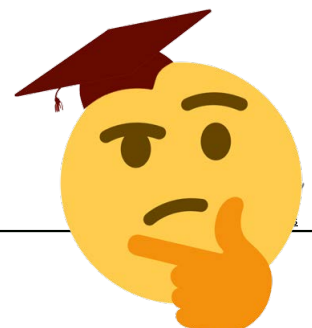
(c) Given that  $x = 1$  is one of the positive solutions, show that  $m = 5$

(1)

(d) By drawing a suitable straight line on the grid, find an estimate for the negative solution of  $x^3 - 6x + 5 = 0$   
Give your estimate to 1 decimal place.

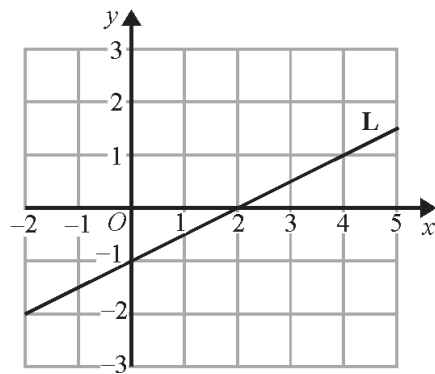
(2)

(Total for Question is 7 marks)



7 - (4MA0-S 2017-Paper 4HR-Q12) - FUNCTIONS & GRAPHS

The straight line **L** is shown on the grid.

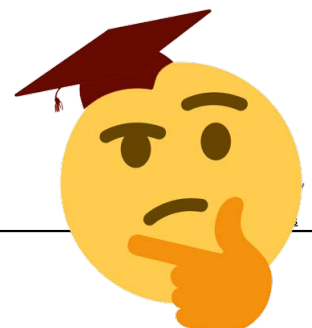


(a) Find an equation of **L**.

.....  
(2)

(b) Find an equation of the line that is parallel to **L** and passes through the point (5, 4)

.....  
(2)



8 - (4MA0-S 2017-Paper 4HR-Q20) - *FUNCTIONS & GRAPHS*

The functions  $f$  and  $g$  are such that

$$f(x) = \frac{1}{x+5} \quad \text{and} \quad g(x) = 2x + 3$$

(a) State which value of  $x$  must be excluded from any domain of  $f$ .

.....  
(1)

(b) Find  $g(10)$

.....  
(1)

(c) Calculate  $gf(-7)$

.....  
(2)

(d) Express the inverse function  $g^{-1}$  in the form  $g^{-1}(x) = \dots$

$$g^{-1}(x) = \dots \dots \dots$$

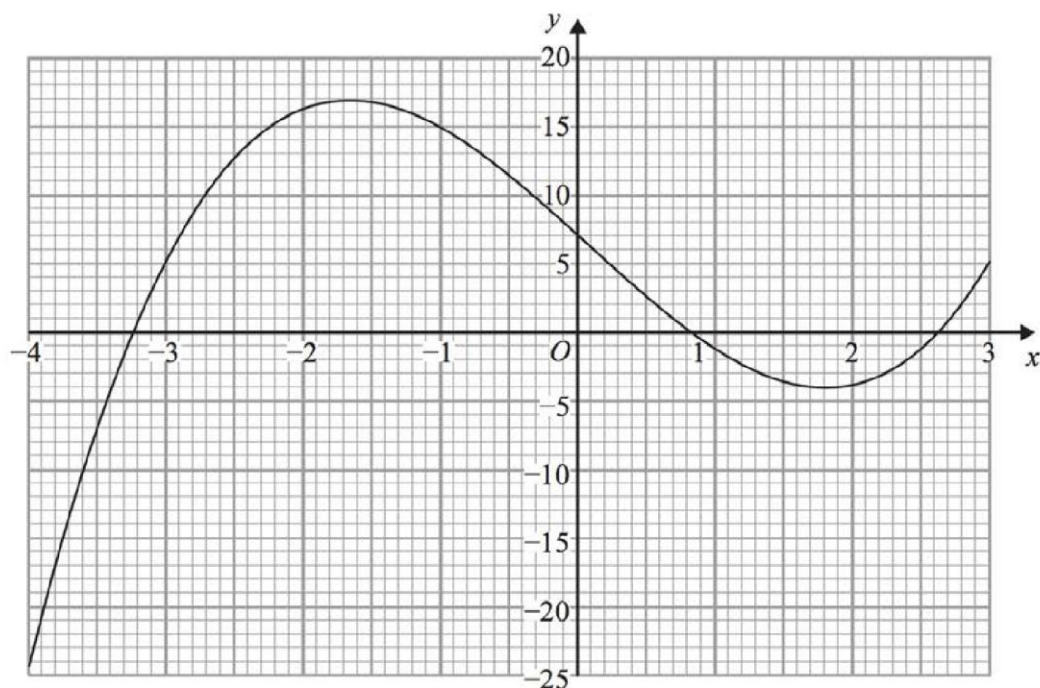
(2)





9 - (4MA0-W 2017-Paper 4HR-Q18) - FUNCTIONS & GRAPHS

Here is the graph of  $y = x^3 - 0.2x^2 - 9x + 7$  for  $-4 \leq x \leq 3$



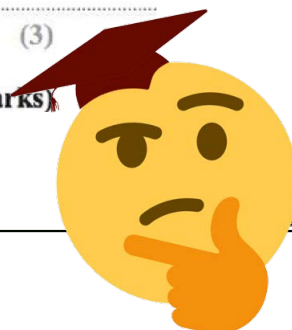
- (a) Use the graph to find an estimate for the solution of the equation  $x^3 - 0.2x^2 - 9x + 7 = -5$

.....  
(2)

- (b) By drawing a suitable straight line on the grid, find an estimate for the solution of the equation  $x^3 - 0.2x^2 - 4x + 7 = 0$

.....  
(3)

(Total for Question is 5 marks)



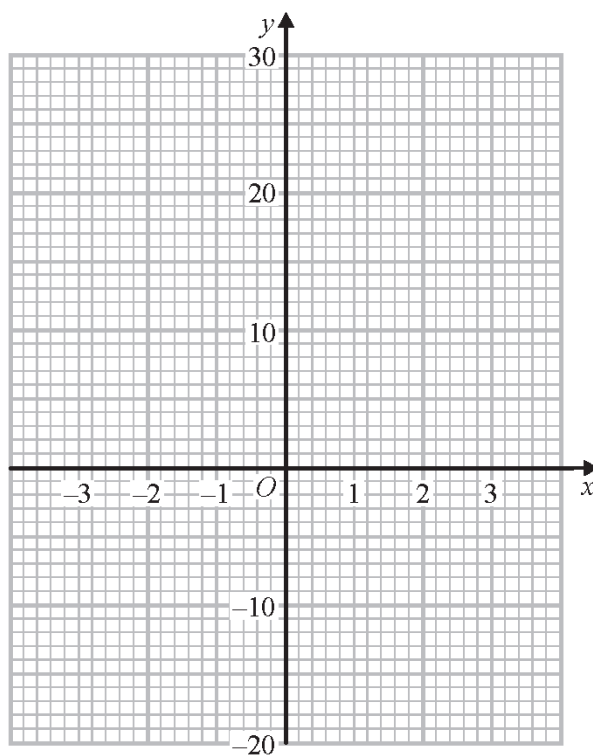
**10** - (4MA0-S 2018-Paper 4HR-Q15) - *FUNCTIONS & GRAPHS*

(a) Complete the table of values for  $y = x^3 - 2x + 3$

|     |    |    |    |   |   |   |   |
|-----|----|----|----|---|---|---|---|
| $x$ | -3 | -2 | -1 | 0 | 1 | 2 | 3 |
| $y$ |    | -1 | 4  | 3 |   | 7 |   |

(2)

(b) On the grid, draw the graph of  $y = x^3 - 2x + 3$  for values of  $x$  from -3 to 3



(2)

(c) By drawing a suitable straight line on the grid, find estimates for the solutions of the equation  $x^3 - 5x + 1 = 0$

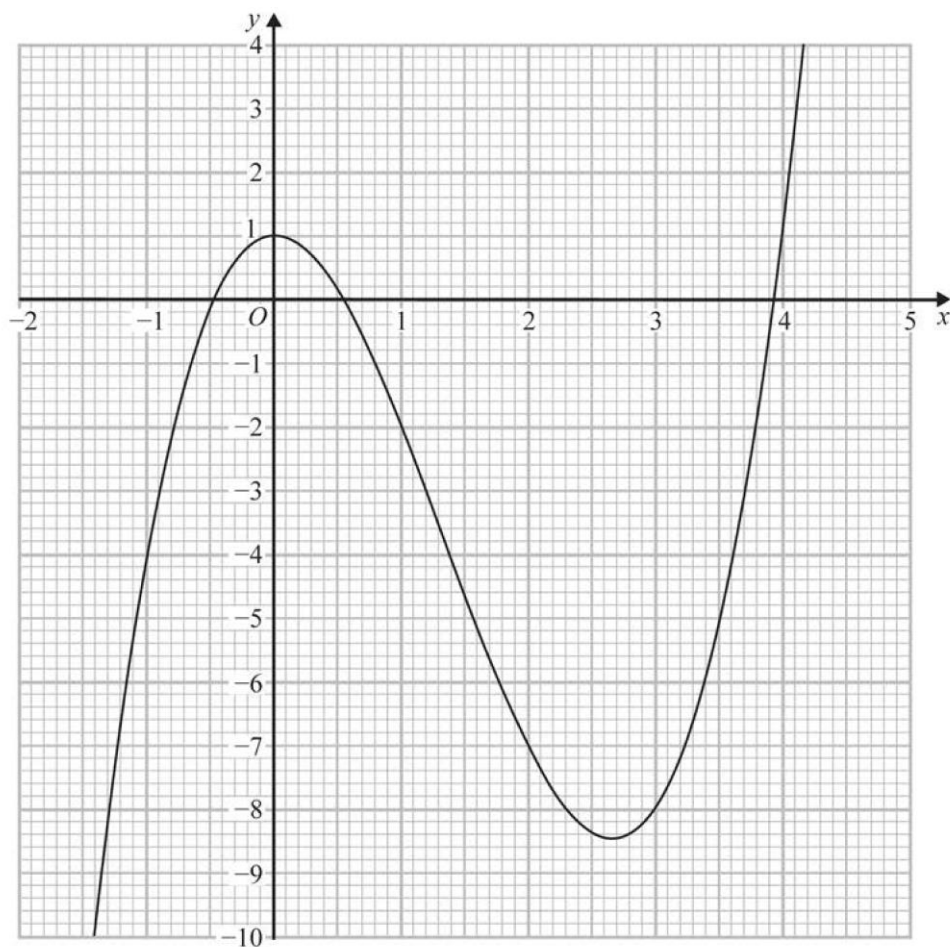
Give your solutions correct to 1 decimal place.

(3)



**11** - (4MA0-W 2018-Paper 4HR-Q13) - FUNCTIONS & GRAPHS

Here is the graph of  $y = x^3 - 4x^2 + 1$



- (a) Use the graph to solve the equation  $x^3 - 4x^2 + 1 = 2$

$x = \dots\dots\dots$   
(1)

- (b) For which values of  $k$  does the equation  $x^3 - 4x^2 + 1 = k$  have exactly two solutions.

$k = \dots\dots\dots$  or  $\dots\dots\dots$   
(2)



The equation  $x^3 - 4x^2 + x - 2 = 0$  can be solved by finding the point of intersection of the line **L** with the graph of  $y = x^3 - 4x^2 + 1$

(c) Find an equation of **L**.

.....  
(2)



1 - (4MA0-S 2015-Paper 4HR-Q11) - MENSURATION

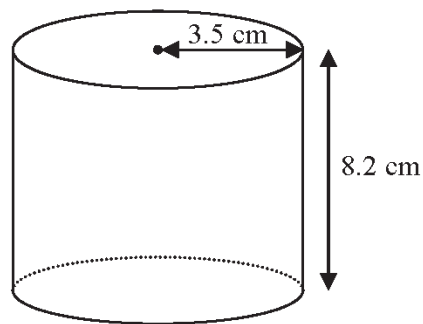


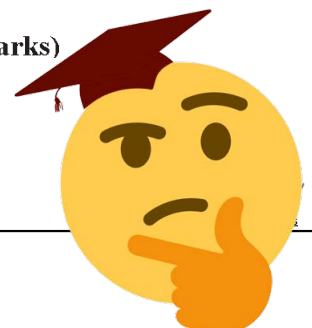
Diagram **NOT**  
accurately drawn

A solid cylinder has radius 3.5 cm and height 8.2 cm.

Work out the **total** surface area of the cylinder.  
Give your answer correct to 3 significant figures.

..... cm<sup>2</sup>

(Total for Question \_\_ is 3 marks)



2 - (4MA0-S 2015-Paper 4HR-Q20) - MENSURATION

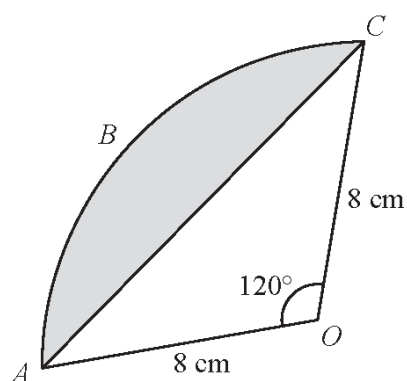


Diagram **NOT**  
accurately drawn

$ABC$  is an arc of a circle with centre  $O$  and radius 8 cm.

$AC$  is a chord of the circle.

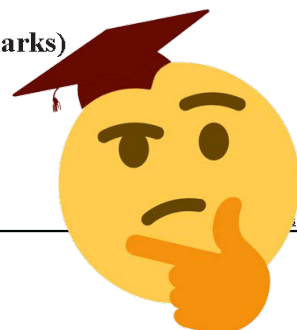
Angle  $AOC = 120^\circ$

Calculate the perimeter of the shaded segment.

Give your answer correct to 3 significant figures.

..... cm

(Total for Question is 5 marks)



3 - (4MA0-S 2016-Paper 4HR-Q7) - MENSURATION

Here are two circles.

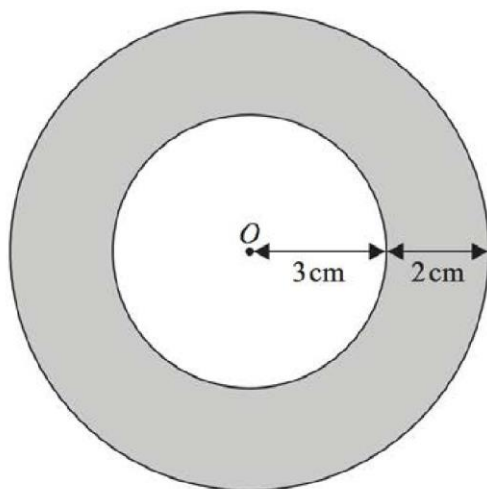


Diagram **NOT**  
accurately drawn

The circles have the same centre  $O$ .

The radius of the inner circle is 3 cm.

The width of the shaded region between the inner circle and outer circle is 2 cm.

Work out the area of the shaded region.

Give your answer correct to 3 significant figures.

.....cm<sup>2</sup>

**3 marks**



4 - (4MA0-W 2016-Paper 4HR-Q5) - *MENSURATION*

Here are a rectangle and a square.

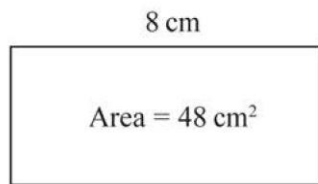


Diagram **NOT**  
accurately drawn

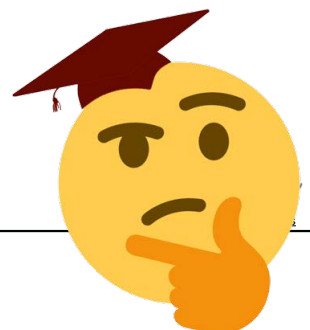
The rectangle has length 8 cm and area 48 cm<sup>2</sup>

The perimeter of the square is the same as the perimeter of the rectangle.

Calculate the area of the square.

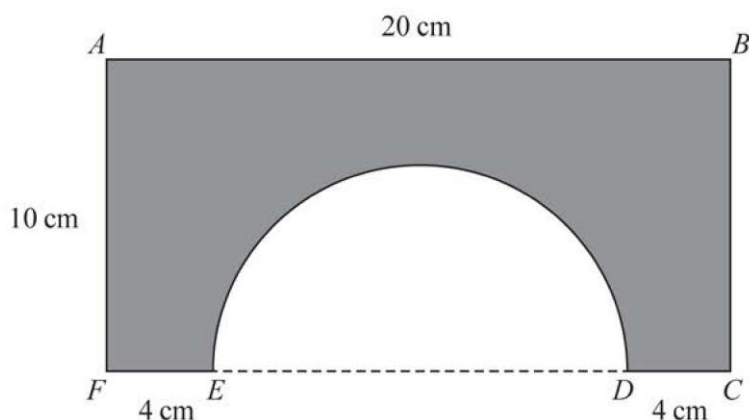
..... cm<sup>2</sup>

(Total for Question is 4 marks)





5 - (4MA0-W 2016-Paper 4HR-Q11) - MENSURATION

Diagram **NOT**  
accurately drawn

The shaded shape is made by cutting a semicircle from a rectangular piece of card,  $ABCF$ , as shown in the diagram.

$FEDC$  is a straight line.

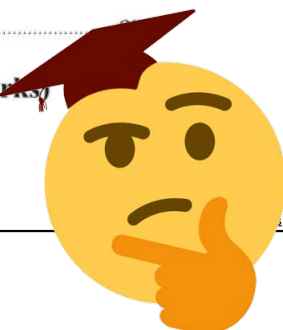
The centre of the semicircle lies on  $ED$ .

$AF = BC = 10$  cm,  $AB = 20$  cm,  $FE = DC = 4$  cm.

Work out the perimeter of the shaded shape.

Give your answer correct to 3 significant figures.

(Total for Question is 3 marks)



6 - (4MA0-W 2017-Paper 4HR-Q4) - MENSURATION

The diagram shows a rectangle and a circle.

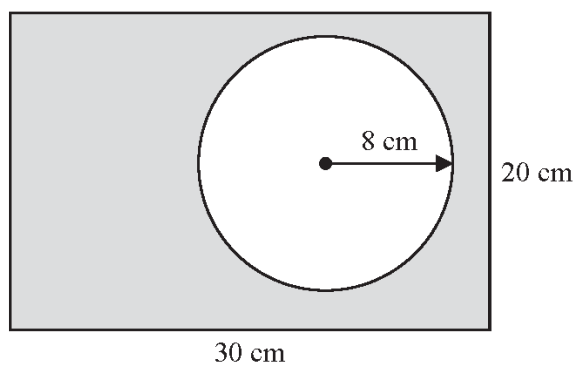


Diagram **NOT**  
accurately drawn

The rectangle has length 30 cm and width 20 cm.

The circle has radius 8 cm.

Work out the area of the shaded region.

Give your answer correct to 3 significant figures.

..... cm<sup>2</sup>

(Total for Question is 4 marks)



7 - (4MA0-W 2017-Paper 4HR-Q19) - MENSURATION

The diagram shows a solid cone.

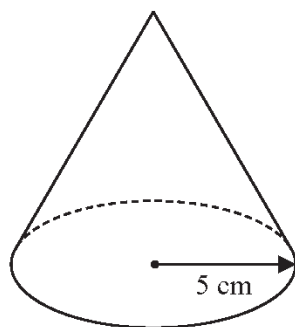


Diagram **NOT**  
accurately drawn

The radius of the base of the cone is 5 cm.  
The total surface area of the cone is  $90\pi \text{ cm}^2$

Work out the volume of the cone.  
Give your answer as a multiple of  $\pi$ .

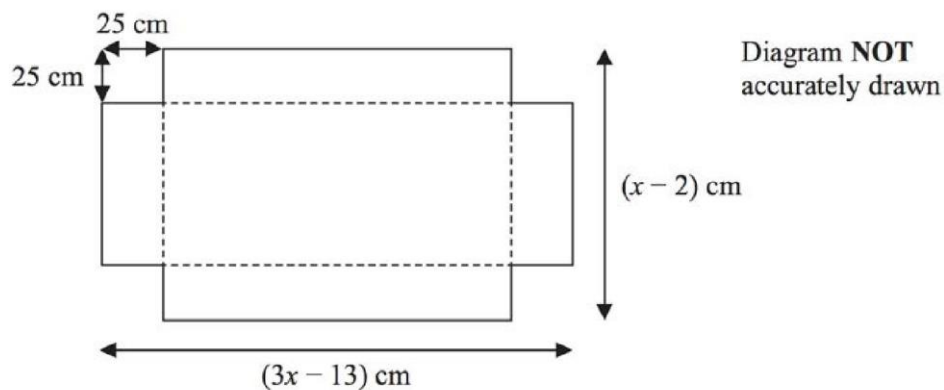
.....  $\text{cm}^3$

(Total for Question is 5 marks)

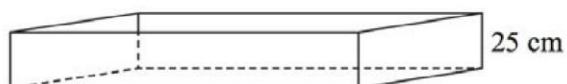


8 - (4MA0-W 2017-Paper 4HR-Q21) - MENSURATION

A rectangular piece of card has length  $(3x - 13)$  cm and width  $(x - 2)$  cm.  
A square, with sides of length 25 cm, is removed from each corner of the card.



The card is then folded along the dashed lines to make an open box with height 25 cm as shown below.



(a) Show that the length of the open box is  $(3x - 63)$  cm.

(1)



The volume of the open box is  $81\,900\text{ cm}^3$

(b) Find the value of  $x$ .

Show clear algebraic working.

$$x = \dots\dots\dots$$

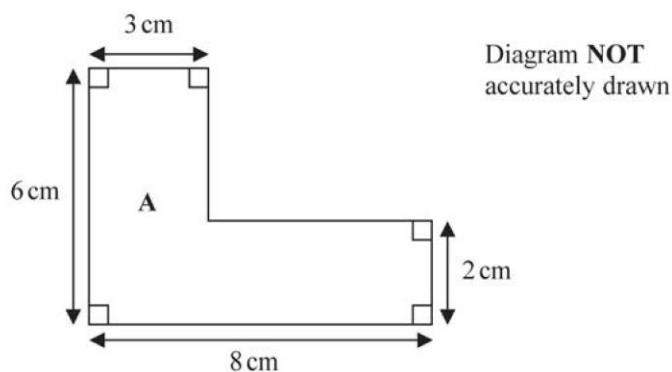
(5)

(Total for Question is 6 marks)



9 - (4MA0-W 2018-Paper 4HR-Q2) - MENSURATION

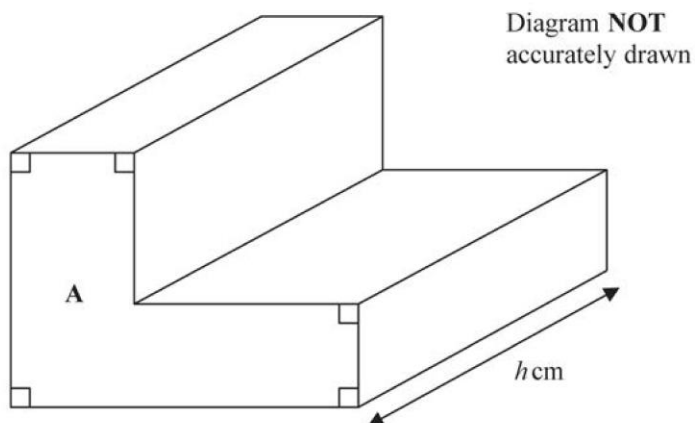
The diagram shows shape A.



(a) Work out the area of shape A.

.....cm<sup>2</sup>  
(3)

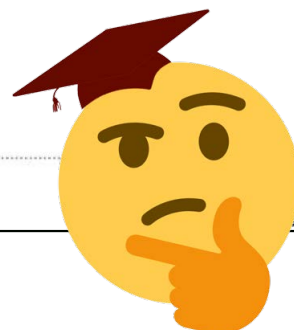
Here is a prism with shape A as its cross section.



The volume of the prism is 350 cm<sup>3</sup>  
The length of the prism is  $h$  cm.

(b) Work out the value of  $h$ .

.....  
(2)



10 - (4MA0-W 2019-Paper 4HR-Q2) - MENSURATION

The diagram shows a square and a circle.

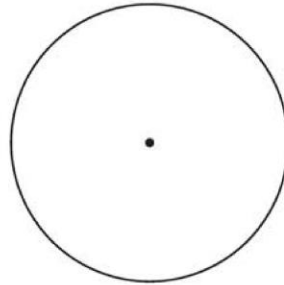
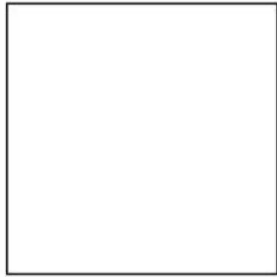


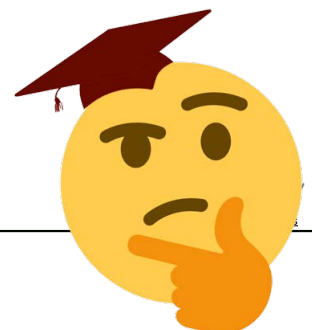
Diagram **NOT**  
accurately drawn

The square has area  $400 \text{ cm}^2$

The diameter of the circle is equal to the length of a side of the square.

Work out the circumference of the circle.

Give your answer correct to 1 decimal place.



11 - (4MA0-W 2019-Paper 4HR-Q8) - MENSURATION

Here is a prism.

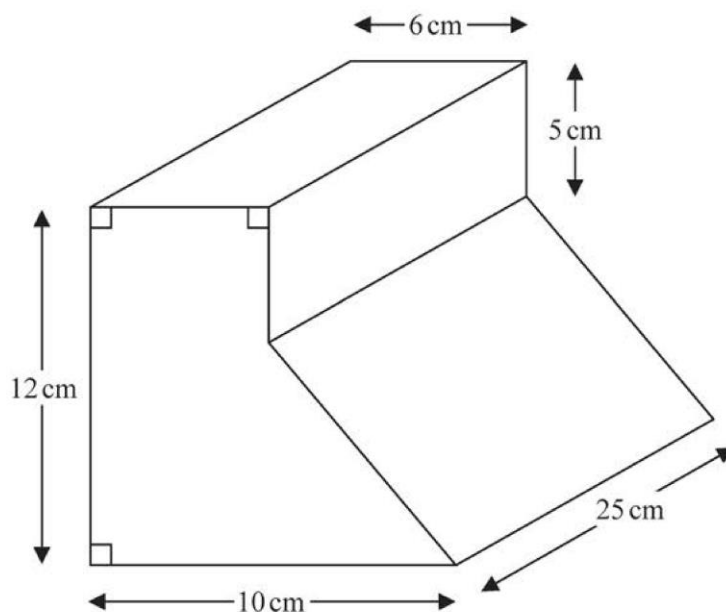


Diagram **NOT**  
accurately drawn

Work out the volume of this prism.





12 - (4MA0-W 2019-Paper 4HR-Q14) - MENSURATION

Here is a solid shape S.

The solid shape consists of a cylinder and a hemisphere.

The centre of the circular face of the hemisphere and the centre of the top face of the cylinder are at the same point.

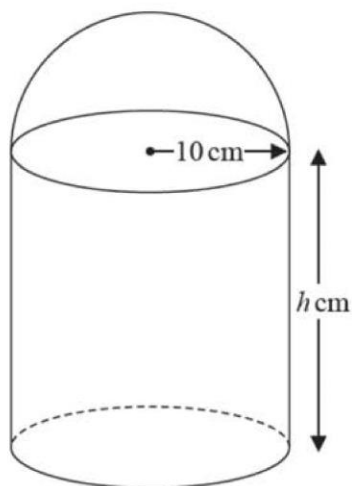


Diagram **NOT**  
accurately drawn

The radius of the cylinder and the radius of the hemisphere are both 10 cm.

The height of the cylinder is  $h$  cm.

The total surface area of S is  $1000\pi \text{ cm}^2$

Find the value of  $h$ .

$h =$



1 - (4MA0-S 2015-Paper 4HR-Q13) - GEOMETRY

$PQRS$  and  $PLMN$  are similar quadrilaterals.

$PN = 12$  cm,  $NS = 8$  cm,  $PL = 9$  cm and  $RS = 13.5$  cm.

$LM$  is parallel to  $QR$  and  $MN$  is parallel to  $RS$ .

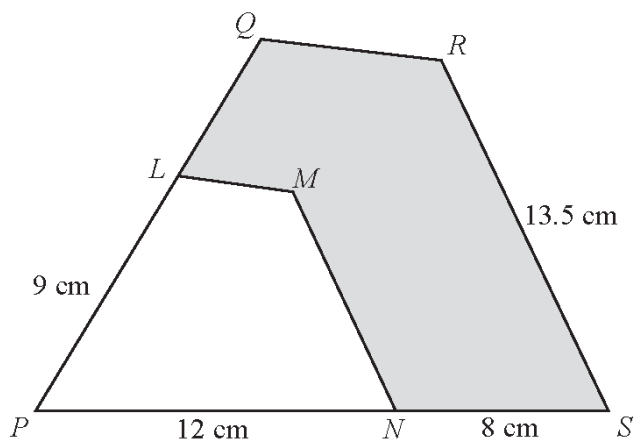


Diagram **NOT**  
accurately drawn

(a) Work out the length of  $MN$ .

..... cm  
(2)

(b) Work out the length of  $LQ$ .

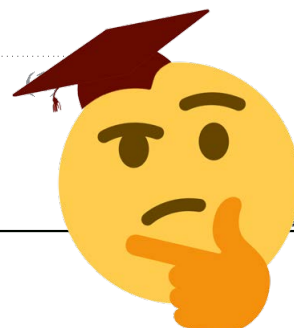
..... cm  
(2)

The area of  $PLMN$  is  $A$  cm<sup>2</sup>

The area of  $PQRS$  is  $kA$  cm<sup>2</sup>

(c) Find the value of  $k$ .

$k =$  .....



The area of the shaded region is  $105.6 \text{ cm}^2$

(d) Work out the value of  $A$ .

$$A = \dots\dots\dots (3)$$

**(Total for Question    is 8 marks)**



## 2 - (4MA0-S 2015-Paper 4HR-Q17) - GEOMETRY

$J, K, L$  and  $M$  are points on the circumference of a circle.

$GJH$  is the tangent to the circle at  $J$ .

$MK$  and  $JL$  intersect at the point  $P$ .

$GML$  is a straight line.

Angle  $HJK = 62^\circ$ , angle  $JKM = 21^\circ$  and angle  $JGL = 78^\circ$

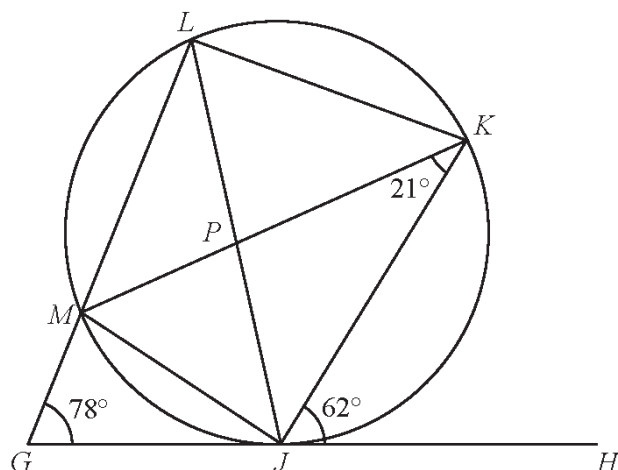


Diagram **NOT**  
accurately drawn

(a) Write down the size of angle  $MLJ$ .

.....  
(1)

(b) Write down the size of angle  $JLK$ .

.....  
(1)

(c) Work out the size of angle  $KPL$ .

.....  
(3)

(Total for Question is 5 marks)



**3** - (4MA0-W 2015-Paper 4HR-Q2) - *GEOMETRY*

The wheel of the Singapore Flyer is a circle with a diameter of 150 metres.

- (a) Calculate the circumference of the wheel.  
Give your answer correct to the nearest metre.

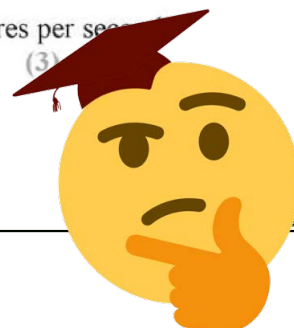


..... metres  
(2)

The wheel takes 30 minutes to rotate once.

- (b) Work out the average speed of a point on the circumference of the wheel as it rotates once.  
Give your answer in metres per second correct to 3 significant figures.

..... metres per second  
(3)



The diagram shows a giant wheel above horizontal ground.

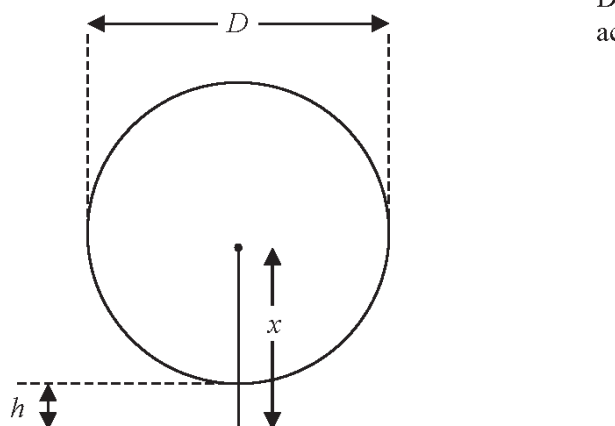


Diagram **NOT**  
accurately drawn

The wheel is a circle of diameter  $D$  metres.  
The lowest point of the wheel is  $h$  metres above the ground.  
The centre of the wheel is  $x$  metres above the ground.

(c) Express  $h$  in terms of  $D$  and  $x$

.....  
(2)

(Total for Question is 7 marks)



4 - (4MA0-W 2015-Paper 4HR-Q3) - GEOMETRY

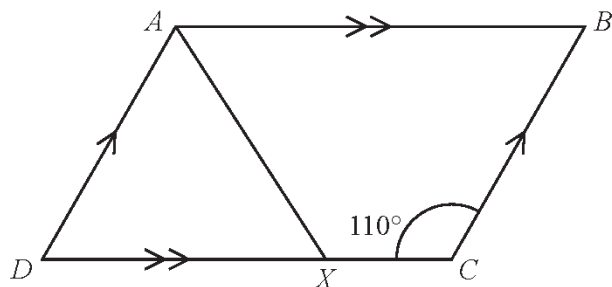


Diagram **NOT**  
accurately drawn

$ABCD$  is a parallelogram.

Angle  $DCB = 110^\circ$

$X$  is the point on  $DC$  such that  $AX$  bisects the angle  $DAB$ .

Calculate the size of angle  $AXC$ .

(Total for Question is 4 marks)



5 - (4MA0-W 2015-Paper 4HR-Q7) - GEOMETRY

Here is a trapezium  $ABCD$ .

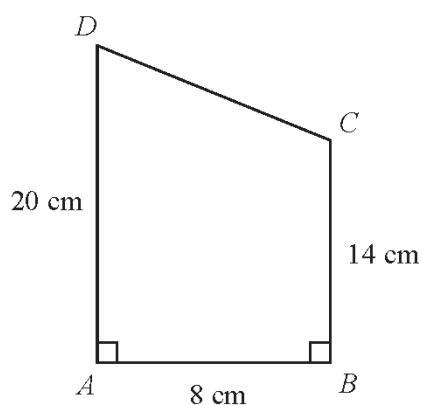


Diagram **NOT**  
accurately drawn

Angle  $DAB = \text{angle } ABC = 90^\circ$

$AD = 20 \text{ cm}$

$AB = 8 \text{ cm}$

$BC = 14 \text{ cm}$

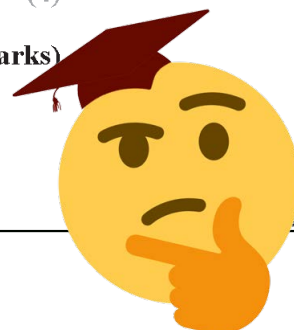
(a) Calculate the area of the trapezium  $ABCD$ .

.....  $\text{cm}^2$   
(2)

(b) Calculate the length of  $CD$ .

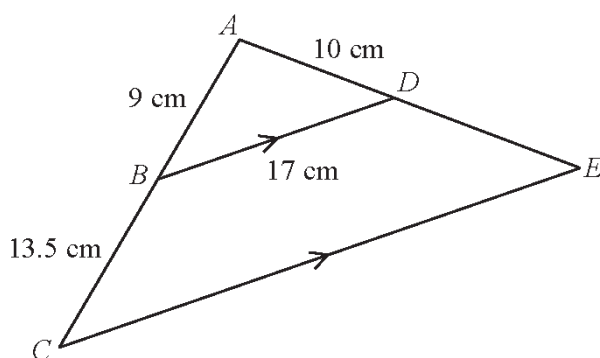
.....  $\text{cm}$   
(4)

(Total for Question . is 6 marks)





6 - (4MA0-W 2015-Paper 4HR-Q10) - GEOMETRY

Diagram **NOT**  
accurately drawn

In the diagram  $ABC$  and  $ADE$  are straight lines.  
 $BD$  is parallel to  $CE$ .

$AB = 9 \text{ cm}$ ,  $BC = 13.5 \text{ cm}$ ,  $AD = 10 \text{ cm}$ ,  $BD = 17 \text{ cm}$

(a) Calculate the length of  $CE$ .

..... cm  
 (2)

(b) Calculate the length of  $DE$ .

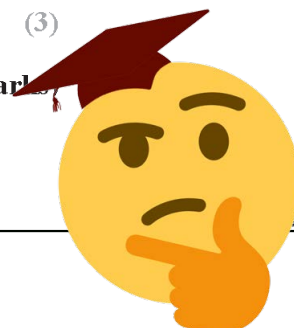
..... cm  
 (2)

The area of triangle  $ABD$  is  $36 \text{ cm}^2$

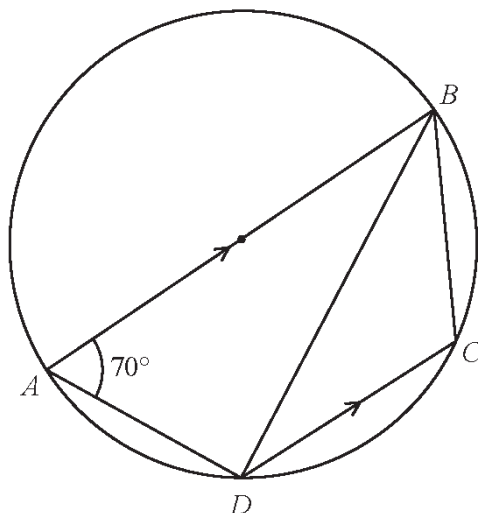
(c) Calculate the area of quadrilateral  $BDEC$ .

.....  $\text{cm}^2$   
 (3)

(Total for Question is 7 marks)



7 - (4MA0-W 2015-Paper 4HR-Q16) - GEOMETRY

Diagram **NOT**  
accurately drawn

$A$ ,  $B$ ,  $C$  and  $D$  are points on a circle.  
 $AB$  is a diameter of the circle.  
 $DC$  is parallel to  $AB$ .  
Angle  $BAD = 70^\circ$

(a) Calculate the size of angle  $BDC$ .

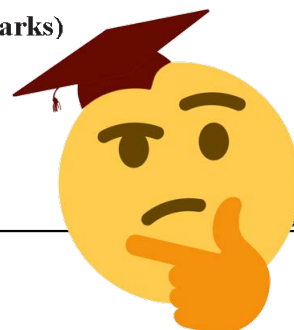
.....  
(2)

The tangent to the circle at  $D$  meets the line  $BC$  extended at  $T$ .

(b) Calculate the size of angle  $BTd$ .

.....  
(3)

(Total for Question is 5 marks)



8 - (4MA0-S 2016-Paper 4HR-Q4) - GEOMETRY

Here is a kite  $ABCD$ .

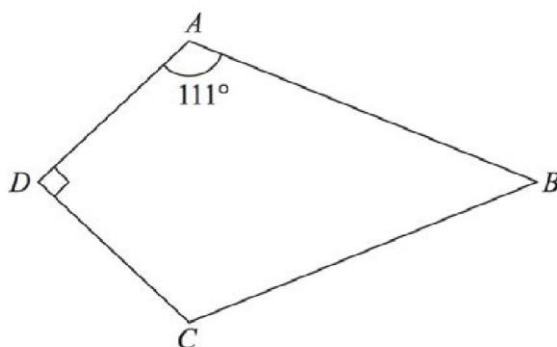


Diagram **NOT**  
accurately drawn

Angle  $DAB = 111^\circ$

Angle  $ADC = 90^\circ$

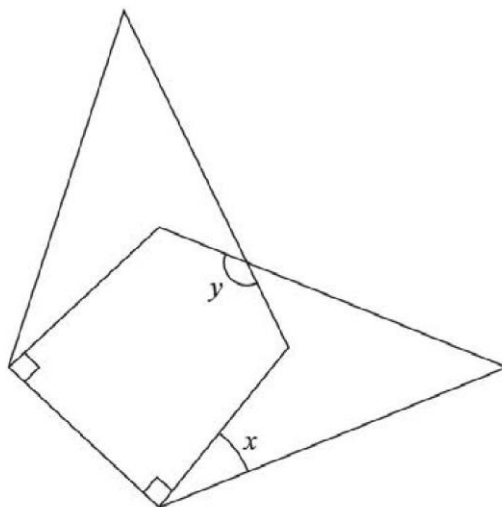
(a) Work out the size of angle  $ABC$ .

.....  
(2)



Two of these kites are arranged so that a shorter side of one of the kites is placed on top of a shorter side of the other kite, as shown in the diagram below.

Diagram **NOT**  
accurately drawn



(b) Work out the size of angle  $x$ .

(c) Work out the size of angle  $y$ .

.....  
(2)

.....  
(3)



9 - (4MA0-S 2016-Paper 4HR-Q11) - GEOMETRY

Here is a triangle  $QRS$ .

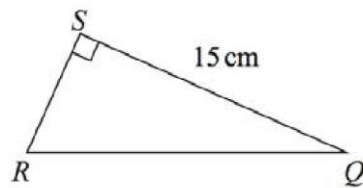


Diagram **NOT**  
accurately drawn

$$SQ = 15 \text{ cm}$$

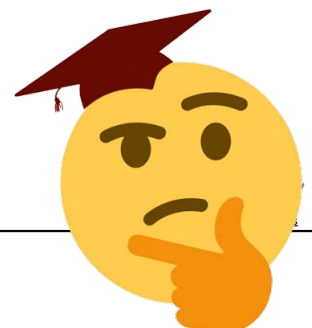
$$\text{Angle } RSQ = 90^\circ$$

$$\text{Area of triangle } QRS = 60 \text{ cm}^2$$

Work out the size of angle  $SQR$ .

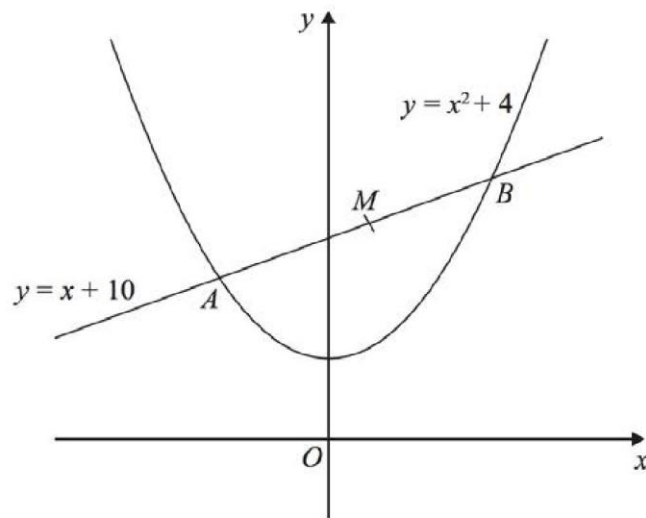
Give your answer correct to 1 decimal place.

.....  
4 marks



10 - (4MA0-S 2016-Paper 4HR-Q20) - GEOMETRY

The sketch shows the curve with equation  $y = x^2 + 4$  and the line with equation  $y = x + 10$



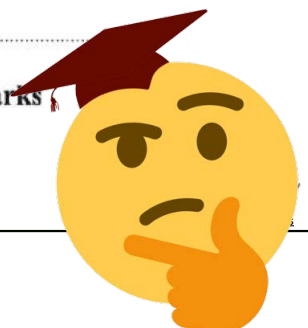
The line cuts the curve at the points  $A$  and  $B$ .

$M$  is the midpoint of  $AB$ .

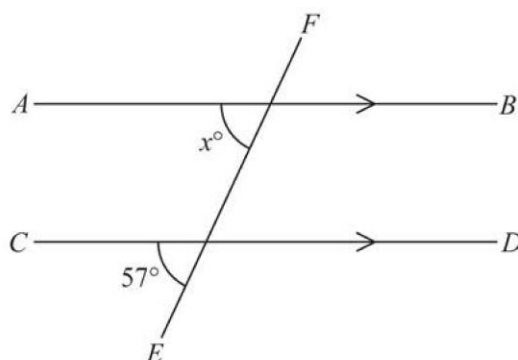
Find the coordinates of  $M$ .

Show clear algebraic working.

6 marks



11 - (4MA0-W 2016-Paper 4HR-Q2) - GEOMETRY

Diagram **NOT**  
accurately drawn

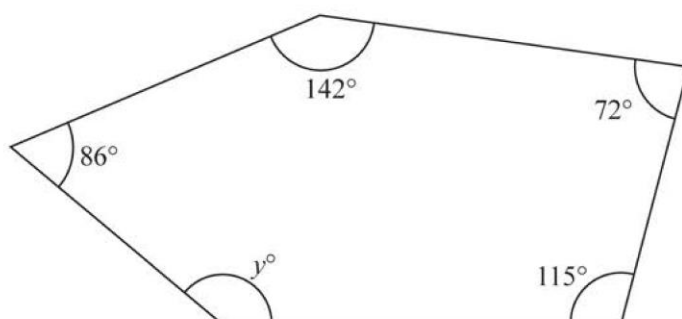
$AB$  is parallel to  $CD$   
 $EF$  is a straight line.

(a) (i) Find the value of  $x$  $x = \dots\dots\dots$ 

(ii) Give a reason for your answer.

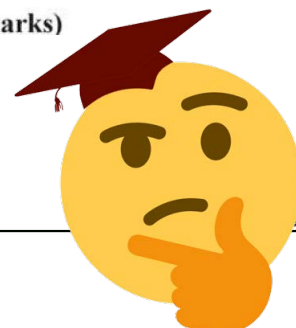
(2)

Here is a pentagon.

Diagram **NOT**  
accurately drawn(b) Work out the value of  $y$ . $y = \dots\dots\dots$ 

(3)

(Total for Question is 5 marks)



12 - (4MA0-W 2016-Paper 4HR-Q13) - GEOMETRY

The diagram shows triangle  $ABC$ .

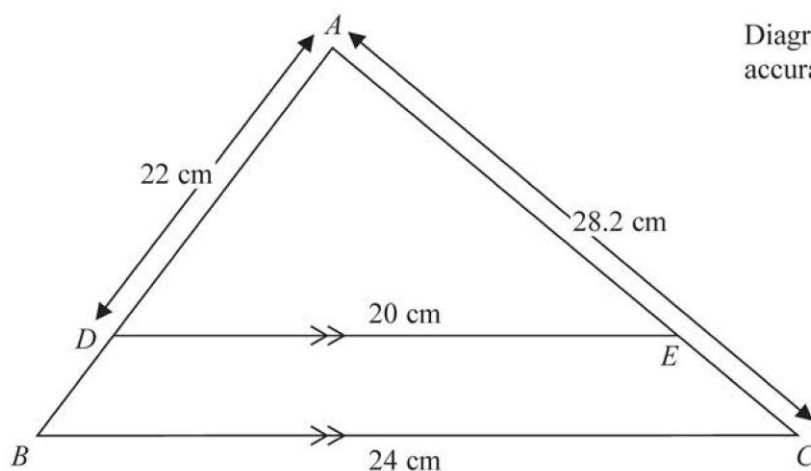


Diagram **NOT**  
accurately drawn

$ADB$  and  $AEC$  are straight lines.

$DE$  is parallel to  $BC$ .

$DE = 20$  cm,  $BC = 24$  cm,  $AD = 22$  cm,  $AC = 28.2$  cm

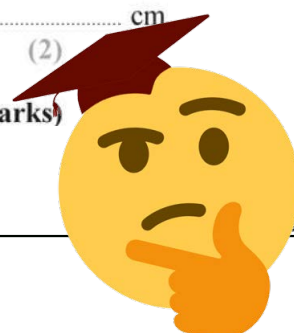
(a) Work out the length of  $AB$ .

..... cm  
(2)

(b) Work out the length of  $EC$ .

..... cm  
(2)

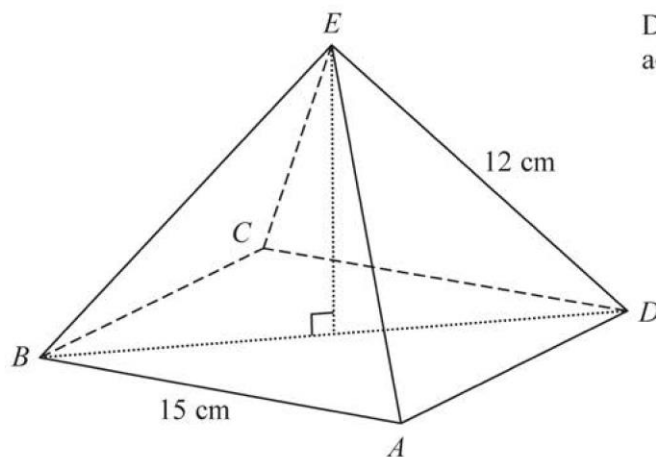
(Total for Question is 4 marks)





13 - (4MA0-W 2016-Paper 4HR-Q21) - GEOMETRY, TRIGONOMETRY

$ABCDE$  is a square-based pyramid.



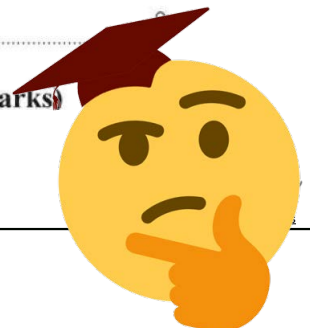
$$AE = BE = CE = DE = 12 \text{ cm}$$

$$AB = 15 \text{ cm}$$

Calculate the size of angle  $DEB$ .

Give your answer to the nearest degree.

(Total for Question is 4 marks)



14 - (4MA0-S 2017-Paper 4HR-Q8) - *GEOMETRY*

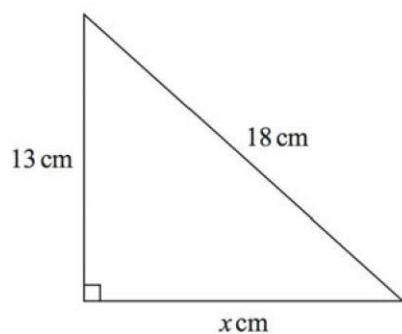


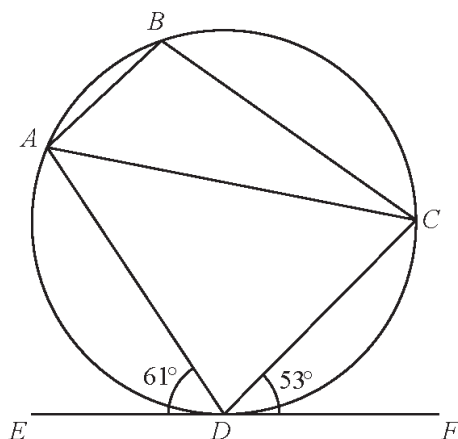
Diagram **NOT**  
accurately drawn

Work out the value of  $x$ .  
Give your answer correct to 3 significant figures.

.....  
**3 marks**



15 - (4MA0-S 2017-Paper 4HR-Q15) - GEOMETRY

Diagram **NOT**  
accurately drawn

$A$ ,  $B$ ,  $C$  and  $D$  are points on a circle.  
 $EDF$  is the tangent to the circle at  $D$ .

Angle  $ADE = 61^\circ$  and angle  $CDF = 53^\circ$

(a) (i) Write down the size of angle  $ACD$ .

.....  
 o

(ii) Give a reason for your answer.

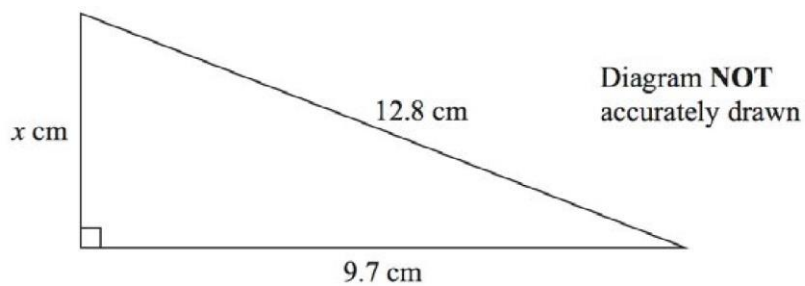
.....  
 (2)

(b) Work out the size of angle  $ABC$ .

.....  
 o  
 (2)



16 - (4MA0-W 2017-Paper 4HR-Q6) - *GEOMETRY*



Work out the value of  $x$ .  
Give your answer correct to 3 significant figures.

.....  
(Total for Question is 3 marks)



17 - (4MA0-W 2017-Paper 4HR-Q8) - GEOMETRY

The diagram shows a parallelogram  $ABCD$ .

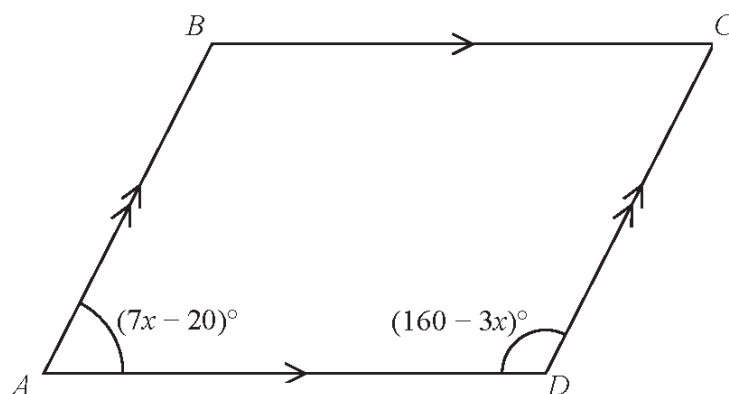


Diagram **NOT**  
accurately drawn

$$\text{Angle } BAD = (7x - 20)^\circ$$

$$\text{Angle } ADC = (160 - 3x)^\circ$$

Work out the value of  $x$ .

Show clear algebraic working.

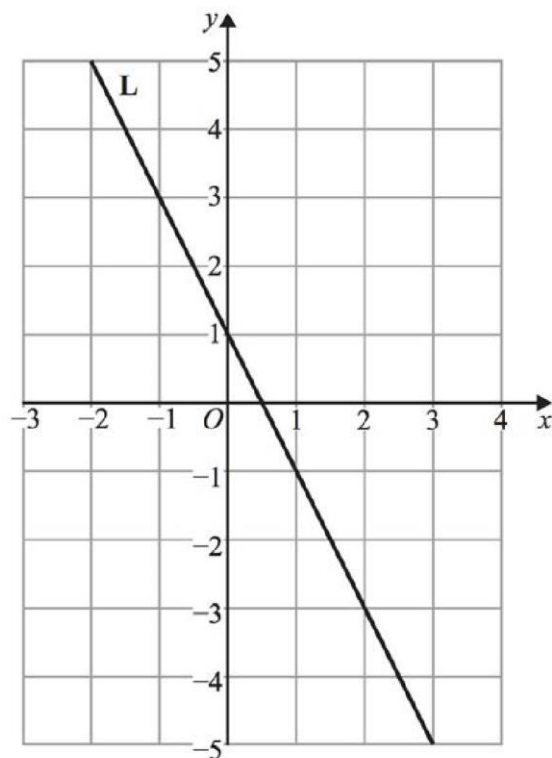
$$x = \dots\dots\dots$$

(Total for Question is 3 marks)



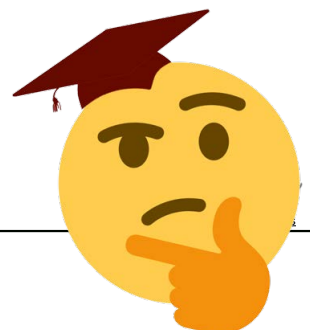
18 - (4MA0-W 2017-Paper 4HR-Q11) - GEOMETRY

Here is the straight line **L** drawn on a grid.



Find an equation for **L**.

(Total for Question is 2 marks)



**19** - (4MA0-W 2017-Paper 4HR-Q14) - *GEOMETRY*

$ABCDE$  and  $AWXYZ$  are two mathematically similar pentagons.

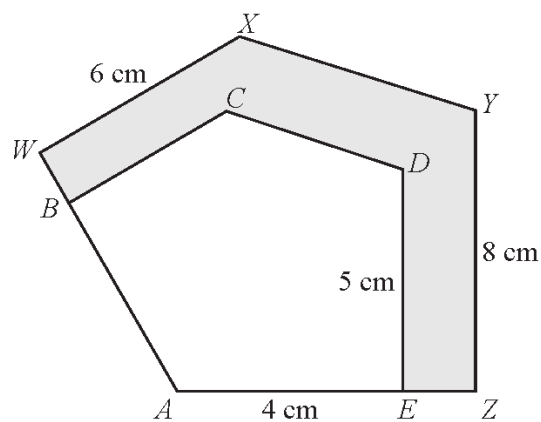


Diagram **NOT**  
accurately drawn

$AE = 4 \text{ cm} \quad WX = 6 \text{ cm} \quad DE = 5 \text{ cm} \quad YZ = 8 \text{ cm}$

- (a) Calculate the length of  $AZ$ .

..... cm  
(2)

- (b) Calculate the length of  $BC$ .

..... cm

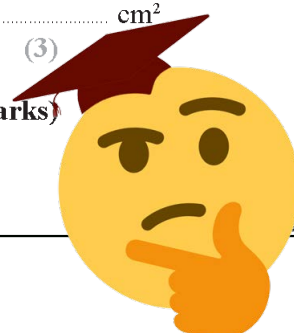
(2)

The area of pentagon  $AWXYZ$  is  $52.48 \text{ cm}^2$

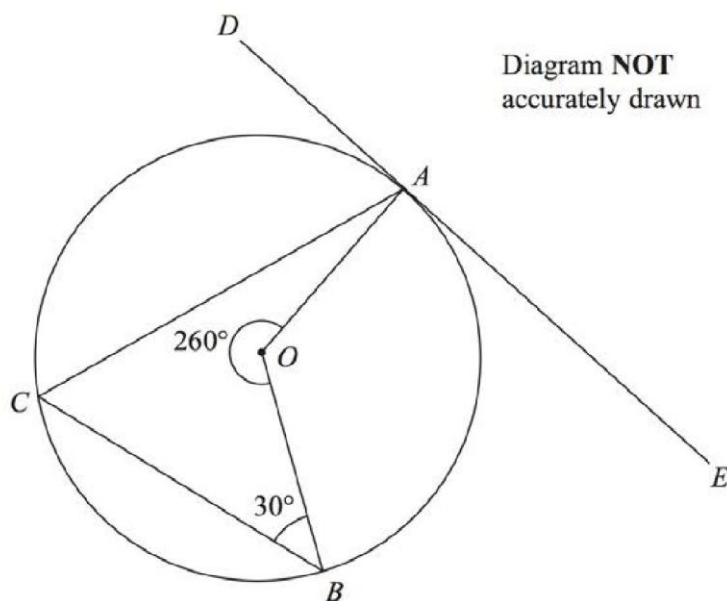
- (c) Calculate the area of the shaded region.

..... cm<sup>2</sup>  
(3)

(Total for Question 1 is 7 marks)



20 - (4MA0-W 2017-Paper 4HR-Q17) - GEOMETRY



$A$ ,  $B$ , and  $C$  are points on the circumference of a circle, centre  $O$ .  
 $DAE$  is a tangent to the circle.

(a) Work out the size of angle  $ACB$ .

.....  
 (2)

(b) Work out the size of angle  $CAD$ .

.....  
 (2)

(Total for Question is 4 marks)





21 - (4MA0-S 2018-Paper 4HR-Q2) - GEOMETRY

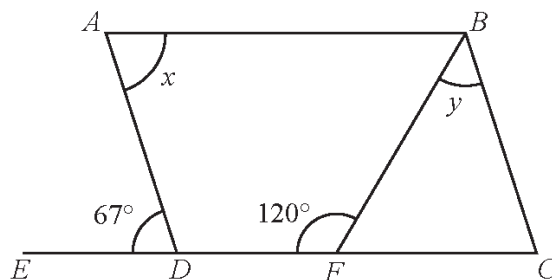


Diagram **NOT**  
accurately drawn

$ABCD$  is a parallelogram.  
 $EDFC$  is a straight line.

(a) (i) Write down the size of angle  $x$ .

○

(ii) Give a reason for your answer.

(2)

(b) Work out the size of angle  $y$ .

○

(2)



22 - (4MA0-S 2018-Paper 4HR-Q17) - GEOMETRY

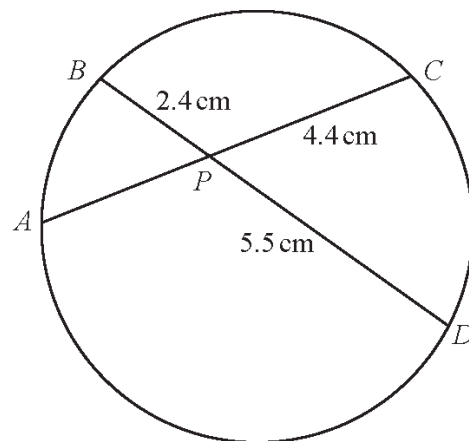


Diagram **NOT**  
accurately drawn

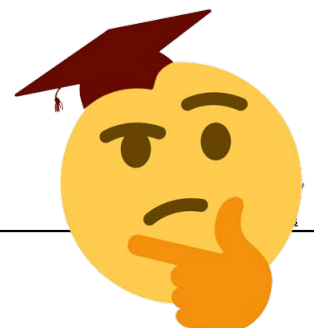
$A$ ,  $B$ ,  $C$  and  $D$  are points on a circle.  
 $APC$  and  $BPD$  are straight lines.

$PB = 2.4\text{ cm}$ ,  $PD = 5.5\text{ cm}$  and  $PC = 4.4\text{ cm}$ .

Work out the length of  $PA$ .

..... cm

(Total for Question is 2 marks)



23 - (4MA0-S 2018-Paper 4HR-Q24) - GEOMETRY

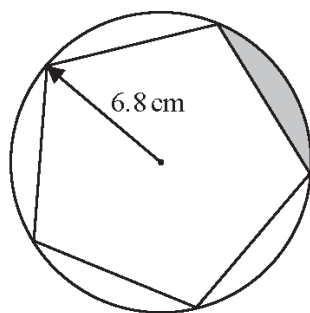
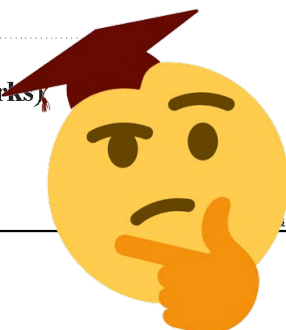


Diagram **NOT**  
accurately drawn

A regular pentagon is drawn inside a circle of radius 6.8 cm.  
Each vertex of the pentagon lies on the circle.

Find the perimeter of the region shown shaded in the diagram.  
Give your answer correct to 3 significant figures.

(Total for Question is 4 marks)



**24** - (4MA0-W 2018-Paper 4HR-Q3) - *GEOMETRY*

$A$  is the point with coordinates  $(1, 3)$

$B$  is the point with coordinates  $(7, 8)$

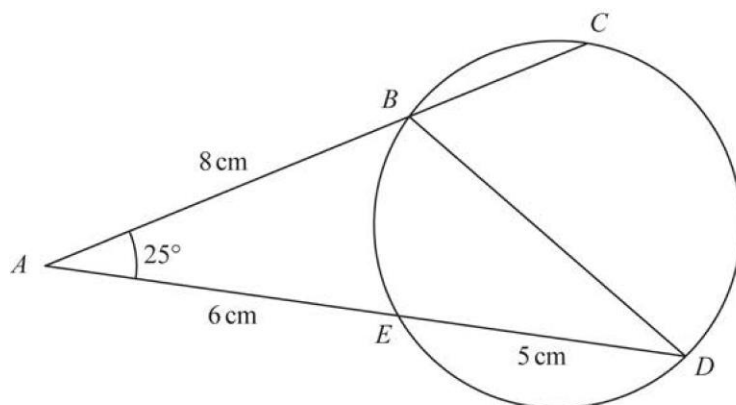
Find the coordinates of the midpoint of the line segment  $AB$ .

( ..... , ..... )

(Total for Question is 2 marks)



25 - (4MA0-W 2018-Paper 4HR-Q15) - GEOMETRY

Diagram **NOT**  
accurately drawn

$B$ ,  $C$ ,  $D$  and  $E$  are points on a circle.

$ABC$  and  $AED$  are straight lines.

$AB = 8$  cm,  $AE = 6$  cm and  $ED = 5$  cm.

Angle  $BAE = 25^\circ$

- (a) Calculate the length of  $BD$ .  
Give your answer correct to 3 significant figures.

..... cm  
(3)

- (b) Calculate the length of  $AC$ .

..... cm  
(2)



26 - (4MA0-W 2019-Paper 4HR-Q6) - *GEOMETRY*

Here is a right-angled triangle.

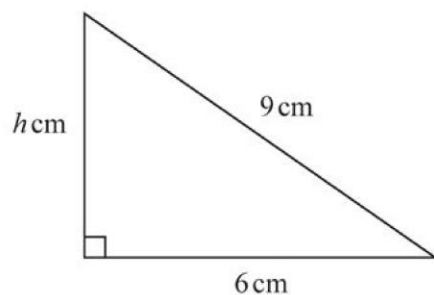


Diagram **NOT**  
accurately drawn

Calculate the value of  $h$ .

Give your answer correct to 2 decimal places.

$h =$



27 - (4MA0-W 2019-Paper 4HR-Q13) - GEOMETRY

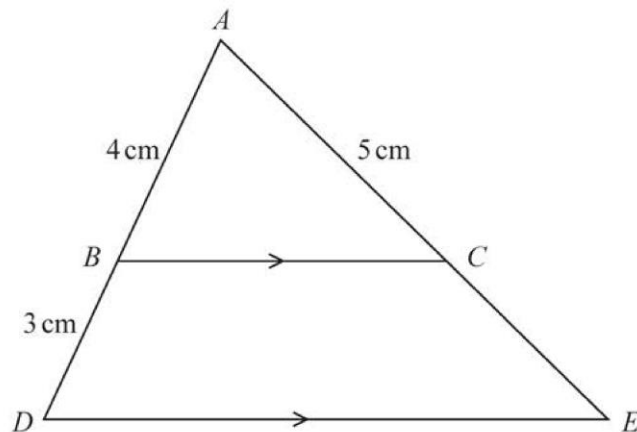


Diagram **NOT**  
accurately drawn

In the diagram  $ABD$  and  $ACE$  are straight lines.  
 $BC$  is parallel to  $DE$ .

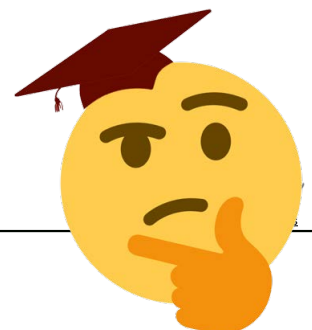
(a) Calculate the length of  $CE$ .

(2) cm

The area of triangle  $ABC$  is  $8 \text{ cm}^2$

(b) Work out the area of trapezium  $BCED$ .

(3)  $\text{cm}^2$



28 - (4MA0-W 2019-Paper 4HR-Q17) - GEOMETRY

$A, B, C$  and  $D$  are points on a circle, centre  $O$ .

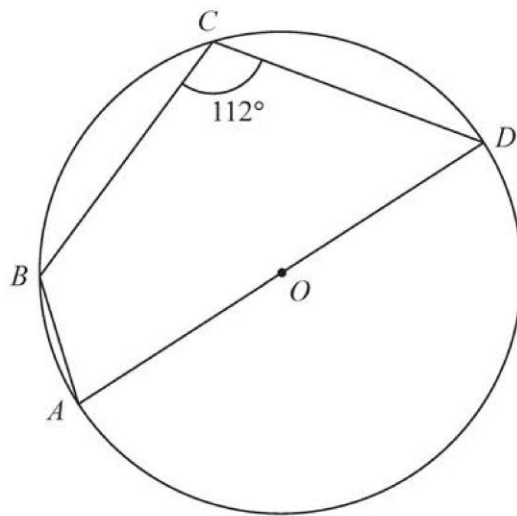


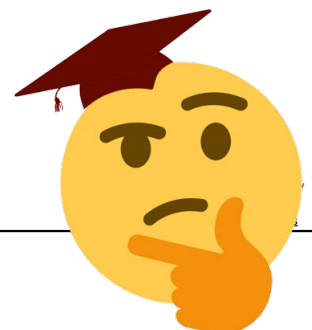
Diagram **NOT**  
accurately drawn

$AOD$  is a diameter of the circle.

Angle  $BCD = 112^\circ$

Calculate the size of angle  $ADB$ .

Give a reason for each stage of your working.





1 - (4MA0-S 2015-Paper 4HR-Q7) - TRIGONOMETRY

The diagram shows two points  $S$  and  $T$ .  
The bearing of  $T$  from  $S$  is  $043^\circ$

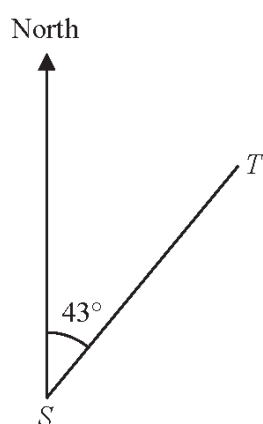


Diagram **NOT**  
accurately drawn

Work out the bearing of  $S$  from  $T$ .

○

(Total for Question is 2 marks)



2 - (4MA0-S 2015-Paper 4HR-Q10) - TRIGONOMETRY

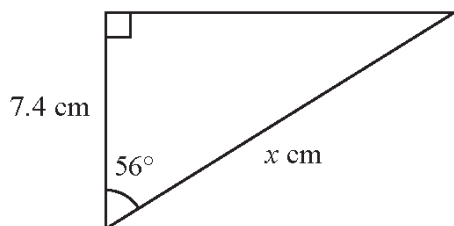


Diagram **NOT**  
accurately drawn

Work out the value of  $x$ .  
Give your answer correct to 3 significant figures.

$x = \dots\dots\dots$

(Total for Question is 3 marks)



3 - (4MA0-S 2016-Paper 4HR-Q17) - TRIGONOMETRY

The diagram shows a prism.

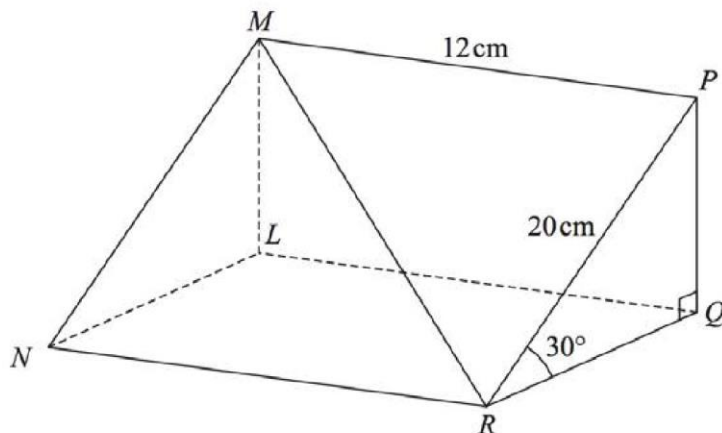


Diagram **NOT**  
accurately drawn

Triangle  $PQR$  is a cross section of the prism.

$$PR = 20 \text{ cm}$$

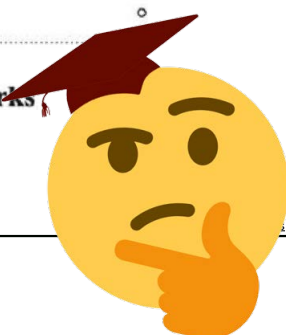
$$MP = 12 \text{ cm}$$

$$\text{Angle } PRQ = 30^\circ$$

$$\text{Angle } PQR = 90^\circ$$

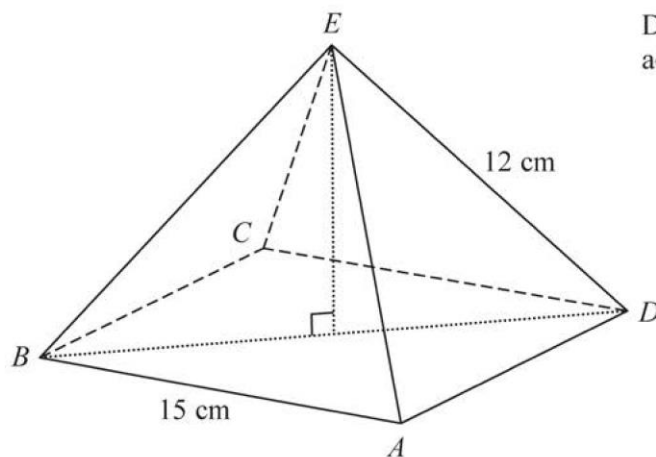
Calculate the size of the angle that the line  $MR$  makes with the plane  $RQLN$ .  
Give your answer correct to 1 decimal place.

5 marks



4 - (4MA0-W 2016-Paper 4HR-Q21) - GEOMETRY, TRIGONOMETRY

$ABCDE$  is a square-based pyramid.



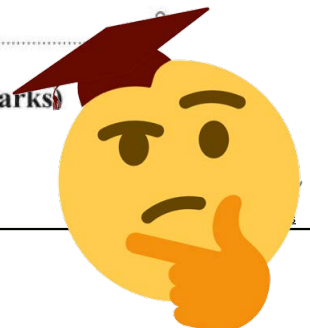
$$AE = BE = CE = DE = 12 \text{ cm}$$

$$AB = 15 \text{ cm}$$

Calculate the size of angle  $DEB$ .

Give your answer to the nearest degree.

(Total for Question is 4 marks)



5 - (4MA0-W 2016-Paper 4HR-Q23) - TRIGONOMETRY

$ABC$  is a triangle.

$$AB = 12 \text{ cm}$$

$$AC = 14 \text{ cm}$$

The area of triangle  $ABC$  is  $72 \text{ cm}^2$

Find, in degrees, the two possible sizes of angle  $BAC$ .

Give your answers correct to the nearest degree.

(Total for Question 5 is 4 marks)



## 6 - (4MA0-S 2017-Paper 4HR-Q13) - TRIGONOMETRY

The diagram shows triangle  $ABC$ .

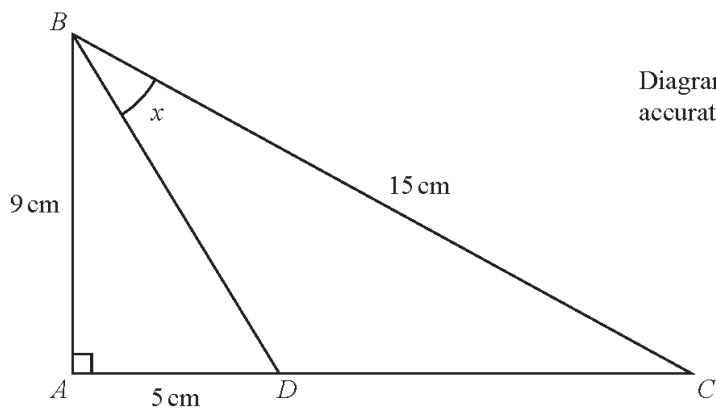


Diagram **NOT**  
accurately drawn

$$AB = 9\text{ cm} \quad BC = 15\text{ cm}$$

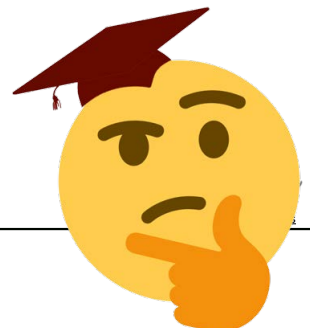
$D$  is the point on  $AC$  such that  $AD = 5\text{ cm}$ .

$$\text{Angle } BAC = 90^\circ$$

Calculate the size of angle  $x$ .

Give your answer to the nearest degree.

.....  
4 marks)



7 - (4MA0-S 2017-Paper 4HR-Q22) - TRIGONOMETRY

$ABCDEFGH$  is a cuboid.

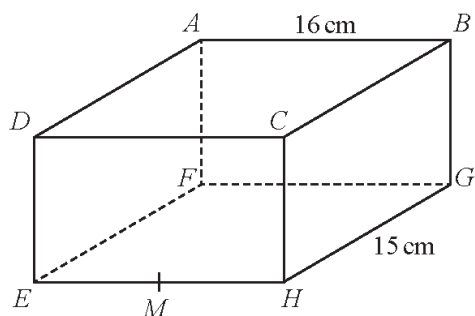


Diagram **NOT**  
accurately drawn

$AB = 16$  cm and  $HG = 15$  cm.

$M$  is the midpoint of  $EH$ .

$BM$  makes an angle of  $24^\circ$  with the base  $EFGH$ .

Calculate the height,  $BG$ , of the cuboid.

Give your answer correct to 3 significant figures.

..... cm

4 marks)



8 - (4MA0-S 2017-Paper 4HR-Q24) - TRIGONOMETRY

The diagram shows triangle  $KLM$ .

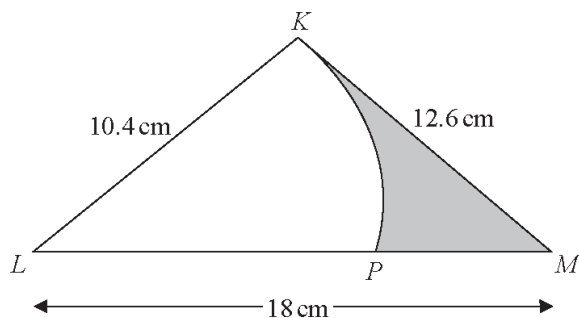


Diagram **NOT**  
accurately drawn

$KLP$  is a sector of a circle with centre  $L$  and radius  $10.4$  cm.

The region of the triangle outside the sector is shown shaded in the diagram.

Calculate the area of the shaded region.

Give your answer correct to 3 significant figures.

.....  $\text{cm}^2$

**5 marks**





## 9 - (4MA0-W 2017-Paper 4HR-Q9) - TRIGONOMETRY

The diagram shows the positions of two towns,  $A$  and  $B$ .

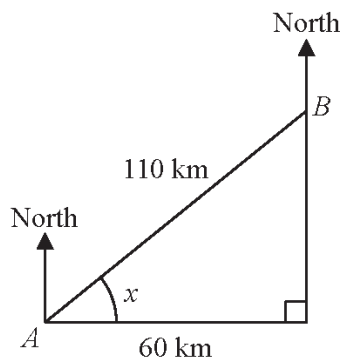


Diagram **NOT**  
accurately drawn

The distance from  $A$  to  $B$  is 110 km.  
 $B$  is 60 km east of  $A$ .

- (a) Work out the size of angle  $x$ .  
Give your answer correct to 1 decimal place.

.....  
(3)

- (b) Work out the bearing of  $B$  from  $A$ .  
Give your answer correct to the nearest degree.

.....  
(2)

The distance from  $A$  to  $B$  is 110 km correct to 2 significant figures.

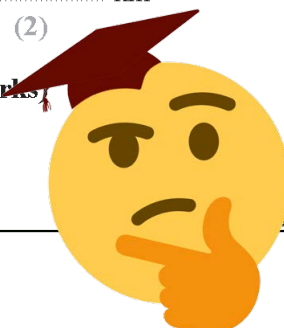
- (c) (i) Write down the lower bound for the distance from  $A$  to  $B$ .

..... km

- (ii) Write down the upper bound for the distance from  $A$  to  $B$ .

..... km  
(2)

(Total for Question is 7 marks)



**10** - (4MA0-S 2018-Paper 4HR-Q8) - TRIGONOMETRY

$A$ ,  $B$  and  $C$  are three cities.

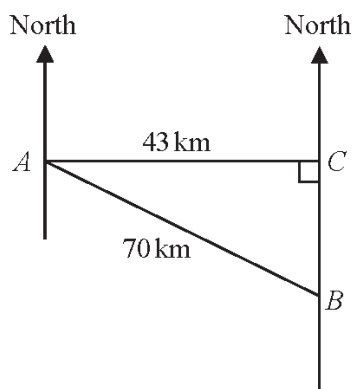


Diagram **NOT**  
accurately drawn

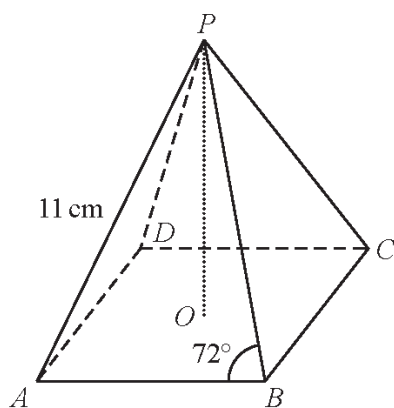
City  $C$  is due east of city  $A$  and due north of city  $B$ .  
City  $A$  is 43 km from city  $C$  and 70 km from city  $B$ .

Work out the bearing of city  $B$  from city  $A$ .  
Give your answer correct to the nearest degree.

(Total for Question is 4 marks)



11 - (4MA0-S 2018-Paper 4HR-Q23) - TRIGONOMETRY

Diagram **NOT**  
accurately drawn

The diagram shows a pyramid with a horizontal square base.  
 The vertex,  $P$ , of the pyramid is vertically above the centre,  $O$ , of the base.  
 The triangular faces of the pyramid are congruent isosceles triangles.

In triangle  $ABP$

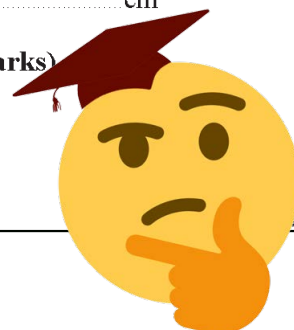
$PA = PB = 11$  cm and angle  $PBA = 72^\circ$

Work out the height,  $OP$ , of the pyramid.

Give your answer correct to 3 significant figures.

..... cm

(Total for Question 11 is 4 marks)



**12** - (4MA0-W 2018-Paper 4HR-Q8) - *TRIGONOMETRY*

Here is a right-angled triangle.

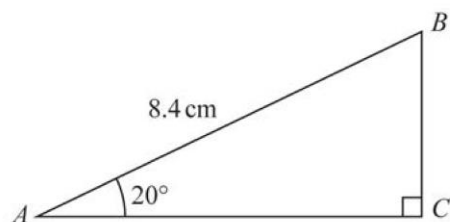


Diagram **NOT**  
accurately drawn

Calculate the length of  $BC$ .

Give your answer correct to 3 significant figures.

.....cm

(Total for Question is 3 marks)



1 - (4MA0-S 2015-Paper 4HR-Q1) - SETS

$$S = \{c, h, i, n, a\}$$

$$V = \{i, t, a, l, y\}$$

List the elements of the set

(i)  $S \cap V$

.....

(ii)  $S \cup V$

.....

(Total for Question \_ is 2 marks)



2 - (4MA0-W 2015-Paper 4HR-Q9) - SETS

$$\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$A = \{\text{even numbers}\}$$

$$B = \{\text{multiples of 3}\}$$

(a) List the members of set  $B$ .

.....  
(1)

(b) Find  $A \cup B$

.....  
(1)

(c) Find  $A \cap B$

.....  
(1)

$x$  is a member of  $\mathcal{E}$

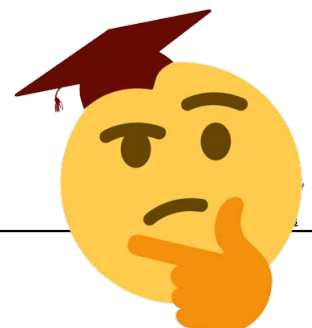
$$x \in B$$

$$x \notin A$$

(d) What are the possible values of  $x$ ?

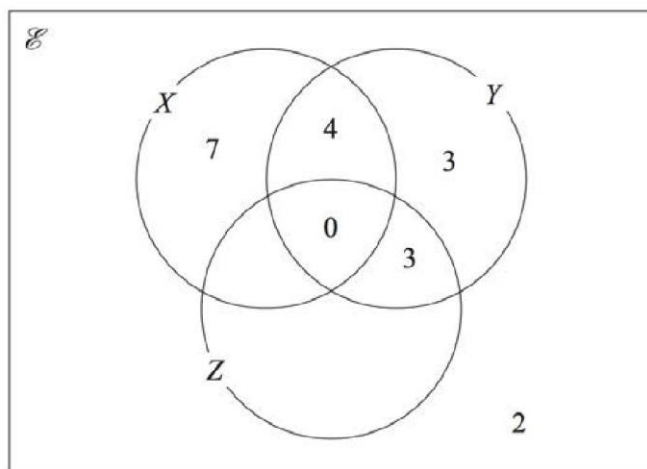
.....  
(2)

(Total for Question is 5 marks)



3 - (4MA0-S 2016-Paper 4HR-Q18) - SETS

The Venn diagram shows a universal set  $\mathcal{E}$  and three sets  $X$ ,  $Y$  and  $Z$ .



The numbers shown represent **numbers** of elements.

$$n(X') = 14$$

$$n(Z) = 14$$

(a) Complete the Venn diagram.

(2)

(b) Find the value of

(i)  $n(X \cup Z)$

.....

(ii)  $n(X \cap Y')$

.....

(2)



4 - (4MA0-W 2016-Paper 4HR-Q4) - SETS

$\mathcal{E} = \{\text{whole numbers}\}$

$A = \{\text{factors of } 100\}$

$B = \{\text{multiples of } 5\}$

List the members of the set  $A \cap B$

.....  
(Total for Question is 2 marks)





**5** - (4MA0-S 2017-Paper 4HR-Q2) - SETS

$$\mathcal{E} = \{4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$$

$$A = \{\text{multiples of } 5\}$$

$$B = \{\text{odd numbers}\}$$

(a) List the members of the set

(i)  $A \cap B$

(ii)  $A \cup B$

(2)

The set  $C$  has 6 members and  $B \cap C = \emptyset$

(b) List the members of set  $C$ .

(2)



6 - (4MA0-W 2017-Paper 4HR-Q5) - SETS

$$\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$A = \{2, 3, 5, 7\}$$

$$B = \{1, 3, 5, 7, 9\}$$

(a) List the members of the set

(i)  $A \cap B$

.....

(ii)  $A \cup B$

.....

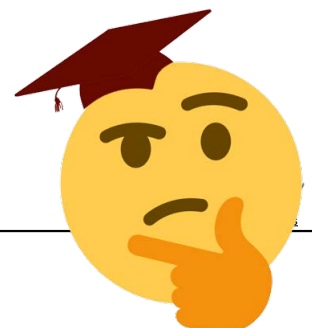
(2)

(b) Find  $n(A')$

.....

(1)

(Total for Question is 3 marks)



7 - (4MA0-W 2019-Paper 4HR-Q10) - SETS

$$\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$A = \{1, 3, 5, 7, 9\}$$

$$B = \{\text{numbers greater than } 6\}$$

(a) List the members of the set  $A \cup B$

(1)

$$C = \{3, 6, 9\}$$

(b) List the members of the set  $A \cap C$

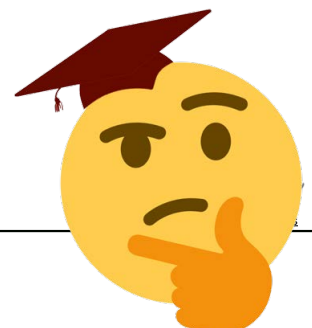
(1)

$D$  is a set with 4 members.

$$5 \in D \text{ and } B \cap D = \emptyset$$

(c) List the members of one possible set  $D$ .

(2)



**1 - (4MA0-S 2015-Paper 4HR-Q5) - STATISTICS**

Jordan's school awards certificates for outstanding work.

The table shows information about the numbers of certificates awarded in Jordan's class during a term.

| Number of certificates | Number of students |
|------------------------|--------------------|
| 0                      | 4                  |
| 1                      | 9                  |
| 2                      | 7                  |
| 3                      | 1                  |
| 4                      | 6                  |
| 5                      | 3                  |

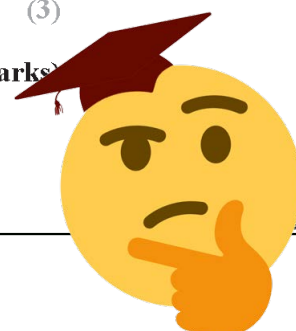
(a) Work out the median number of certificates awarded.

.....  
(2)

(b) Work out the interquartile range of the numbers of certificates awarded.

.....  
(3)

(Total for Question 1 is 5 marks)

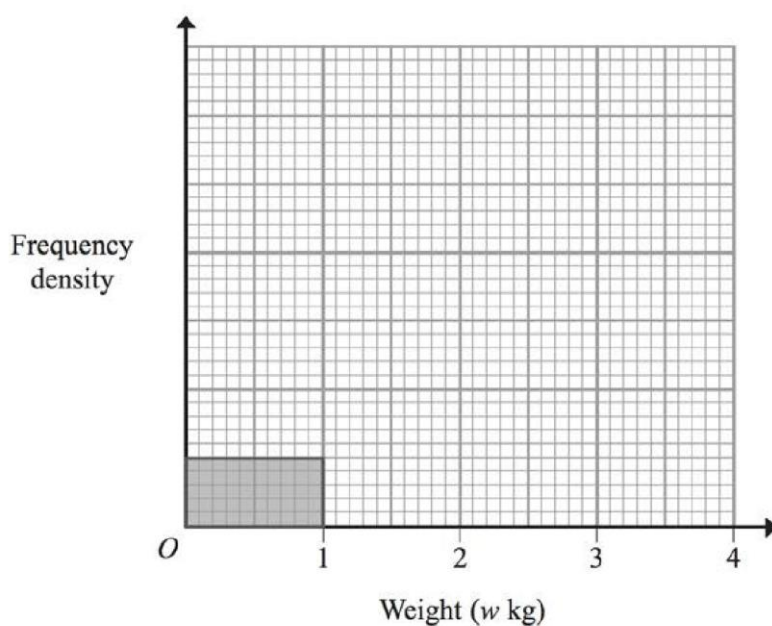


2 - (4MA0-S 2015-Paper 4HR-Q18) - STATISTICS

400 people are asked to guess the weight of a large cake.  
The table shows information about the weights they guess.

| Weight ( $w$ kg) | Number of guesses |
|------------------|-------------------|
| $0 < w \leq 1$   | 50                |
| $1 < w \leq 1.6$ | 90                |
| $1.6 < w \leq 2$ | 120               |
| $2 < w \leq 2.5$ | 95                |
| $2.5 < w \leq 4$ | 45                |

Use the information in the table to complete the histogram.



(Total for Question is 3 marks)



**3 - (4MA0-W 2015-Paper 4HR-Q6) - STATISTICS**

The table gives information about the number of vehicles passing a point on a road in each of 70 intervals of equal length.

| Number of vehicles | Frequency |
|--------------------|-----------|
| 1 to 5             | 8         |
| 6 to 10            | 10        |
| 11 to 15           | 18        |
| 16 to 20           | 20        |
| 21 to 25           | 10        |
| 26 to 30           | 4         |

(a) Write down the modal class interval.

.....  
(1)

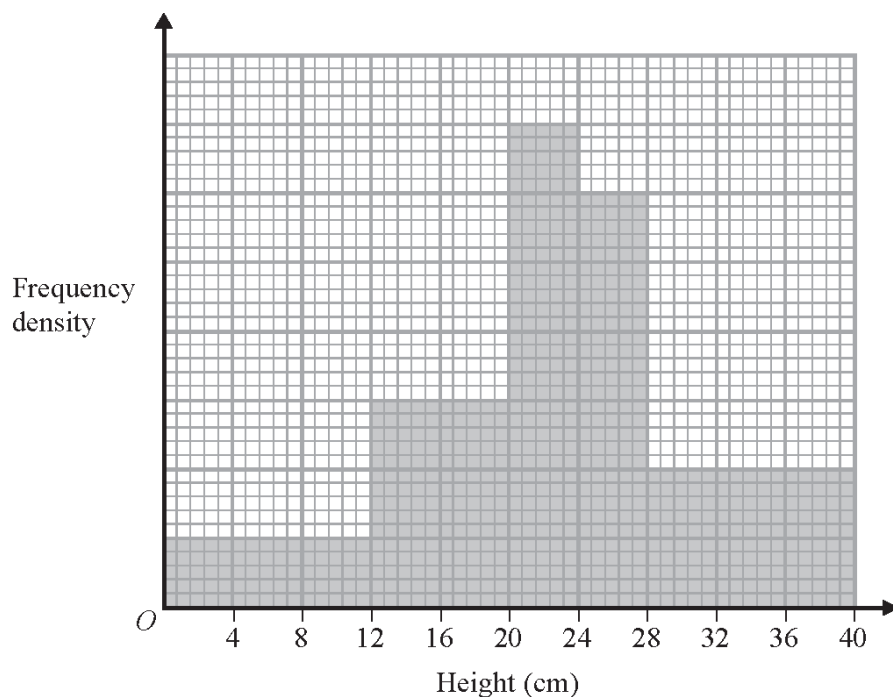
(b) Calculate an estimate for the mean.

.....  
(4)

**(Total for Question is 5 marks)**



4 - (4MA0-W 2015-Paper 4HR-Q18) - STATISTICS

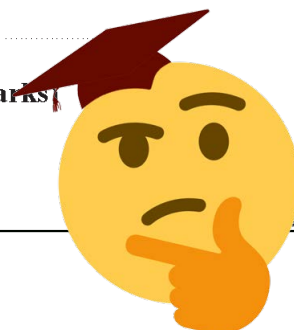


The histogram gives information about the heights of some plants.

There are 360 plants with a height of 20 cm or less.

Work out the number of plants with a height of more than 20 cm.

(Total for Question is 3 marks)



5 - (4MA0-S 2016-Paper 4HR-Q6) - STATISTICS

Here is a list of numbers written in order of size.

3      6       $x$        $y$

The numbers

have a median of 8

have a mean of 11

Find the value of  $x$  and the value of  $y$ .

$x =$  .....

$y =$  .....

**3 marks**





6 - (4MA0-S 2016-Paper 4HR-Q9) - *STATISTICS*

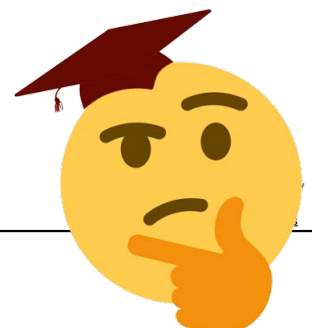
There are 30 apples in a box.  
The mean weight of these 30 apples is 120 grams.

There are 10 apples in a bag.  
The mean weight of these 10 apples is 95 grams.

Work out the mean weight of the 40 apples.

.....grams

**3 marks**



7 - (4MA0-S 2016-Paper 4HR-Q12) - STATISTICS

The table gives some information about the incomes, £ $I$ , of 100 people in the UK.

| Income (£ $I$ )            | Frequency |
|----------------------------|-----------|
| $0 < I \leq 10\,000$       | 12        |
| $10\,000 < I \leq 20\,000$ | 41        |
| $20\,000 < I \leq 30\,000$ | 25        |
| $30\,000 < I \leq 40\,000$ | 12        |
| $40\,000 < I \leq 50\,000$ | 6         |
| $50\,000 < I \leq 60\,000$ | 4         |

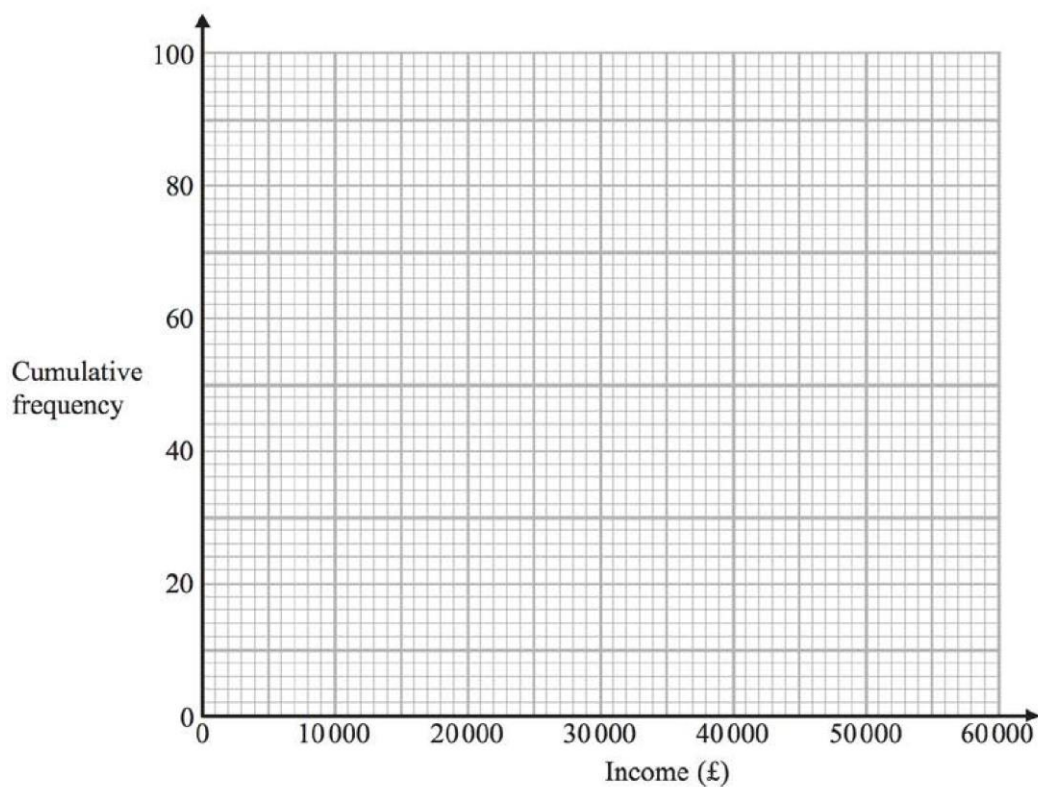
(a) Complete the cumulative frequency table.

| Income (£ $I$ )      | Cumulative frequency |
|----------------------|----------------------|
| $0 < I \leq 10\,000$ | 12                   |
| $0 < I \leq 20\,000$ |                      |
| $0 < I \leq 30\,000$ |                      |
| $0 < I \leq 40\,000$ |                      |
| $0 < I \leq 50\,000$ |                      |
| $0 < I \leq 60\,000$ |                      |

(1)



(b) On the grid, draw a cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for

(i) the median,

£.....

(ii) the interquartile range.

£.....

(3)



**8 - (4MA0-W 2016-Paper 4HR-Q7) - STATISTICS**

Mr Rowland has a class of 30 students.

He gave them 24 words to spell.

The table shows information about the number of correct spellings for each student.

| Number of correct spellings | Frequency |
|-----------------------------|-----------|
| 0 – 4                       | 1         |
| 5 – 9                       | 5         |
| 10 – 14                     | 6         |
| 15 – 19                     | 10        |
| 20 – 24                     | 8         |

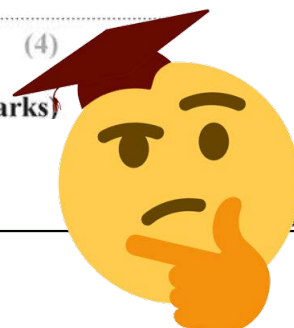
(a) Write down the modal class.

.....  
(1)

(b) Work out an estimate for the mean number of correct spellings.  
Give your answer to 1 decimal place.

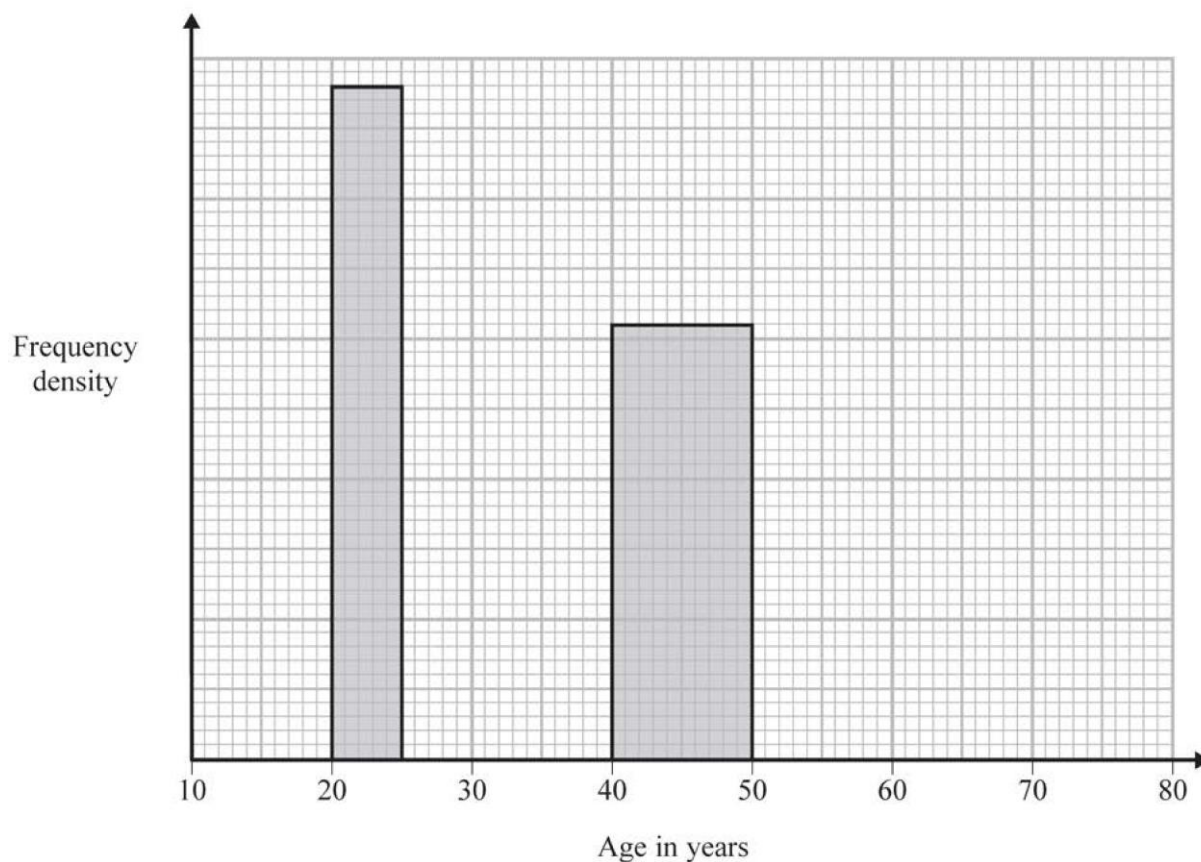
.....  
(4)

(Total for Question is 5 marks)



9 - (4MA0-W 2016-Paper 4HR-Q18) - STATISTICS

The incomplete histogram and the incomplete table show information about the ages of people watching a film in a cinema.



| Age ( $a$ years) | Number of people |
|------------------|------------------|
| $10 \leq a < 20$ | 38               |
| $20 \leq a < 25$ | 24               |
| $25 \leq a < 40$ | 63               |
| $40 \leq a < 50$ |                  |
| $50 \leq a < 80$ | 24               |

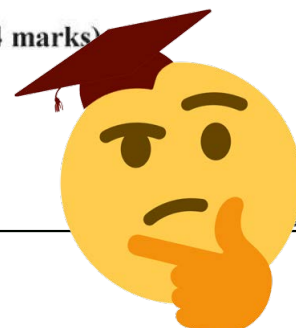
(a) Use the histogram to complete the table.

(2)

(b) Use the table to complete the histogram.

(2)

(Total for Question 9 is 4 marks)



**10** - (4MA0-S 2017-Paper 4HR-Q6) - *STATISTICS*

The frequency table shows information about the distances 60 office workers travel to work each day.

| Distance travelled ( $d$ km) | Frequency |
|------------------------------|-----------|
| $0 < d \leq 10$              | 5         |
| $10 < d \leq 20$             | 12        |
| $20 < d \leq 30$             | 17        |
| $30 < d \leq 40$             | 20        |
| $40 < d \leq 50$             | 6         |

- (a) Write down the modal class.

.....  
(1)

- (b) Work out an estimate for the mean distance travelled to work by these office workers.  
Give your answer correct to 1 decimal place.

..... km  
(4)

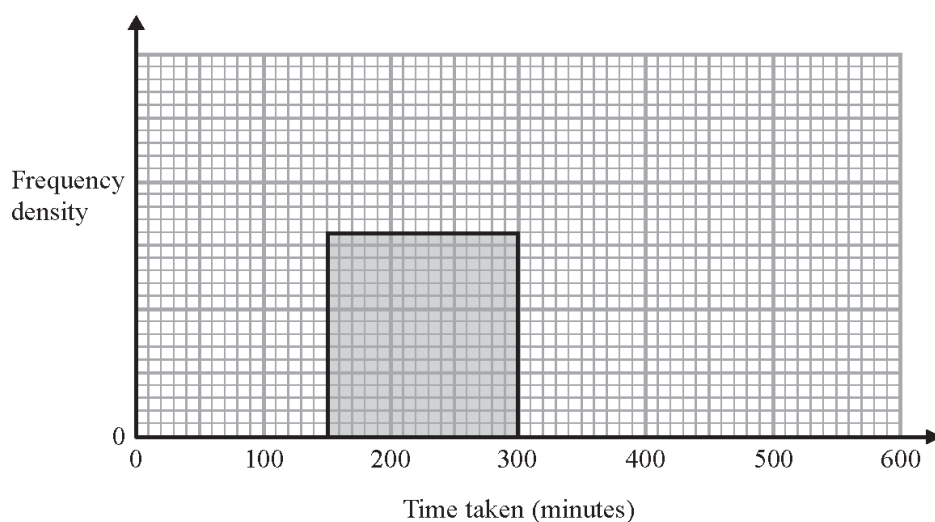


**11** - (4MA0-S 2017-Paper 4HR-Q19) - STATISTICS

The table gives information about the time taken by each of 600 people to reach their holiday destination.

| Time taken ( $t$ minutes) | Frequency |
|---------------------------|-----------|
| $0 < t \leq 100$          | 120       |
| $100 < t \leq 150$        | 140       |
| $150 < t \leq 300$        | 240       |
| $300 < t \leq 500$        | 80        |
| $500 < t \leq 600$        | 20        |

- (a) Use the information in the table to complete the histogram.



(3)

- (b) Work out an estimate for the number of people who took more than 200 minutes to reach their holiday destination.

(2)

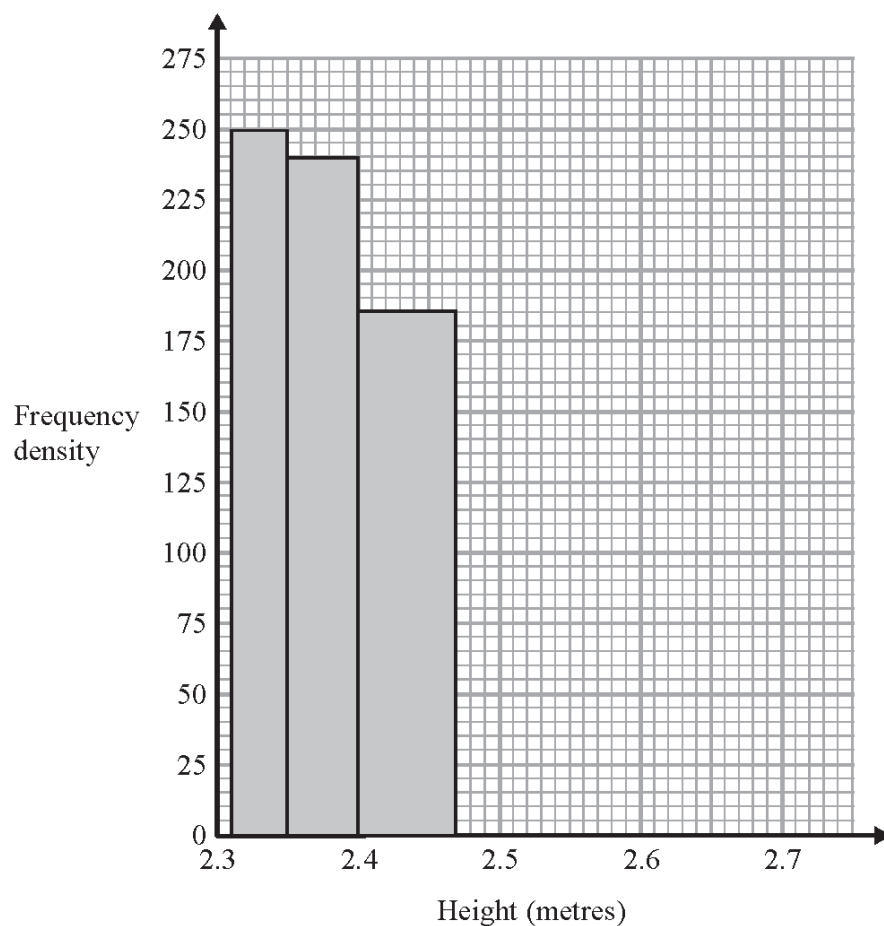


12 - (4MA0-W 2017-Paper 4HR-Q16) - STATISTICS

The table shows information about the heights, in metres, of 45 of the world's tallest men.

| Height ( $h$ metres) | Number of men |
|----------------------|---------------|
| $2.31 < h \leq 2.35$ | 10            |
| $2.35 < h \leq 2.40$ | 12            |
| $2.40 < h \leq 2.47$ | 13            |
| $2.47 < h \leq 2.72$ | 10            |

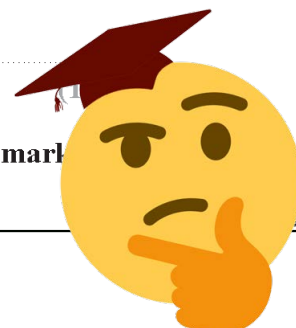
(a) Use the information in the table to complete the histogram.



(2)

(b) Find an estimate for the number of these men with height between 2.32 metres and 2.34 metres.

(Total for Question is 3 marks)





**13** - (4MA0-S 2018-Paper 4HR-Q1) - *STATISTICS*

Three numbers have

- a mean of 17
- a median of 20
- a range of 27

Find the three numbers.

..... ; ..... ; .....

(Total for Question is 3 marks)



**14** - (4MA0-S 2018-Paper 4HR-Q3) - *STATISTICS*

The table gives information about the number of trees in each of 20 gardens.

| Number of trees | Frequency |
|-----------------|-----------|
| 0               | 2         |
| 1               | 7         |
| 2               | 3         |
| 3               | 4         |
| 4               | 3         |
| 5               | 1         |

(a) Work out the total number of trees in these gardens.

.....  
(2)

(b) Find the median number of trees in these gardens.

.....  
(1)



**15** - (4MA0-S 2018-Paper 4HR-Q11) - *STATISTICS*

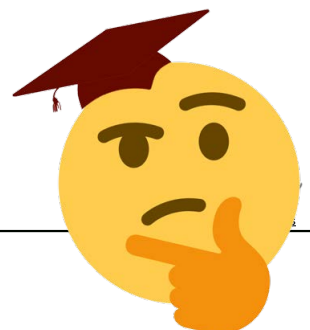
A group of 15 businessmen were asked to give the number of different countries they had each visited on business.

Here are the results.

0   1   3   3   4   6   7   8   8   9   10   10   11   12   14

Work out the interquartile range of the number of countries visited.

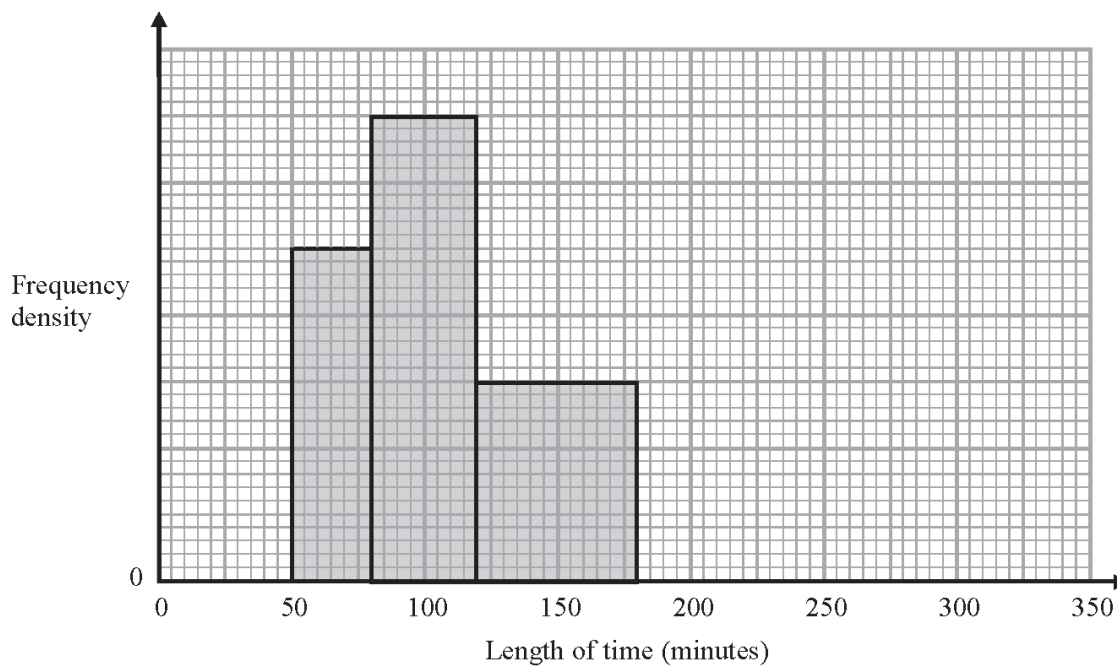
.....  
(Total for Question    is 2 marks)



**16** - (4MA0-S 2018-Paper 4HR-Q18) - STATISTICS

The incomplete histogram and table give information about the lengths of time, in minutes, that some people spent at an airport.

| Time ( $t$ minutes) | Frequency |
|---------------------|-----------|
| $0 < t \leq 50$     | 10        |
| $50 < t \leq 80$    | 15        |
| $80 < t \leq 120$   |           |
| $120 < t \leq 180$  |           |
| $180 < t \leq 240$  | 12        |
| $240 < t \leq 320$  | 8         |



(a) Use the histogram to complete the table.

(2)

(b) Use the table to complete the histogram.

(2)



## 17 - (4MA0-W 2018-Paper 4HR-Q6) - STATISTICS

The table gives information about the number of goals scored in each of 40 European Championship football matches.

| Number of goals scored | Frequency |
|------------------------|-----------|
| 0                      | 1         |
| 1                      | 8         |
| 2                      | 12        |
| 3                      | 15        |
| 4                      | 4         |

(a) Find the mean number of goals scored.

.....  
(3)

(b) Work out the interquartile range of the number of goals scored.

.....  
(2)

Francois has a recording of each of the 40 matches.  
He is going to choose at random one of these matches to watch.

(c) Work out the probability that in this match more than 2 goals were scored.

.....  
(2)



**18** - (4MA0-W 2019-Paper 4HR-Q12) - STATISTICS

Mwai plays netball.

In January, she played in 11 netball matches.

Here is the number of goals she scored in each of these matches.

42      20      37      32      32      41      37      40      28      36      36

- (a) Find the interquartile range of the numbers of goals Mwai scored in January.  
Show your working clearly.

(3)

In February, Mwai played in 10 netball matches.

In each of these matches, she scored more than 41 goals.

- (b) Work out the median of the numbers of goals that Mwai scored in the 21 matches in January and February.

(2)

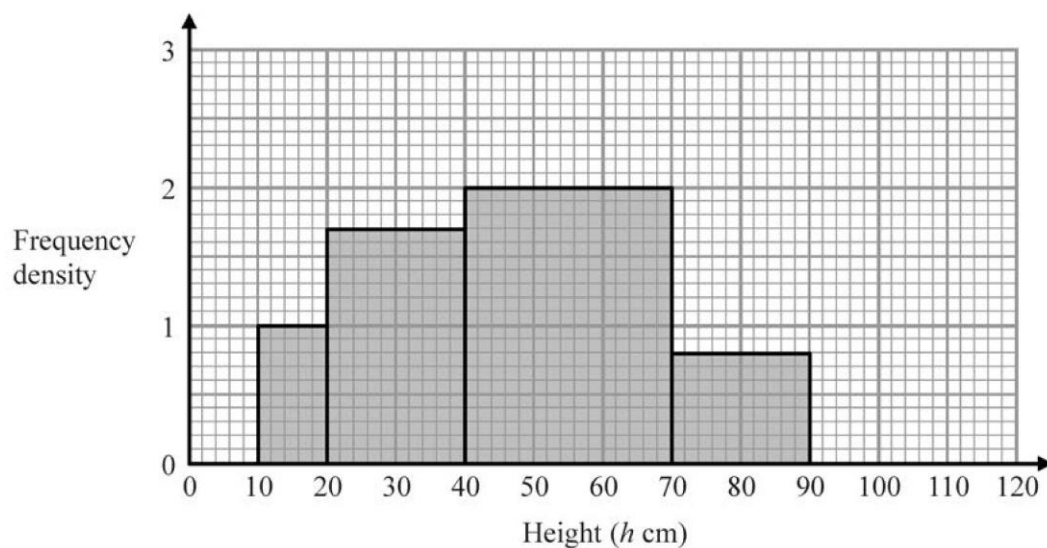


19 - (4MA0-W 2019-Paper 4HR-Q21) - STATISTICS

Mayang collected bamboo plants for an experiment.

The heights of Mayang's bamboo plants are all between 10 cm and 110 cm.

The incomplete histogram gives some information about the heights,  $h$  cm, of the bamboo plants.



Mayang found that 4% of the bamboo plants had heights in the interval  $90 < h \leq 110$

Use this information to complete the histogram.



**1 - (4MA0-S 2015-Paper 4HR-Q6) - PROBABILITY**

The table shows the probabilities of people in Wales being in blood group O or in blood group A or in blood group AB.

| Blood group | Probability |
|-------------|-------------|
| O           | 0.44        |
| A           | 0.42        |
| B           |             |
| AB          | 0.04        |

All people in Wales are in exactly one of the blood groups O, A, B or AB.

A person is selected at random from the people in Wales.

(a) Find the probability that this person is in blood group B.

.....  
(2)

(b) Find the probability that this person is in blood group O or A.

.....  
(1)

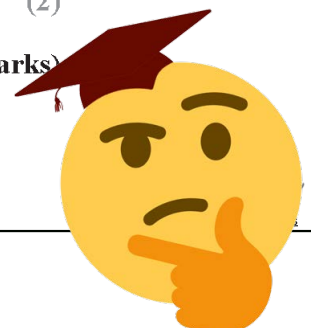
There are 1200 students in Aled's school.

Aled's school is in Wales.

(c) Work out an estimate for the number of pupils in Aled's school who are in blood group AB.

.....  
(2)

(Total for Question 1 is 5 marks)





2 - (4MA0-S 2015-Paper 4HR-Q16) - *PROBABILITY*

When a fair dice is thrown the probability of scoring 6 is  $\frac{1}{6}$   
Arun throws four fair dice.

Work out the probability that he scores 6 with at least one of the four dice.

.....  
(Total for Question    is 3 marks)



**3 - (4MA0-W 2015-Paper 4HR-Q13) - PROBABILITY**

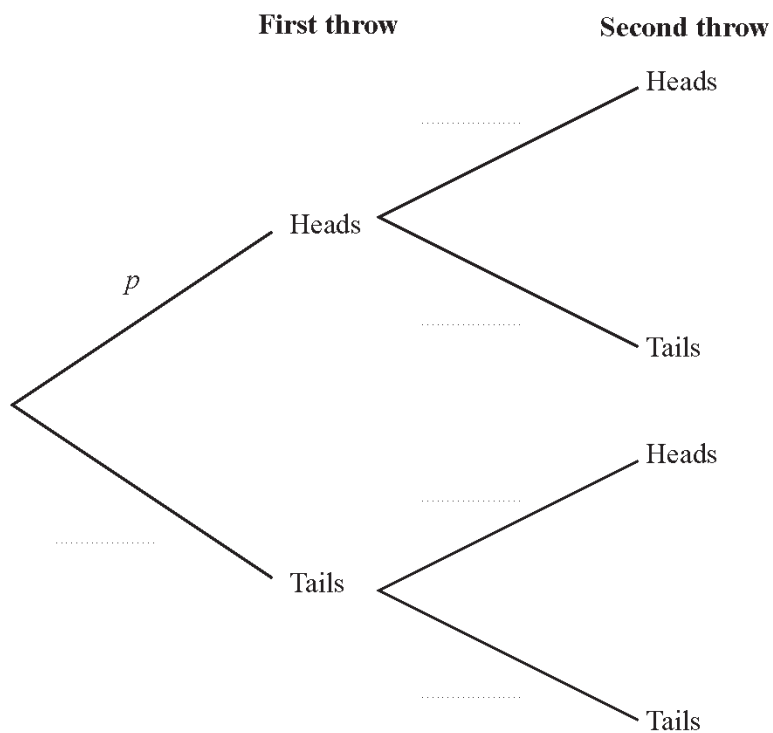
Jim has a biased coin.

The probability that Jim will throw Heads on any throw is  $p$ .

Jim throws the coin twice.

(a) Complete the probability tree diagram.

Give your probabilities in terms of  $p$ .



(2)

(b) Find an expression, in terms of  $p$ , for the probability that Jim will throw two Heads.

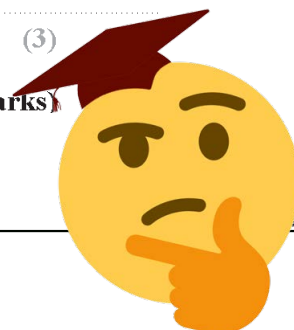
(1)

Given that  $p = 0.8$ ,

(c) work out the probability that Jim will throw exactly one Head.

(3)

(Total for Question is 6 marks)



4 - (4MA0-S 2016-Paper 4HR-Q15) - PROBABILITY

Naveed has two bags of tiles, bag **A** and bag **B**.

There are 10 tiles in bag **A**.

7 of these tiles are red.

The other 3 tiles are white.

There are 8 tiles in bag **B**.

5 of these tiles are red.

The other 3 tiles are white.

Naveed takes at random one tile from each bag.

(a) Work out the probability that the tiles are the same colour.

.....  
(3)

All 18 tiles are put in a box.

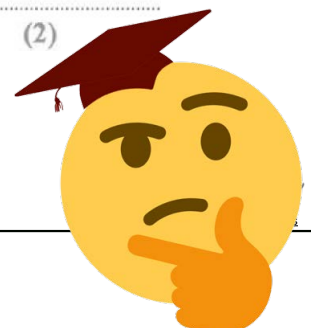
Naveed takes at random one tile from the box.

He does not replace the tile.

Naveed then takes at random a second tile from the box.

(b) Work out the probability that both tiles are red.

.....  
(2)



## 5 - (4MA0-W 2016-Paper 4HR-Q17) - PROBABILITY

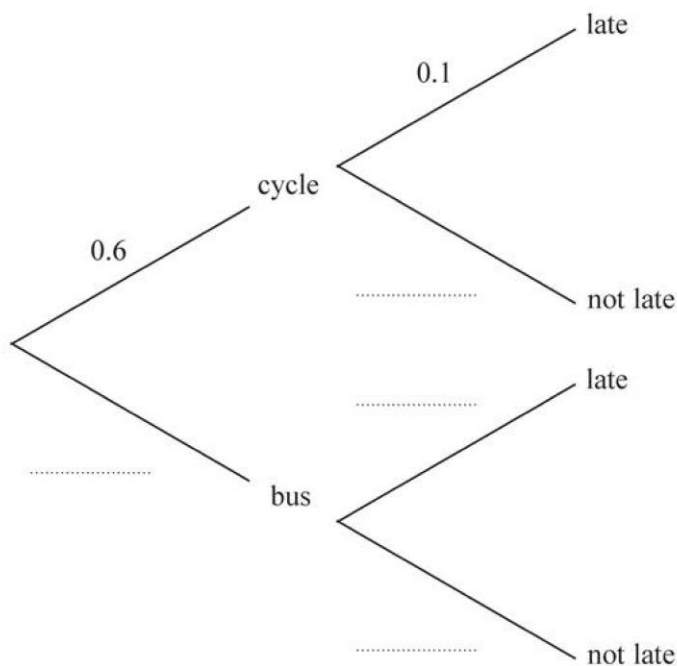
Chaiwat either cycles to work or goes by bus.

On any day that he goes to work, the probability that he cycles is 0.6

When he cycles, the probability that he is late is 0.1

When he goes by bus, the probability that he is late is 0.3

(a) Complete the probability tree diagram.



(2)

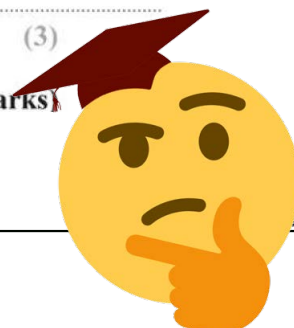
(b) Calculate the probability that on a day Chaiwat goes to work, he cycles and is late for work.

(2)

(c) Calculate the probability that on a day Chaiwat goes to work, he is **not** late for work.

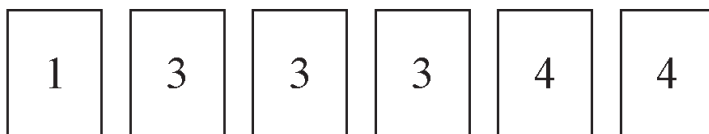
(3)

(Total for Question is 7 marks)



**6** - (4MA0-S 2017-Paper 4HR-Q16) - *PROBABILITY*

Here are six cards.  
Each card has a number on it.



The cards are turned over to hide their numbers and are then mixed up.  
Malachi takes at random two of the cards and turns them over to show their numbers.

(a) Calculate the probability that the number 4 is on both of the cards Malachi takes.

.....  
(2)

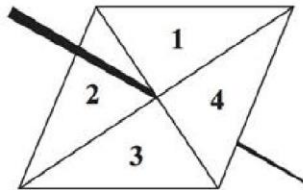
(b) Calculate the probability that the sum of the numbers on the two cards Malachi takes is an even number.

.....  
(3)



7 - (4MA0-W 2017-Paper 4HR-Q2) - PROBABILITY

Here is a biased 4-sided spinner.



The spinner is spun.

The table shows the probability that the spinner lands on 1 and the probability that it lands on 2

| Number      | 1    | 2   | 3 | 4 |
|-------------|------|-----|---|---|
| Probability | 0.15 | 0.4 |   |   |

(a) Work out the probability that the spinner will land on 1 or on 2

.....  
(1)

The probability that the spinner will land on 3 is twice the probability that the spinner will land on 4

(b) Work out the probability that the spinner will land on 3

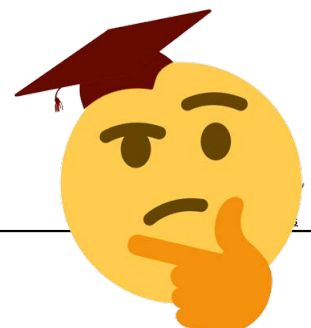
.....  
(2)

Daljit is going to spin the spinner 160 times.

(c) Work out an estimate for the number of times the spinner will land on 2

.....  
(2)

(Total for Question is 5 marks)



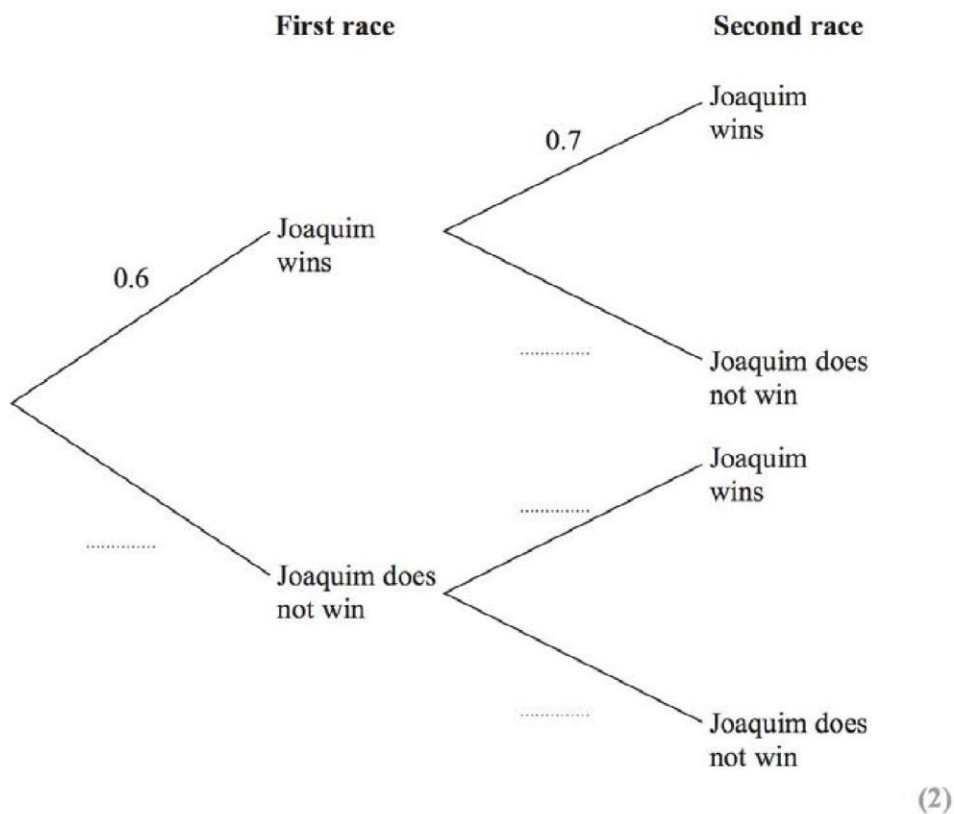
8 - (4MA0-W 2017-Paper 4HR-Q12) - PROBABILITY

Joaquim takes part in two cycle races.

The probability that he wins the first race is 0.6

The probability that he wins the second race is 0.7

(a) Complete the probability tree diagram.



(b) Work out the probability that Joaquim wins both races.

(2)



Joaquim takes part in a third cycle race.

The probability that Joaquim wins the third race is 0.2

(c) Work out the probability that he wins exactly one of the three races.

.....  
(3)

**(Total for Question is 7 marks)**





**9 - (4MA0-S 2018-Paper 4HR-Q14) - PROBABILITY**

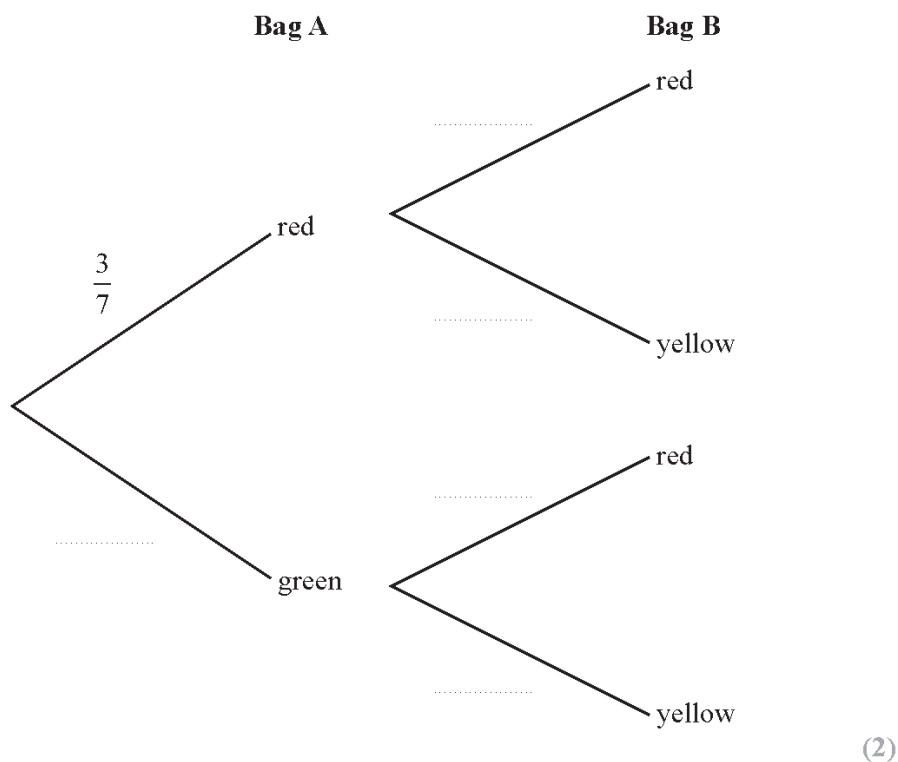
Genevieve has two bags of marbles, bag A and bag B.

In bag A there are only 3 red marbles and 4 green marbles.

In bag **B** there are only 4 red marbles and 5 yellow marbles.

Genevieve takes at random one marble from each bag.

(a) Complete the probability tree diagram.



(b) Work out the probability that Genevieve takes two red marbles.

(2)



**10** - (4MA0-W 2018-Paper 4HR-Q12) - *PROBABILITY*

In a bowl, there are 20 grapes.

13 of these grapes are green and 7 of these grapes are red.

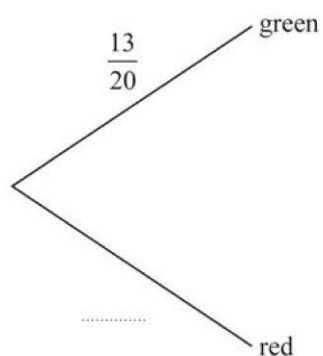
Jayesh takes at random a grape from the bowl and eats the grape.

He then takes at random another grape from the bowl and eats the grape.

(a) Complete the probability tree diagram.

**First grape**

**Second grape**



(3)

(b) Work out the probability that Jayesh eats two green grapes.

(2)



Jayesh takes at random a third grape from the bowl and eats this grape.

(c) Work out the probability that there are now 11 green grapes in the bowl.

.....  
(3)



11 - (4MA0-W 2019-Paper 4HR-Q15) - PROBABILITY

Bag A and bag B each contain 10 counters.

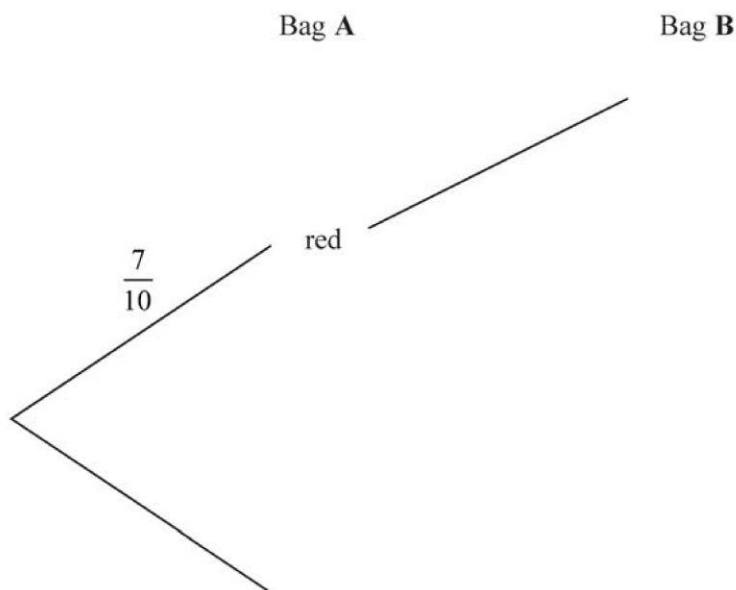
There are 7 red counters and 3 green counters in bag A.

There are 4 red counters and 6 green counters in bag B.

Ahmed takes at random a counter from bag A.

Bhavana takes at random a counter from bag B.

(a) Complete the probability tree diagram.



(3)

(b) Calculate the probability that Ahmed takes a red counter and Bhavana takes a green counter.

(2)



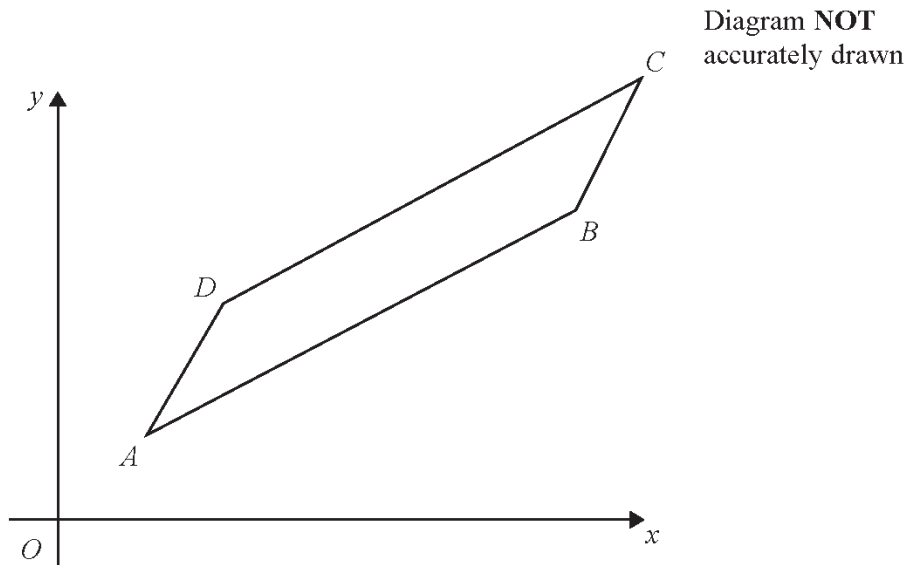
(c) Calculate the probability that at least one red counter is taken.

(3)



1 - (4MA0-W 2015-Paper 4HR-Q15) - *VECTORS*

Here is the parallelogram  $ABCD$ .



$$\vec{AD} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}, \vec{AB} = \begin{pmatrix} 5 \\ 3 \end{pmatrix}$$

(a) Find the magnitude of  $\vec{AD}$ .

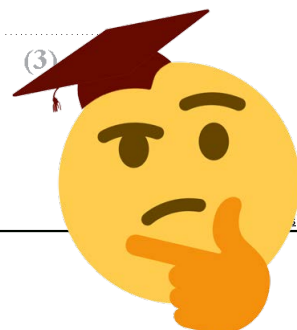
Give your answer correct to 3 significant figures.

.....  
(2)

The point  $A$  has coordinates  $(4, 2)$

(b) Work out the coordinates of the point  $C$ .

.....  
(3)



The diagonals of the parallelogram  $ABCD$  cross at the point  $E$ .

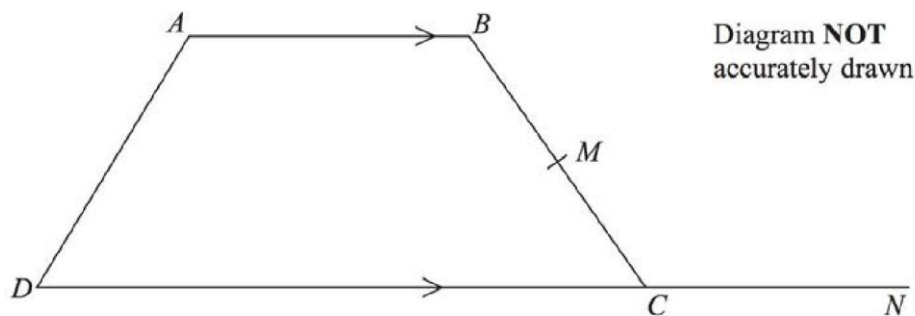
(c) Find as a column vector,  $\vec{OE}$ .

.....  
(3)

(Total for Question is 8 marks)



2 - (4MA0-S 2016-Paper 4HR-Q19) - VECTORS

 $AB$  is parallel to  $DC$ 

$$DC = 2AB$$

 $M$  is the midpoint of  $BC$ 

$$\vec{AD} = 2\mathbf{b}$$

$$\vec{AB} = 4\mathbf{a}$$

- (a) Find  $\vec{BM}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .  
Give your answer in its simplest form.

(2)

 $N$  is the point such that  $DCN$  is a straight line and  $DC : CN = 2 : 1$ 

- (b) Show that  $AMN$  is a straight line.

(2)





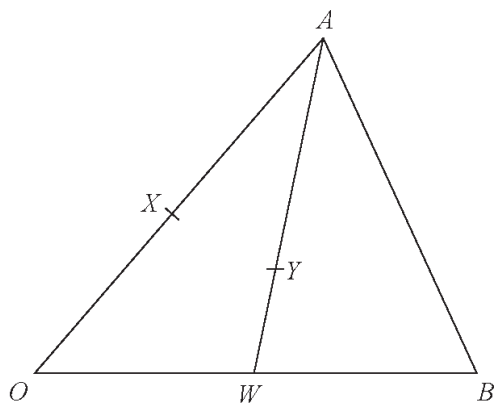
**3** - (4MA0-S 2017-Paper 4HR-Q21) - VECTORS

Diagram **NOT**  
accurately drawn

$OAB$  is a triangle.

$X$  is the midpoint of  $OA$  and  $W$  is the midpoint of  $OB$ .

$Y$  is the point on  $AW$  such that  $AY : YW = 2 : 1$

$\vec{OX} = 3\mathbf{a}$  and  $\vec{OW} = 3\mathbf{b}$

(a) Express in terms of  $\mathbf{a}$  and  $\mathbf{b}$

(i)  $\vec{AW}$

(ii)  $\vec{AY}$

(iii)  $\vec{XB}$

.....

.....

.....

(3)

(b) Show by a vector method that  $XYB$  is a straight line.

(2)



## 4 - (4MA0-W 2018-Paper 4HR-Q17) - VECTORS

$PQRS$  is a quadrilateral.

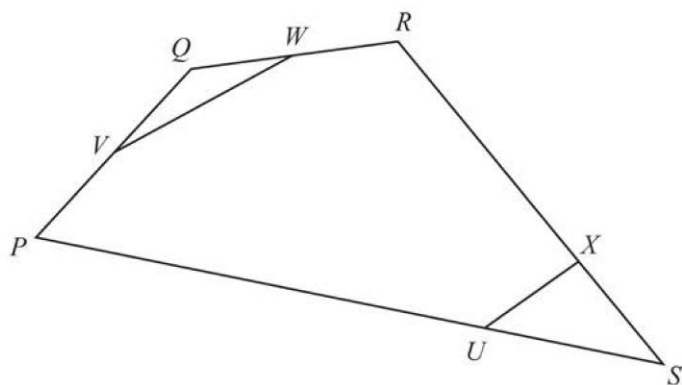


Diagram **NOT**  
accurately drawn

$$\vec{PQ} = 6\mathbf{a} \quad \vec{QR} = 4\mathbf{b} \quad \vec{RS} = 2\mathbf{c}$$

$V$  is the midpoint of  $PQ$ .

$W$  is the midpoint of  $QR$ .

$X$  is the point on  $RS$  such that  $RX = \frac{3}{4}RS$ .

$U$  is the point on  $PS$  such that  $PU = \frac{3}{4}PS$ .

(a) (i) Find  $\vec{PS}$  in terms of  $\mathbf{a}$ ,  $\mathbf{b}$  and  $\mathbf{c}$

(ii) Find  $\vec{VW}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$

(2)

(b) Show, by a vector method, that  $VW$  is parallel to  $UX$ .

(3)



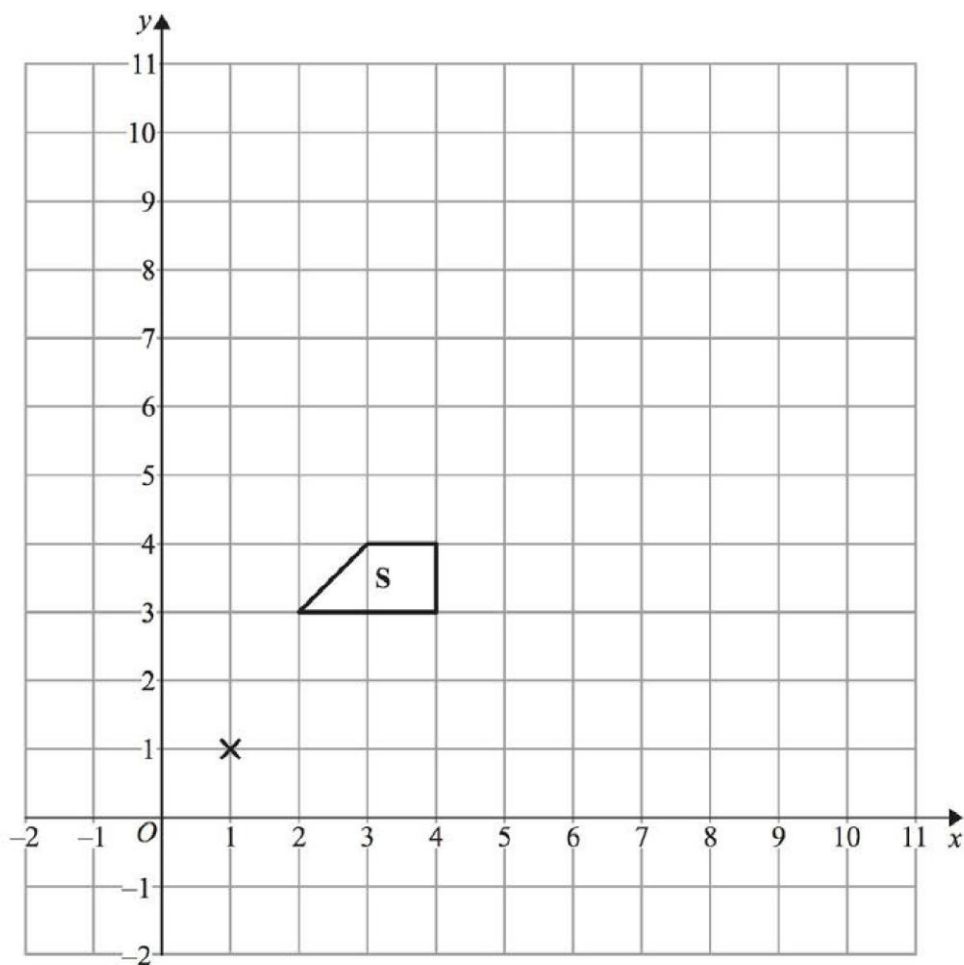
Given that  $\vec{RS} = \begin{pmatrix} 6 \\ -5 \end{pmatrix}$

- (c) calculate the magnitude of  $\vec{RS}$ .  
Give your answer as a surd.

.....  
(2)



1 - (4MA0-S 2016-Paper 4HR-Q1) - TRANSFORMATION



- (a) Enlarge shape S, by scale factor 2, centre (1, 1).  
Label the new shape T.

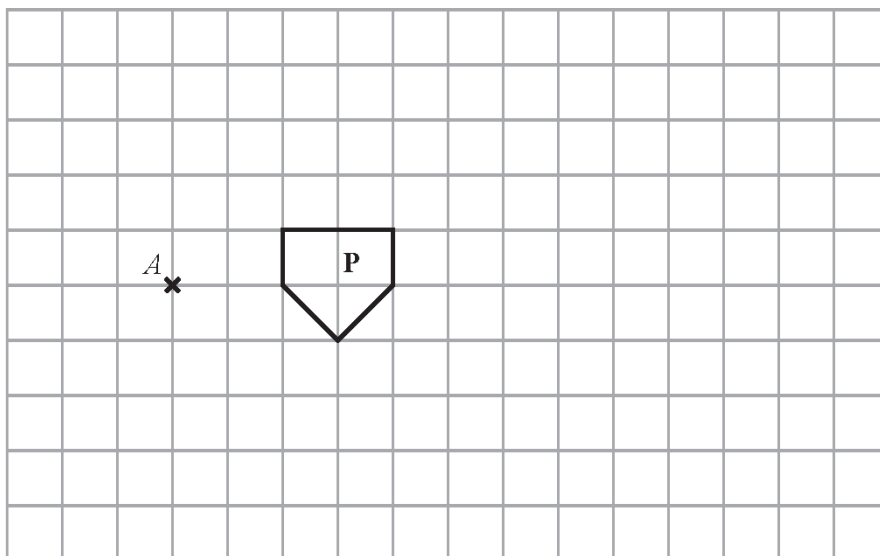
(2)

- (b) Describe fully the single transformation that maps shape T onto shape S.

(1)

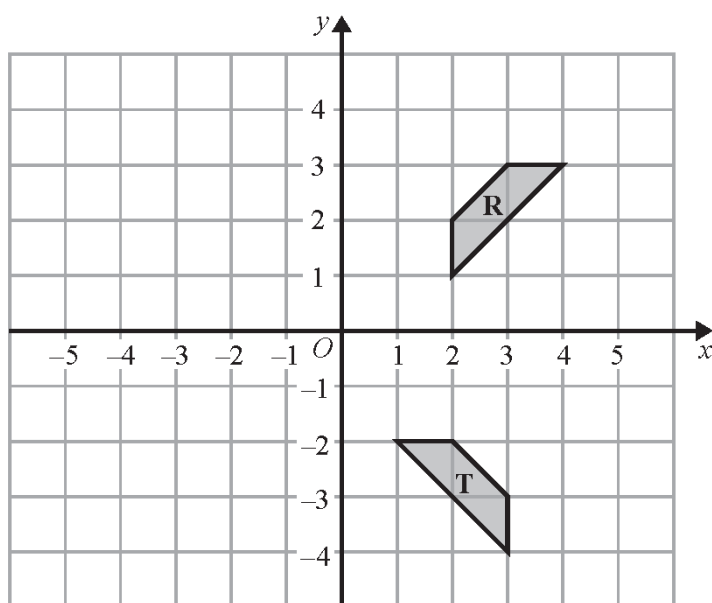


2 - (4MA0-S 2018-Paper 4HR-Q5) - TRANSFORMATION



(a) On the grid, enlarge shape  $P$  with scale factor 3 and centre  $A$ .

(2)



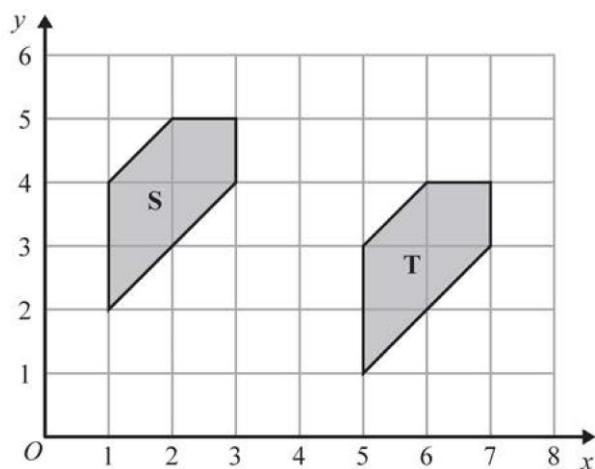
(b) Describe fully the single transformation that maps shape  $R$  onto shape  $T$ .

(3)



**3 - (4MA0-W 2018-Paper 4HR-Q5) - TRANSFORMATION**

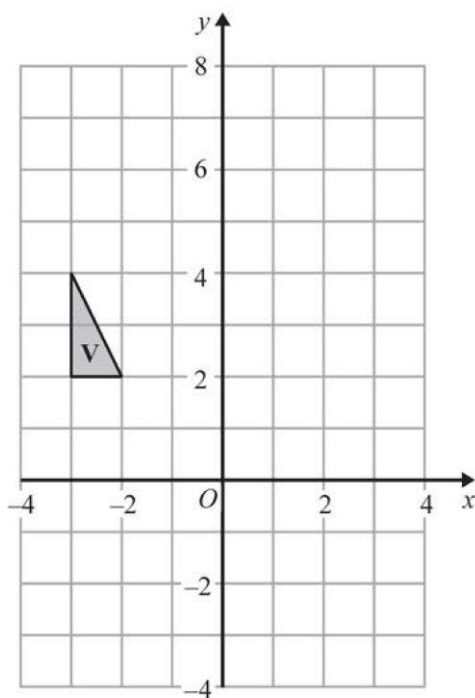
The diagram shows shape **S** and shape **T** on a centimetre grid.



(a) Describe fully the single transformation that maps shape **S** onto shape **T**.

(2)

(b) On the grid, rotate triangle **V**  $90^\circ$  anticlockwise about the point (2, 2)



(2)

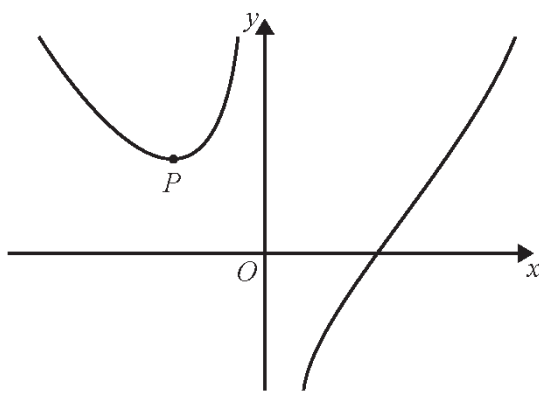


**1** - (4MA0-S 2015-Paper 4HR-Q21) - DIFFERENTIATION & KINEMATICS

$$y = x^2 - \frac{16}{x}$$

(a) Find  $\frac{dy}{dx}$

$$\frac{dy}{dx} = \dots\dots\dots (3)$$



The graph shows part of the curve with equation  $y = x^2 - \frac{16}{x}$

The point  $P$  is the turning point of the curve.

(b) Work out the coordinates of  $P$ .

$$(\dots\dots\dots, \dots\dots\dots) (4)$$

(Total for Question is 7 marks)

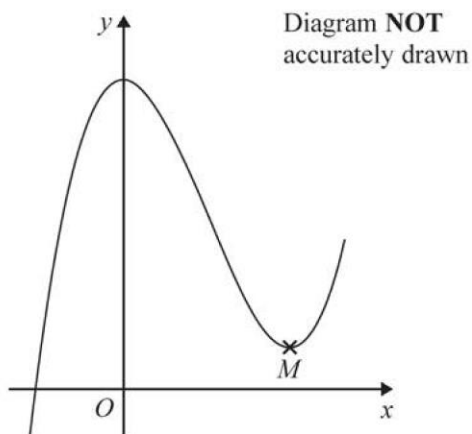


2 - (4MA0-W 2018-Paper 4HR-Q16) - DIFFERENTIATION & KINEMATICS

$$y = 2x^3 - 9x^2 + 31$$

(a) Find  $\frac{dy}{dx}$

$$\frac{dy}{dx} = \dots\dots\dots (2)$$



The diagram shows a sketch of the curve with equation  $y = 2x^3 - 9x^2 + 31$   
The point  $M$  is a turning point on the curve.

(b) Work out the gradient of the line  $OM$ .  
Show clear algebraic working.

.....  
(4)





**3** - (4MA0-W 2019-Paper 4HR-Q18) - DIFFERENTIATION & KINEMATICS

A particle  $P$  moves along a straight line.

$O$  is a fixed point on the line.

The displacement,  $s$  metres, of  $P$  from  $O$  at time  $t$  seconds is given by

$$s = t + \frac{36}{t} + 4 \quad \text{for } t > 1$$

The velocity of  $P$  at time  $t$  seconds is  $v$  m/s.

(a) By differentiation, find an expression for  $v$  in terms of  $t$  for  $t > 1$

$$v = \quad (2)$$

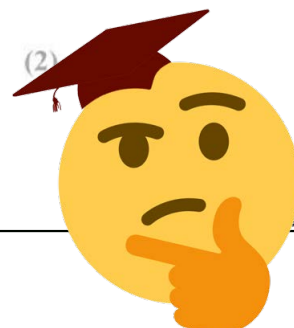
(b) Find the value of  $t$  for which  $v = 0$

$$t = \quad (2)$$

The acceleration of  $P$  at time  $t$  seconds is  $a$  m/s<sup>2</sup>

(c) Find the value of  $a$  when  $t = 2$

$$a = \quad (2)$$



# ANSWERS



1 - (4MA0-S 2015-Paper 4HR-Q2) - NUMBER

|  |                                                                                                                                       |     |
|--|---------------------------------------------------------------------------------------------------------------------------------------|-----|
|  | $\frac{638}{2.75}$ or $\frac{638}{2\frac{3}{4}}$ or $\frac{638}{11/4}$ or $\frac{638}{11} \times 4$ or $\frac{638}{165} \times 60$ oe |     |
|  |                                                                                                                                       | 232 |

2 - (4MA0-S 2015-Paper 4HR-Q3) - NUMBER

|     |                                                                                                                                                                                                              |       |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| (a) | Eg $\frac{7\frac{1}{2}}{100} \times 15000$ or $0.075 \times 15000$ oe or 1125 or<br>$0.075 \times 15000 + 15000$ or $15000 \times 1.075$ oe                                                                  | 16125 |
| (b) | Eg $\frac{1800}{8} \times 108$ or $\frac{1800}{0.08} \times 1.08$ or $22500 \times 1.08$ or $\frac{1800}{0.08} + 1800$ or<br>$\frac{1800}{8} \times 100 + 1800$ or $225 \times 100 + 1800$ or $22500 + 1800$ | 24300 |



**3** - (4MA0-S 2015-Paper 4HR-Q8) - NUMBER

|     |                                                                                                                                                                                   |          |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| (a) | Eg $\frac{175}{7} \times 9$                                                                                                                                                       | 225      |
| (b) | $\frac{400}{27+14+9} \times 27$ oe or $\frac{400}{27+14+9}$ or $\frac{400}{50}$ or 8                                                                                              | 216      |
| (c) | $(9 : 7 =) 27 : 21$ or $9 : \frac{14}{3}$<br>Or Flaky: (flour $x$ ), fat $\frac{7}{9}x$ and Sweet: (flour $x$ ), fat $\frac{14}{27}x$<br>where $x$ may also be any positive value | 3 : 2 oe |

**4** - (4MA0-S 2015-Paper 4HR-Q14) - NUMBER

|     |                                                                                                  |                       |
|-----|--------------------------------------------------------------------------------------------------|-----------------------|
| (a) | $V = \frac{k}{t^2}$<br><br>$28 = \frac{k}{2.5^2}$ oe or<br>$k = 28 \times 2.5^2$ or<br>$k = 175$ | $V = \frac{175}{t^2}$ |
| (b) | $V = \frac{175}{6.25^2}$                                                                         | 4.48                  |



5 - (4MA0-W 2015-Paper 4HR-Q1) - NUMBER

|  |                                                                        |     |
|--|------------------------------------------------------------------------|-----|
|  | $600 \times 67.1 (= 40260)$ <b>or</b><br>$67.1 \div 82.5 (= 0.813...)$ |     |
|  | $"40260" \div 82.5$ <b>or</b><br>$"0.813.." \times 600$                |     |
|  |                                                                        | 488 |

6 - (4MA0-W 2015-Paper 4HR-Q5) - NUMBER

|    |  |            |
|----|--|------------|
| a  |  | 25         |
| bi |  | $n(n+2)+1$ |
| ii |  | $(n+1)^2$  |

7 - (4MA0-W 2015-Paper 4HR-Q8) - NUMBER

|   |                                                                                                                                                                               |                                                  |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| a | $224 = 2 \times 112 = 2 \times 2 \times 56 =$<br>$2 \times 2 \times 2 \times 28 = 2 \times 2 \times 2 \times 2 \times 14$<br>$2 \times 2 \times 2 \times 2 \times 2 \times 7$ |                                                  |
|   |                                                                                                                                                                               |                                                  |
|   |                                                                                                                                                                               | $2^5 \times 7$                                   |
| b | $56 + 32 + 16$<br>$56 + 32 + 14$<br>$56 + 28 + 16$                                                                                                                            |                                                  |
|   |                                                                                                                                                                               | eg. 56, 32, 16<br>or 56, 32, 14<br>or 56, 28, 16 |



## 8 - (4MA0-S 2016-Paper 4HR-Q3) - NUMBER

|   |                                                                                                                                                                   |      |   |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|
| a | $\frac{1.75}{2.1} \times 100$ oe                                                                                                                                  | 83.3 | 2 |
| b | $54.99 \times 5.52 (= 303.(54...))$ or<br>$343 \div 5.52 (=62.(137...))$<br>$343 - (54.99 \times 5.52)(=39.(45...))$ or<br>$(343 \div 5.52) - 54.99 (=7.(14...))$ | 39   | 3 |
| c | $7\text{h } 24\text{ min} = 7.4\text{ h} \left( \text{or } 7\frac{24}{60} \right)$ oe or<br>444 (mins) or 26640 (secs)                                            | 746  | 3 |
|   | $\frac{5522}{7.4}$ or $\frac{5522}{444} \times 60$ or<br>$\frac{5522}{26640} \times 3600$                                                                         |      |   |

## 9 - (4MA0-S 2016-Paper 4HR-Q8) - NUMBER

|   |                                                         |     |   |
|---|---------------------------------------------------------|-----|---|
| a | $8000:50$ or $50:8000$ or $\frac{8000}{50}$ oe          | 160 | 2 |
| b | $\frac{72}{80} \times 50$ oe $72 \times 100 \div '160'$ | 45  | 2 |

## 10 - (4MA0-S 2016-Paper 4HR-Q13) - NUMBER

|   |                                                                                                                                                                                 |                   |   |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---|
| a |                                                                                                                                                                                 | $2.5 \times 10^5$ | 1 |
| b | $\frac{4\pi}{3} \times (6.99 \times 10^7)^3 \div$<br>$\left[ \frac{4\pi}{3} \times (6.37 \times 10^6)^3 \right]$ or<br>$(1.43... \times 10^{24}) \div (1.08... \times 10^{21})$ | 1320              | 3 |



**11** - (4MA0-W 2016-Paper 4HR-Q1) - NUMBER

|     |                                  |        |
|-----|----------------------------------|--------|
| (a) | $(40 \div 16) \times 240$ oe     |        |
|     |                                  | 600    |
| (b) | $(600 \div 120) \times 16$ oe    |        |
|     |                                  | 80     |
| (c) | $240 \div 150$ or $150 : 240$ oe |        |
|     |                                  | 1.6 oe |

**12** - (4MA0-W 2016-Paper 4HR-Q3) - NUMBER

|  |                                                                                    |                   |
|--|------------------------------------------------------------------------------------|-------------------|
|  | $\frac{3 \times 5}{20} + \frac{4 \times 4}{20}$ or $\frac{15}{20} + \frac{16}{20}$ |                   |
|  |                                                                                    | $\frac{31}{20}$   |
|  | <b>Alternative</b><br>$0.75 + 0.8 = 1.55$                                          |                   |
|  |                                                                                    | $1\frac{55}{100}$ |

**13** - (4MA0-W 2016-Paper 4HR-Q8) - NUMBER

|  |                                                               |      |
|--|---------------------------------------------------------------|------|
|  | $0.16x = 192$ or $16\% = 192$ oe or<br>$\frac{192}{16} (=12)$ |      |
|  | $\frac{192}{0.16}$ or $\frac{192}{16} \times 100$ oe          |      |
|  |                                                               | 1200 |

**14** - (4MA0-W 2016-Paper 4HR-Q9) - NUMBER

|  |                                                    |     |
|--|----------------------------------------------------|-----|
|  | $1\frac{24}{60}$ oe or 1.4 or 84                   |     |
|  | $\frac{725}{1.4}$ oe or $\frac{725}{84} \times 60$ |     |
|  |                                                    | 518 |



## 15 - (4MA0-W 2016-Paper 4HR-Q10) - NUMBER

|     |                                                                                                             |                         |
|-----|-------------------------------------------------------------------------------------------------------------|-------------------------|
| (a) |                                                                                                             | 1 590 000               |
| (b) | $2.97 \times 10^6 - 4.22 \times 10^5$ oe or<br>$4.22 \times 10^5 - 2.97 \times 10^6$ oe or<br>$\pm 2548000$ |                         |
|     |                                                                                                             | $\pm 2.548 \times 10^6$ |
| (c) | $1.25 \times 10^6 \div 4.22 \times 10^5$ oe or 2.96... or $\frac{625}{211}$                                 |                         |
|     |                                                                                                             | 3                       |

## 16 - (4MA0-W 2016-Paper 4HR-Q15) - NUMBER

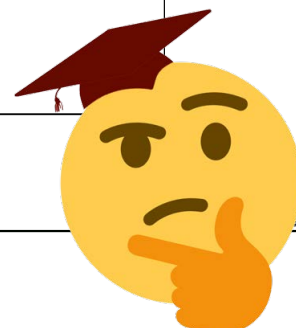
|  |                                                                                          |      |
|--|------------------------------------------------------------------------------------------|------|
|  | eg.<br>$x = 0.2666...$ and $10x = 2.666...$ or<br>$10x = 2.666...$ and $100x = 26.66...$ |      |
|  |                                                                                          | show |
|  | <b>Alternative method</b>                                                                |      |
|  | eg. $x = 0.0666...$ and $100x = 6.666$<br>with subtraction                               |      |
|  |                                                                                          |      |

## 17 - (4MA0-W 2016-Paper 4HR-Q16) - NUMBER

|  |                                       |                      |
|--|---------------------------------------|----------------------|
|  | $Q = \frac{"k"}{t^2}$                 |                      |
|  | $320 = \frac{"k"}{0.5^2}$ or “k” = 80 |                      |
|  |                                       | $Q = \frac{80}{t^2}$ |

## 18 - (4MA0-S 2017-Paper 4HR-Q1) - NUMBER

|     |                                                                                                                                                                                   |     |   |                                                                                    |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|------------------------------------------------------------------------------------|
| (a) | Eg $\frac{30}{12} \times 110$ or $2.5 \times 110$ or $\frac{30}{12}$ or 2.5 or<br>$\frac{110}{12} \times 30$ or $9.16(666...) \times 30$ or $\frac{110}{12}$ or $9.16(666...)$ oe | 275 | 2 | M1 Accept 9.16(666...) rounded or truncated to at least 3 SF<br><br>A1             |
| (b) | Eg $\frac{375}{100} \times 12$ or $3.75 \times 12$ or<br>$375 \div \frac{100}{12}$ or $375 \div 8.33(333...)$ or<br>$\frac{12}{100} \times 375$ or $0.12 \times 375$              | 45  | 2 | M1 For a complete method<br>Accept 8.33(333...) rounded to at least 3 SF<br><br>A1 |





**19** - (4MA0-S 2017-Paper 4HR-Q3) - *NUMBER*

|     |  |             |   |                                                                                                           |
|-----|--|-------------|---|-----------------------------------------------------------------------------------------------------------|
| (a) |  | 14.37028405 | 2 | M1 102.66 or 1.843(9...) or 7.143(9...)<br>A1 Accept 14.37(028.....) rounded or truncated to at least 4SF |
| (b) |  | 14.4        | 1 | B1 ft As long as from at least 4sf                                                                        |

**20** - (4MA0-S 2017-Paper 4HR-Q10) - *NUMBER*

|     |  |                   |   |    |
|-----|--|-------------------|---|----|
| (a) |  | 22 000 000        | 1 | B1 |
| (b) |  | $9.5 \times 10^5$ | 1 | B1 |

**21** - (4MA0-S 2017-Paper 4HR-Q11) - *NUMBER*

|  |                                                                                                                                                                                                                                                                                                                    |         |   |                                                                                                                                                                                           |                                   |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
|  | $7500 \times 0.04$ or 300 or $7500 \times 1.04$ or 7800<br>or $7500 \times 1.04^n$ ( $n > 1$ )<br><br>Eg $7500 + \frac{4}{100} \times 7500 + \frac{4}{100} \times (7500 +$<br>“300”)<br>$+ \frac{4}{100} \times (7500 + \text{“300”} + \text{“312”})$ or<br>$7500 + \text{“300”} + \text{“312”} + \text{“324.48”}$ | 8436.48 | 3 | M1 For interest for first year or<br>for $7500 \times 0.04 \times 3$ oe or 900<br>or<br>for $7500 + 7500 \times 0.04 \times 3$ oe<br>or an answer of 8400<br><br>M1 For a complete method | M2 for $7500 \times 1.04^3$<br>oe |
|  |                                                                                                                                                                                                                                                                                                                    |         |   | A1 Accept answers in the range 8436 – 8437<br>NB: Answer in the range 936 -937 gets M2A0                                                                                                  |                                   |

**22** - (4MA0-W 2017-Paper 4HR-Q1) - *NUMBER*

|     |                                                                  |     |   |
|-----|------------------------------------------------------------------|-----|---|
| (a) | e.g. $\frac{100}{24} \times 30$                                  |     | 2 |
|     |                                                                  | 125 |   |
| (b) | e.g. $\frac{850}{300} \times 24$ or $850 \div \frac{300}{24}$ oe |     | 2 |
|     |                                                                  | 68  |   |

**23** - (4MA0-W 2017-Paper 4HR-Q3) - *NUMBER*

|                                        |     |   |
|----------------------------------------|-----|---|
| $\frac{35}{100} \times 1200$ oe or 420 |     | 3 |
| 1200 – “420”                           |     |   |
|                                        | 780 |   |



**24 - (4MA0-W 2017-Paper 4HR-Q10) - NUMBER**

|     |  |        |   |
|-----|--|--------|---|
| (a) |  | 111375 | 2 |
|     |  |        |   |
| (b) |  | 2025   | 2 |
|     |  |        |   |

**25 - (4MA0-S 2018-Paper 4HR-Q4) - NUMBER**

|                                                                      |      |   |        |                              |
|----------------------------------------------------------------------|------|---|--------|------------------------------|
| $\frac{6}{100} \times 8.50$ or $0.06 \times 8.50$ or $0.51$ or $51p$ | 9.01 | 3 | M1     | M2 for $1.06 \times 8.50$ oe |
| $8.50 + "0.51"$                                                      |      |   | M1 dep |                              |
|                                                                      |      |   | A1     |                              |

**26 - (4MA0-S 2018-Paper 4HR-Q6) - NUMBER**

|                                                                                                                    |               |   |    |                                                                                |
|--------------------------------------------------------------------------------------------------------------------|---------------|---|----|--------------------------------------------------------------------------------|
| $2240 \div 805 (=2.78(26).....)$<br>"0.7826..." $\times 60 (=46.95...)$ or<br>"2.7826..." $\times 60 (=166.95...)$ | 2 hrs 47 mins | 3 | M1 | M1 Method to change "0.7826..." to minutes or "2.7826..." to minutes<br>A1 cao |
|                                                                                                                    |               |   | M1 |                                                                                |
|                                                                                                                    |               |   | A1 |                                                                                |

**27 - (4MA0-S 2018-Paper 4HR-Q10) - NUMBER**

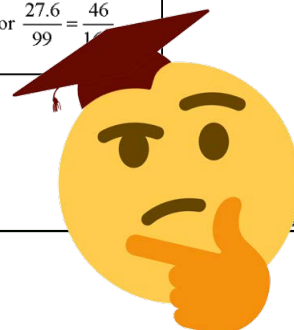
|     |                                                                                                                                                                                                                                                                     |                                         |   |       |                                                                                                                                                                                                                             |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|---|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) | eg $280 = 2 \times 140 = 2 \times 2 \times 70 (=2 \times 2 \times 2 \times 35 = 2 \times 2 \times 2 \times 5 \times 7)$<br>eg $280 = 10 \times 28 = 2 \times 5 \times 28 (=2 \times 5 \times 2 \times 14 = 2 \times 5 \times 2 \times 2 \times 7)$<br>2, 2, 2, 5, 7 | $2 \times 2 \times 2 \times 5 \times 7$ | 3 | M1    | for at least first 2 correct steps in repeated factorisation (may be seen in a tree diagram)                                                                                                                                |
|     |                                                                                                                                                                                                                                                                     |                                         |   | A1dep | For all correct factors, may include 1                                                                                                                                                                                      |
|     |                                                                                                                                                                                                                                                                     |                                         |   | A1dep | Must see correct method<br>Accept $2 \times 5 \times 7$                                                                                                                                                                     |
| (b) | 2, 3, 3, 5, 7 or<br>2, 5, 7, 9 or<br>$280 = 2 \times 2 \times 70$ and $630 = 3 \times 3 \times 70$                                                                                                                                                                  | 70                                      | 2 | M1    | For prime factors of 630 (which may be shown in part (a)) or factors 2, 5, 7, 9 of 630 or common prime factors 2, 5, 7 or $280 = 2 \times 2 \times 70$ and $630 = 3 \times 3 \times 70$<br><br>or an answer of 10, 14 or 35 |
|     |                                                                                                                                                                                                                                                                     |                                         |   | A1    | Accept $2 \times 5 \times 7 (\times 1)$                                                                                                                                                                                     |

**28 - (4MA0-S 2018-Paper 4HR-Q13) - NUMBER**

|     |                                                                                     |                      |   |                                                                                                                                    |
|-----|-------------------------------------------------------------------------------------|----------------------|---|------------------------------------------------------------------------------------------------------------------------------------|
| (a) |                                                                                     | $3.7 \times 10^{-5}$ | 1 | B1                                                                                                                                 |
| (b) |                                                                                     | $2.34 \times 10^9$   | 1 | B1                                                                                                                                 |
| (c) | $(1.4 \times 10^9) \div (3.5 \times 10^7)$ or $\frac{1400\,000\,000}{35\,000\,000}$ | 40                   | 2 | M1<br>or for an answer equivalent to $4 \times 10^n$ where $n$ is an integer, e.g. 4, $4 \times 10^{-2}$ , 4000, $0.4 \times 10^3$ |
|     |                                                                                     |                      |   | A1<br>Accept $4 \times 10^1$ or $4 \times 10$                                                                                      |

**29 - (4MA0-S 2018-Paper 4HR-Q20) - NUMBER**

|  |                                            |                                                           |                                     |   |    |                                                                                                |
|--|--------------------------------------------|-----------------------------------------------------------|-------------------------------------|---|----|------------------------------------------------------------------------------------------------|
|  | $1000x = 278.7878...$<br>$10x = 2.7878...$ | $100x = 27.8787...$<br>$x = 0.2787...$                    | $\frac{46}{165}$<br>correctly shown | 2 | M1 | Two appropriate equations selected for use. e.g. $1000x = 278.7878...$ and $10x = 2.7878...$   |
|  | $990x = 276$<br>$x = \frac{276}{990}$      | $99x = 27.6$<br>$x = \frac{27.6}{99} (= \frac{276}{990})$ |                                     |   | A1 | e.g. $\frac{276}{990} = \frac{46}{165}$ or $\frac{27.6}{99} = \frac{46}{165}$<br>must be shown |



**30 - (4MA0-S 2018-Paper 4HR-Q25) - NUMBER**

|  |                                                             |      |   |    |                                                                             |
|--|-------------------------------------------------------------|------|---|----|-----------------------------------------------------------------------------|
|  | 11.45, 11.55, 5.05, 5.15                                    | 1001 | 4 | M1 | For a correct upper or lower bound for either number                        |
|  | $11.55^3 (=1540 (.798875\dots))$                            |      |   | M1 | Correct method to find upper bound for volume of box                        |
|  | $\frac{4}{3} \times \pi \times 5.05^3 (=539 (.53429\dots))$ |      |   | M1 | Correct method to find lower bound for volume of ball                       |
|  |                                                             |      |   | A1 | dep on correct working<br>Accept 1001 or answer in range [1001.26, 1001.34] |

**31 - (4MA0-W 2018-Paper 4HR-Q1) - NUMBER**

|     |                                                       |       |   |                |                                                    |
|-----|-------------------------------------------------------|-------|---|----------------|----------------------------------------------------|
| (a) | $36 \times \frac{12}{100}$ oe (= 4.32)<br>36 - "4.32" |       |   | M1<br>M1<br>A1 | M2 for a complete method<br>Eg $0.88 \times 36$ oe |
|     |                                                       | 31.68 | 3 |                |                                                    |
| (b) | $\frac{81}{180} \times 100$ (%)                       | 45    | 2 | M1<br>A1       | For $\frac{81}{180}$ oe                            |

**32 - (4MA0-W 2018-Paper 4HR-Q4) - NUMBER**

|                           |                                                                                                                      |     |   |                |                                                                                |
|---------------------------|----------------------------------------------------------------------------------------------------------------------|-----|---|----------------|--------------------------------------------------------------------------------|
|                           | $\frac{400}{5+3}$ or 50 or $\frac{400}{5+3} \times 5$ (=250) or $\frac{400}{5+3} \times 3$ (=150)<br>"50" $\times 2$ |     |   | M1<br>M1<br>A1 | For $\frac{400}{5+3} \times 5$ (=250) and<br>$\frac{400}{5+3} \times 3$ (=150) |
|                           |                                                                                                                      | 100 | 3 |                |                                                                                |
| <b>Alternative Method</b> |                                                                                                                      |     |   |                |                                                                                |
|                           |                                                                                                                      | 100 | 3 | M2<br>A1       | For $\frac{2}{8} \times 400$                                                   |

**33 - (4MA0-W 2018-Paper 4HR-Q9) - NUMBER**

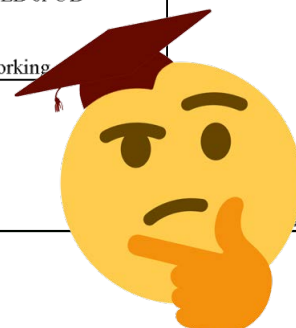
|      |  |                                 |   |    |                                                                                                                                                                               |
|------|--|---------------------------------|---|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (i)  |  | 1, 2, 23, 31, 46, 62, 713, 1426 |   | B3 | Accept factor written as products.<br>If not B3 then<br>B2 for three of 1, 46, 62, 713, 1426<br><br>If not B2 then<br>B1 for one of 46, 62, 713 or four of 1, 2, 23, 31, 1426 |
|      |  |                                 | 3 |    |                                                                                                                                                                               |
| (ii) |  | $23 \times 31$                  | 1 | B1 |                                                                                                                                                                               |

**34 - (4MA0-W 2018-Paper 4HR-Q10) - NUMBER**

|     |                                                                                                                               |                     |   |          |                                                                             |
|-----|-------------------------------------------------------------------------------------------------------------------------------|---------------------|---|----------|-----------------------------------------------------------------------------|
| (a) |                                                                                                                               | 324 000 000         | 1 | B1       |                                                                             |
| (b) |                                                                                                                               | United Kingdom      | 1 | B1       |                                                                             |
| (c) |                                                                                                                               | $3.089 \times 10^9$ | 2 | M1<br>A1 | Sight of digits 3 089<br>Accept $3.09 \times 10^9$                          |
| (d) | Eg $1.87 \times 10^7 : 1.32 \times 10^9$ or $1.87 : 132$ or<br>$187 : 13200$ or $1 : \frac{1200}{17}$ or $1 : 70.5(882\dots)$ |                     |   | M1       | For a correct ratio or $\frac{1.32 \times 10^9}{1.87 \times 10^7}$ oe       |
|     |                                                                                                                               | 71                  | 2 | A1       | oe eg $7.1 \times 10^1$<br>Accept 1 : 71<br>M1A0 for answer of 70.5(882...) |

**35 - (4MA0-W 2018-Paper 4HR-Q18) - NUMBER**

|  |                                                                        |          |   |                |                                                                                                |
|--|------------------------------------------------------------------------|----------|---|----------------|------------------------------------------------------------------------------------------------|
|  | $\frac{17.5, 17.49, 16.5, 63.5 \text{ or } 64.5 \text{ or } 64.49}{2}$ |          |   | B1<br>M1<br>A1 | For any correct LB or UB<br>$63.5 \leq LB < 64$<br>$17 < UB \leq 17.5$<br>From correct working |
|  |                                                                        | 14.25 oe | 3 |                |                                                                                                |



**36** - (4MA0-W 2019-Paper 4HR-Q1) - NUMBER

|     |                                |         |   |                                                           |
|-----|--------------------------------|---------|---|-----------------------------------------------------------|
| (a) | $15\,400 \times 63.21$         | 973 434 | 2 | M1<br>A1                                                  |
| (b) | $\frac{240}{15400} \times 100$ | 1.56    | 2 | M1<br>A1 1.558441... Accept 1.558 $\rightarrow$ 1.56 inc. |

**37** - (4MA0-W 2019-Paper 4HR-Q3) - NUMBER

|  |                                                                                                                                                                                                                |     |   |                                                                                                                                      |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|--------------------------------------------------------------------------------------------------------------------------------------|
|  | $40 \text{ min} = \frac{40}{60} \text{ hr}$<br>$9720 \div 11 \frac{40}{60}$ or $9720 \div 11.4$<br>Alt:<br>$11 \text{ hr } 40 \text{ mins} = 11 \times 60 + 40 = 700 \text{ min}$<br>$9720 \div 700 \times 60$ | 833 |   | M1<br><br>M1 (accept 11.66 or 11.67 or better for 11 40/60)<br>A1 833.1428... Accept 833 $\rightarrow$ 833.2 inc.                    |
|  |                                                                                                                                                                                                                | 833 | 3 | M1<br>M1<br>A1 833.1428... Accept 833 $\rightarrow$ 833.2 inc.<br>NB. Answer of 852(.63..) or 853 implies $9720 \div 11.4$<br>M1M0A0 |

**38** - (4MA0-W 2019-Paper 4HR-Q4) - NUMBER

|     |                                                                                                    |      |   |                                                                |
|-----|----------------------------------------------------------------------------------------------------|------|---|----------------------------------------------------------------|
| (a) | $472 \div 20$                                                                                      | 23.6 | 2 | M1<br>A1                                                       |
| (b) | $10.8 \times 100 (= 1080)$<br>$'1080' \div 60$<br>Alt:<br>$60 \div 100 = 0.6$<br>$10.8 \div '0.6'$ | 18   |   | M1 working in cms<br>M1 dep<br>A1 (accept 1 : 18 or 18 : 1)    |
|     |                                                                                                    | 18   | 3 | M1 working in metres<br>M1 dep<br>A1 (accept 1 : 18 or 18 : 1) |

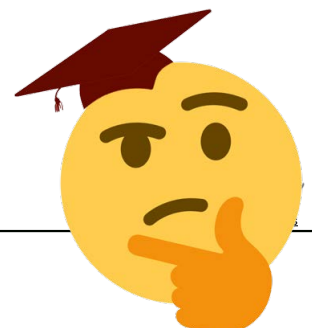
**39** - (4MA0-W 2019-Paper 4HR-Q7) - NUMBER

|  |                                                                                                                                                                                                                                                                  |  |   |                                                                                                                                                                                                                 |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | $\frac{9}{4}$<br>$\frac{9}{4} \times \frac{5}{6} = \frac{45}{24}$<br>$\frac{45}{24} = 1 \frac{21}{24}$ or $\frac{45}{24}$ cancelled down to $\frac{15}{8}$<br>Alt:<br>$\frac{9}{4}$<br>cancelling 9 and 6 to get $\frac{3}{4} \times \frac{5}{2} = \frac{15}{8}$ |  | 3 | M1 converting $2 \frac{1}{4}$ into an improper fraction (e.g. $\frac{9}{4}$ )<br><br>M1<br>A1 dep M2<br><br>M1 converting $2 \frac{1}{4}$ into an improper fraction (e.g. $\frac{9}{4}$ )<br><br>M1 A1 (dep M2) |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



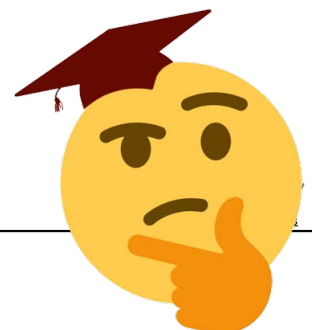
**40** - (4MA0-W 2019-Paper 4HR-Q9) - *NUMBER*

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |   |                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|----------------------------------------------------------------------------------------------------------|
| $120 \times 50 (= 6000)$<br>$120 \times \frac{3}{4} \times 80 (=7200) \text{ or } 120 \times \frac{1}{4} \times 40$<br>$(=1200)$<br><br>$(\text{'7200' + '1200' - '6000'}) \div \text{'6000'} \times 100$<br>or $(\{\text{'7200' + '1200'}\} \div \text{'6000'} - 1) \times 100$<br><br>Alt:<br>$120 \times 50 (= 6000)$<br>$120 \times \frac{3}{4} \times (80 - 50) (=2700) \text{ or }$<br>$120 \times \frac{1}{4} \times (40 - 50) (= - 300)$<br><br>$(\text{'2700' + ' - 300'}) \div \text{'6000'} \times 100$ | 40 |   | M1 cost price<br>M1 part profits<br><br>M1 dep on M2<br><br>A1<br><br>M1 cost price<br>M1 profit or loss |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 40 | 4 | M1 dep on M2<br>A1                                                                                       |



1 - (4MA0-S 2015-Paper 4HR-Q9) - ALGEBRA

|     |                                                                                                                                                                                                               |                    |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| (a) |                                                                                                                                                                                                               | $10p - 15$         |
| (b) | $9 - 3 < 2x$ or<br>$6 < 2x$ or<br>$-2x < 3 - 9$ or<br>$-2x < -6$                                                                                                                                              | $x > 3$            |
| (c) | $6 = (-2)^3 - k(-2) + 5$ or $6 = -8 + 2k + 5$<br>Eg $6 + 8 - 5 = 2k$ or $-2k = -8 + 5 - 6$ or $9 = 2k$ or<br>$-9 = -2k$ or $k = \frac{(-2)^3 - 6 + 5}{-2}$ or $-k = \frac{6 - (-2)^3 - 5}{-2}$ or $-k = -4.5$ | 4.5                |
| (d) | $1 = 3(f + 2)$ or $1 = 3f + 6$ or $\frac{1}{3} = f + 2$                                                                                                                                                       | $-1\frac{2}{3}$ oe |



## 2 - (4MA0-S 2015-Paper 4HR-Q19) - ALGEBRA

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                      |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| (a) (i)  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | -3                                                   |
| (a) (ii) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0                                                    |
| (a)(iii) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | $\frac{3}{2}$                                        |
| (b)      | <p>Eg <math>\sqrt{245} = \sqrt{49} \times \sqrt{5}</math> or <math>\sqrt{245} = \sqrt{49 \times 5}</math> or</p> <p><math>\frac{14}{\sqrt{49 \times 5}}</math> or <math>\frac{14}{\sqrt{49} \times \sqrt{5}}</math></p> <p><math>\frac{14}{\sqrt{245}} \times \frac{\sqrt{245}}{\sqrt{245}}</math> or <math>\frac{14\sqrt{245}}{245}</math> or <math>\frac{14 \times 7\sqrt{5}}{245}</math></p> <p>Note:</p> <p>To rationalise <math>\frac{14}{\sqrt{245}}</math> accept <math>\frac{14}{\sqrt{245}} \times \frac{\sqrt{245}}{\sqrt{245}}</math> or <math>\frac{14\sqrt{245}}{245}</math></p> <p>To rationalise <math>\frac{2}{\sqrt{5}}</math> or <math>\frac{14}{7\sqrt{5}}</math>, etc, only accept</p> <p><math>\frac{2}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}</math> or <math>\frac{14}{7\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}</math> etc.</p> | $\frac{2\sqrt{5}}{5}$                                |
| (c)      | <p><math>e^2 - 2e\sqrt{3} - 2e\sqrt{3} + (2\sqrt{3})^2</math> or</p> <p><math>e^2 - 4e\sqrt{3} + 12</math></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p><math>e = 5</math></p> <p><math>f = 37</math></p> |

## 3 - (4MA0-W 2015-Paper 4HR-Q4) - ALGEBRA

|  |                                                     |                 |
|--|-----------------------------------------------------|-----------------|
|  | $2y - -y = 3 - 6$<br><b>or</b><br>$x + 2x = 3 + 12$ |                 |
|  |                                                     |                 |
|  |                                                     | $x = 5, y = -1$ |



## 4 - (4MA0-W 2015-Paper 4HR-Q11) - ALGEBRA

|   |                           |                     |
|---|---------------------------|---------------------|
| a |                           | $-3$                |
| b |                           | $2y^3$              |
| c | $3x^2 - 2yx + 6xy - 4y^2$ |                     |
|   |                           | $3x^2 + 4xy - 4y^2$ |
| d |                           |                     |
|   |                           | $(4x+1)(x-2)$       |

## 5 - (4MA0-W 2015-Paper 4HR-Q12) - ALGEBRA

|   |                                     |                                |
|---|-------------------------------------|--------------------------------|
| a | $5.67 \times 10^{-8} \times 5800^4$ |                                |
|   |                                     | $6.42 \times 10^7$             |
| b | $T^4 = \frac{I}{k}$                 |                                |
|   |                                     | $T = \sqrt[4]{\frac{I}{k}}$ oe |

## 6 - (4MA0-W 2015-Paper 4HR-Q14) - ALGEBRA

|   |                                                               |              |
|---|---------------------------------------------------------------|--------------|
| a | $x = \frac{-4 \pm \sqrt{(-4)^2 - 4 \times 1 \times (-1)}}{2}$ |              |
|   | $x = \frac{4 \pm \sqrt{20}}{2}$                               |              |
|   |                                                               | 4.24, -0.236 |
|   |                                                               |              |
|   | <b>Alternative scheme</b><br>$(x-2)^2 - 4 - 1 (=0)$           |              |
|   | $x = 2 \pm \sqrt{5}$                                          |              |
|   |                                                               | 4.24, -0.236 |
| b |                                                               | 1.24, -3.24  |





7 - (4MA0-W 2015-Paper 4HR-Q17) - ALGEBRA

|          |                                                                                                                                                                      |                 |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>a</b> | $12 - 3\sqrt{2} + 8\sqrt{2} - 2\sqrt{2} \times \sqrt{2}$ <b>or</b><br>$12 - 3\sqrt{2} + 8\sqrt{2} - 2 \times 2$ <b>or</b><br>$12 - 3\sqrt{2} + 8\sqrt{2} - 4$        |                 |
|          |                                                                                                                                                                      | $8 + 5\sqrt{2}$ |
| <b>b</b> | $\frac{10 + 3\sqrt{2}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$ <b>or</b><br>$\frac{10}{\sqrt{2}} + 3 = \frac{10}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} + 3$ |                 |
|          |                                                                                                                                                                      | $5\sqrt{2} + 3$ |

8 - (4MA0-W 2015-Paper 4HR-Q20) - ALGEBRA

|          |                                                                                                                                                                                                                                                                              |                  |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>a</b> |                                                                                                                                                                                                                                                                              |                  |
|          |                                                                                                                                                                                                                                                                              | $(2x-1)(2x+1)$   |
| <b>b</b> | $\frac{4(2x-1)}{(2x-1)(2x+1)} + \frac{1}{4x^2-1} [=3]$ <b>or</b><br>$\frac{4(4x^2-1)}{(2x+1)(4x^2-1)} + \frac{(2x+1)}{(2x+1)(4x^2-1)} [=3]$ <b>or</b><br>$\frac{4(4x^2-1)}{2x+1} + \frac{1(4x^2-1)}{4x^2-1} = 3(4x^2-1)$ <b>or</b><br>$4(4x^2-1) + (2x+1) = 3(2x+1)(4x^2-1)$ |                  |
|          | $4(2x-1) + 1 = 3(4x^2-1)$ <b>oe or</b><br>$4(4x^2-1) + 2x + 1 = 3(2x+1)(4x^2-1)$ <b>oe</b>                                                                                                                                                                                   |                  |
|          | $12x^2 - 8x = 0$ <b>or</b> $8x - 12x^2 = 0$ <b>or</b><br>$24x^3 - 4x^2 - 8x = 0$ <b>or</b> $8x + 4x^2 - 24x^3 = 0$                                                                                                                                                           |                  |
|          |                                                                                                                                                                                                                                                                              | $0, \frac{2}{3}$ |



9 - (4MA0-S 2016-Paper 4HR-Q2) - ALGEBRA

|   |                                                        |               |   |
|---|--------------------------------------------------------|---------------|---|
| a | Eg $6t - 2t = 5 + 9$<br>or $4t = 14$ or $-4t = -14$ oe |               | 3 |
|   |                                                        | 3.5           |   |
| b | $6y + 6 + 2y - 8$                                      | $8y - 2$      | 2 |
| c |                                                        | $\frac{w}{2}$ | 2 |

10 - (4MA0-S 2016-Paper 4HR-Q10) - ALGEBRA

|                                                        |                                                       |                 |   |
|--------------------------------------------------------|-------------------------------------------------------|-----------------|---|
| $12x + 9y = 18$<br>$12x + 20y = -4$<br>( $11y = -22$ ) | $20x + 15y = 30$<br>$9x + 15y = -3$<br>( $11x = 33$ ) |                 | 4 |
| $y = -2$                                               | $x = 3$                                               |                 |   |
| $4x + 3 \times -2 = 6$                                 | $4 \times 3 + 3y = 6$                                 |                 |   |
|                                                        |                                                       | $x = 3, y = -2$ |   |



**11** - (4MA0-S 2016-Paper 4HR-Q14) - ALGEBRA

|   |                                                                                                                                                                 |                          |   |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---|
| a | $4 \times 2y + 4 \times \frac{2-3y}{4} = 4 \times \frac{1}{4}$ or<br>$\frac{8y}{4} + \frac{2-3y}{4} = \frac{1}{4}$ or<br>$2y = \frac{1}{4} - \frac{2-3y}{4}$ oe |                          | 3 |
|   | $8y + (2 - 3y) = 1$ or $8y = -1 + 3y$<br>Or $5y = -1$ oe                                                                                                        |                          |   |
|   |                                                                                                                                                                 | -0.2                     |   |
| b |                                                                                                                                                                 | $(3x+1)(x-3)$            | 2 |
| c | $4x^2 + 12x$ or $4x^2 - 12x + 9$ or<br>$-4x^2 + 12x - 9$ oe                                                                                                     |                          | 3 |
|   | $4x^2 + 12x - 4x^2 + 12x - 9$                                                                                                                                   |                          |   |
|   |                                                                                                                                                                 | $24x - 9$ or $3(8x - 3)$ |   |

**12** - (4MA0-S 2016-Paper 4HR-Q16) - ALGEBRA

|                                                                         |              |   |
|-------------------------------------------------------------------------|--------------|---|
| $(x =) \frac{- -6 \pm \sqrt{(-6)^2 - 4 \times 2 \times 3}}{2 \times 2}$ |              | 3 |
| $(x =) \frac{6 \pm \sqrt{12}}{4}$                                       |              |   |
|                                                                         | 0.634 & 2.37 |   |

**13** - (4MA0-S 2016-Paper 4HR-Q21) - ALGEBRA

|                                                                                          |                                          |   |
|------------------------------------------------------------------------------------------|------------------------------------------|---|
| $\sqrt{t} = \frac{x}{2a}$ or $x^2 = (2a\sqrt{t})^2$ or<br>$x^4 = (2a\sqrt{t})^4$ oe      |                                          | 4 |
| $t = \left(\frac{x}{2a}\right)^2$ oe or $t^2 = \frac{x^4}{16a^4}$ oe                     |                                          |   |
| $y = a \left[ \left(\frac{x}{2a}\right)^2 \right]^2 - 2a \left(\frac{x}{2a}\right)^2$ oe |                                          |   |
|                                                                                          | $y = \frac{x^4}{16a^3} - \frac{x^2}{2a}$ |   |



## 14 - (4MA0-W 2016-Paper 4HR-Q6) - ALGEBRA

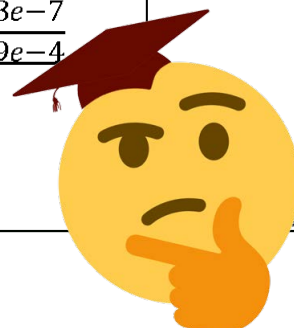
|     |                                                                |                  |
|-----|----------------------------------------------------------------|------------------|
| (a) |                                                                | $x^9$            |
| (b) |                                                                | $y^6$            |
| (c) | $8d+12-6d+10$ oe                                               | $2d+22$          |
| (d) | eg. $9y-5y=2+3$ or $4y=5$                                      |                  |
|     |                                                                | 1.25             |
| (e) | $7x-1=5x$                                                      |                  |
|     | eg. $7x-5x=1$ or $2x=1$ or<br>$\frac{7}{5}x - x = \frac{1}{5}$ |                  |
|     |                                                                | $\frac{1}{2}$ oe |

## 15 - (4MA0-W 2016-Paper 4HR-Q12) - ALGEBRA

|  |                                   |     |
|--|-----------------------------------|-----|
|  | $(4x^2+6x+6x+9) - (4x^2-6x-6x+9)$ |     |
|  | $4x^2+6x+6x+9 - 4x^2+6x+6x-9$     |     |
|  |                                   | 24x |

## 16 - (4MA0-W 2016-Paper 4HR-Q19) - ALGEBRA

|  |                                  |                                                       |
|--|----------------------------------|-------------------------------------------------------|
|  | $4g-9eg=7-3e$ or $3e-7=9eg-4g$   |                                                       |
|  | $g(4-9e)=7-3e$ or $3e-7=g(9e-4)$ |                                                       |
|  |                                  | $g = \frac{7-3e}{4-9e}$ or<br>$g = \frac{3e-7}{9e-4}$ |

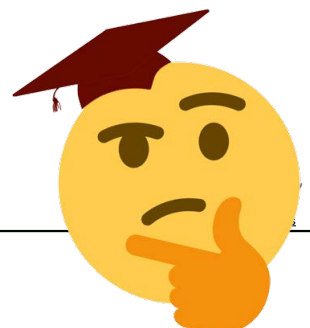


17 - (4MA0-W 2016-Paper 4HR-Q20) - ALGEBRA

|  |                                        |                         |
|--|----------------------------------------|-------------------------|
|  | $\frac{3(2x+5) - 6(x+2)}{(x+2)(2x+5)}$ |                         |
|  | $\frac{6x+15 - 6x - 12}{(x+2)(2x+5)}$  |                         |
|  |                                        | $\frac{3}{(x+2)(2x+5)}$ |

18 - (4MA0-W 2016-Paper 4HR-Q22) - ALGEBRA

|  |                                                                                             |    |
|--|---------------------------------------------------------------------------------------------|----|
|  | $a^2 + a\sqrt{b} + a\sqrt{b} + b$ <b>or</b><br>$a^2 + a\sqrt{b} + a\sqrt{b} + (\sqrt{b})^2$ |    |
|  |                                                                                             | 6  |
|  |                                                                                             | 13 |



## 19 - (4MA0-W 2016-Paper 4HR-Q24) - ALGEBRA

|  |                                                                                                                                                  |                                                            |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
|  | $x^2 + (3x + 2)^2 = 20$                                                                                                                          |                                                            |
|  | $x^2 + 9x^2 + 6x + 6x + 4 = 20$                                                                                                                  |                                                            |
|  | $10x^2 + 12x - 16 = 0$<br>$(5x^2 + 6x - 8 = 0)$                                                                                                  |                                                            |
|  | eg. $(10x - 8)(x + 2)$ or $(5x - 4)(2x + 4)$ or<br>$(5x - 4)(x + 2)$ or<br>$\frac{-12 \pm \sqrt{12^2 - 4 \times 10 \times -16}}{2 \times 10}$ oe |                                                            |
|  |                                                                                                                                                  |                                                            |
|  |                                                                                                                                                  | $x = \frac{4}{5}, y = \frac{22}{5}$ or<br>$x = -2, y = -4$ |

## 20 - (4MA0-S 2017-Paper 4HR-Q4) - ALGEBRA

|  |                                                                                                                                                                            |    |   |    |                                                                                                                               |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|----|-------------------------------------------------------------------------------------------------------------------------------|
|  | $10 \times 4.2 \times 7.5$ or $315 \text{ (cm}^3\text{)}$ oe<br>Eg $0.5 \times 7 \times x \times 5$ or $17.5x$ oe                                                          | 18 | 4 | M1 | For volume of cuboid                                                                                                          |
|  |                                                                                                                                                                            |    |   | M1 | indep<br>For volume of triangular prism                                                                                       |
|  | $10 \times 4.2 \times 7.5 = 0.5 \times 7 \times x \times 5$ or $17.5x = 315$<br>oe or<br>$\frac{10 \times 4.2 \times 7.5}{0.5 \times 7 \times 5}$ or "315" oe<br>"17.5" oe |    |   | M1 | Dep on M2<br>For a correct equation involving<br>volume of cuboid and volume of<br>prism or<br>For a correct expression for x |
|  |                                                                                                                                                                            |    |   | A1 | 18<br>SCB2 for For volume of cuboid =<br>315 and final answer = 9                                                             |



**21 - (4MA0-S 2017-Paper 4HR-Q5) - ALGEBRA**

|     |                                                           |                 |   |                                                                                                                                                                  |
|-----|-----------------------------------------------------------|-----------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) |                                                           | $12 - 28c$      | 1 | B1                                                                                                                                                               |
| (b) |                                                           | $y(y + 8)$      | 1 | B1                                                                                                                                                               |
| (c) | $x^2 - 3x + 7x - 21$                                      | $x^2 + 4x - 21$ | 2 | M1<br>For 3 correct terms<br>or for 4 correct terms ignoring signs<br>or for $x^2 + 4x + c$ for any non-zero<br>value of $c$ or for ... $+ 4x - 21$<br>cao<br>A1 |
| (d) | $5p - 3p = 9$ or $2p = 9$ or $-9 = 3p - 5p$ or $-9 = -2p$ | 4.5             | 2 | M1<br>A1 oe<br>eg $\frac{9}{2}$ or $4\frac{1}{2}$                                                                                                                |
| (e) |                                                           | $y^{11}$        | 1 | B1                                                                                                                                                               |
| (f) |                                                           | $h^8$           | 1 | B1                                                                                                                                                               |
| (g) |                                                           | $e^{15}$        | 1 | B1                                                                                                                                                               |

**22 - (4MA0-S 2017-Paper 4HR-Q7) - ALGEBRA**

|     |                                                                              |                    |   |                                                                                                                                                                      |
|-----|------------------------------------------------------------------------------|--------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) | $4x \geq 27 - 13$ or $4x \geq 14$<br>or $-4x \leq 13 - 27$ or $-4x \leq -14$ | $x \geq 3.5$       | 2 | M1<br>Accept an equation in place of an<br>inequality or<br>accept wrong inequality sign or<br>accept 3.5 oe given as answer<br>A1<br>oe<br>Must be the final answer |
| (b) |                                                                              | Correct line drawn | 1 | B1<br>For a closed circle at -1 with line<br>that goes at least as far as 3 or<br>for a closed circle at -1 with an<br>arrow on a line pointing to the<br>right      |
| (c) |                                                                              | -2, -1, 0, 1, 2    | 2 | B2<br>B1 for list with one error or<br>omission:<br>e.g.<br>-2, -1, 0, 1, 2, 3;<br>-1, 0, 1, 2;<br>-2, -1, 1, 2;<br>-3, -2, -1, 0, 1, 2<br>SCB1 for -3, -2, -1, 0, 1 |

**23 - (4MA0-S 2017-Paper 4HR-Q9) - ALGEBRA**

|                                                                                                                                                                                                     |  |                    |   |                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------|---|----------------------------------------------------------------------------------------------------------------|
| Eg $9x = 22.5$ or $18y = 27$ or $-18y = -27$ or<br>$5x - (13 - 4x) = 9.5$ or $4x + 5x - 9.5 = 13$ or<br>$5\left(\frac{13-2y}{4}\right) - 2y = 9.5$ or<br>$4\left(\frac{9.5+2y}{5}\right) + 2y = 13$ |  |                    | 3 | M1<br>For a complete method to<br>eliminate one variable (condone<br>one arithmetic error)                     |
| Eg $5 \times "2.5" - 2y = 9.5$ or $5x - 2 \times "1.5" = 9.5$                                                                                                                                       |  |                    |   | M1<br>Dep on M1<br>For substituting the other variable<br>or starting again to eliminate the<br>other variable |
|                                                                                                                                                                                                     |  | $x = 2.5, y = 1.5$ |   | A1<br>dep on M1<br>NB: candidates showing no correct<br>working score 0 marks.                                 |



## 24 - (4MA0-S 2017-Paper 4HR-Q14) - ALGEBRA

|                                                                                                                                                                                     |  |     |   |    |                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|---|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $\frac{6(5-x)}{2} - \frac{6(x-1)}{3} = 6 \times 1 \text{ or}$ $3(5-x) - 2(x-1) = 6 \text{ or}$ $\frac{3(5-x)-2(x-1)}{6} (=1) \text{ or}$ $\frac{3(5-x)}{6} - \frac{2(x-1)}{6} (=1)$ |  |     | 4 | M1 | For a clear intention to multiply both sides by 6 or a multiple of 6 or to express LHS as a single fraction with denominator of 6 or a multiple of 6 or to express LHS as the sum of 2 fractions with denominator of 6 or a multiple of 6 |
| $15 - 3x - 2x + 2 = 6 \text{ or}$ $\frac{15-3x-2x+2}{6} = 1$                                                                                                                        |  |     |   | M1 | Expanding brackets in a correct equation.                                                                                                                                                                                                 |
| $\frac{15-3x}{6} - \frac{2x-2}{6} = 1$                                                                                                                                              |  |     |   | M1 | dep on both preceding marks for a correct rearrangement of a correct equation with terms in $x$ on one side and numbers on the other.                                                                                                     |
| Eg $-3x - 2x = 6 - 2 - 15$ or $-5x = -11$ or<br>$3x + 2x = 15 + 2 - 6$ or $5x = 11$                                                                                                 |  | 2.2 |   | A1 | oe<br>Dependent on M2                                                                                                                                                                                                                     |

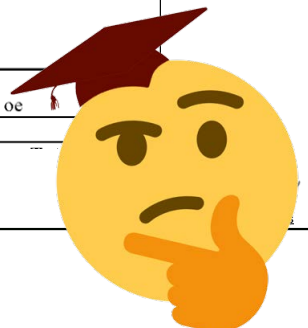
## 25 - (4MA0-S 2017-Paper 4HR-Q17) - ALGEBRA

|                                                                                                                                                                                                                                                                                                                                                                                   |  |                |   |    |                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------|---|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $\frac{3 \pm \sqrt{9+220}}{22} \text{ or } \frac{3 \pm \sqrt{9+220}}{2 \times 11} \text{ or}$ $\frac{3 \pm \sqrt{(-3)^2 - 220}}{2 \times 11} \text{ or } \frac{3 \pm \sqrt{(-3)^2 - 220}}{22}$ NB: denominator must be $2 \times 11$ or 22 <b>and</b> there must be evidence for correct order of operations in the numerator<br>Do not accept sign error or omission of brackets |  |                | 3 | M2 | Or for<br>$\frac{- - 3 \pm \sqrt{(-3)^2 - 4 \times 11 \times -5}}{2 \times 11} \text{ (allow partial correct evaluation)}$ <b>and</b> $\frac{3 \pm \sqrt{229}}{22}$<br><br>If not M2 then<br><br>M1 for<br>$\frac{- - 3 \pm \sqrt{(-3)^2 - 4(11)(-5)}}{2 \times 11}$<br><br>Condone one sign error in substitution;<br>Condone omission of brackets<br>Allow partial correct evaluation |
|                                                                                                                                                                                                                                                                                                                                                                                   |  | 0.82 and -0.55 |   | A1 | for awrt 0.82 <b>and</b> awrt -0.55<br><br>Award M2 A1 for awrt 0.82, -0.55 with sufficient correct working that would gain at least M1                                                                                                                                                                                                                                                 |
| <b>Alternative scheme</b>                                                                                                                                                                                                                                                                                                                                                         |  |                |   |    |                                                                                                                                                                                                                                                                                                                                                                                         |
| $11[(x - \frac{3}{22})^2 - \frac{229}{484}]$ oe                                                                                                                                                                                                                                                                                                                                   |  |                |   | M1 |                                                                                                                                                                                                                                                                                                                                                                                         |

|                                              |  |                |  |    |                                                                                                                                     |
|----------------------------------------------|--|----------------|--|----|-------------------------------------------------------------------------------------------------------------------------------------|
| $\frac{3}{22} \pm \sqrt{\frac{229}{484}}$ oe |  |                |  | M1 |                                                                                                                                     |
|                                              |  | 0.82 and -0.55 |  | A1 | for awrt 0.82 <b>and</b> awrt -0.55<br>Award M2 A1 for awrt 0.82, -0.55 with sufficient correct working that would gain at least M1 |

## 26 - (4MA0-S 2017-Paper 4HR-Q18) - ALGEBRA

|                                                                                                                                                                 |  |      |   |    |                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|---|----|--------------------------------------|
| $480 = k \times 5^2$ or $480 \propto k \times 5^2$ oe or<br>or $(k =) \frac{480}{5^2}$ or $(k =) 19.2$ oe<br>$k \propto \frac{480}{5^2}$ or $k \propto 19.2$ oe |  |      | 3 | M1 |                                      |
| "19.2" $\times 1.5^2$                                                                                                                                           |  |      |   | M1 | Dep on M1<br>or for $A = 19.2x^2$ oe |
|                                                                                                                                                                 |  | 43.2 |   | A1 | oe                                   |





## 27 - (4MA0-S 2017-Paper 4HR-Q23) - ALGEBRA

|  |                                                  |       |   |    |                                                                                                                                         |
|--|--------------------------------------------------|-------|---|----|-----------------------------------------------------------------------------------------------------------------------------------------|
|  | 27.25 or 27.35 or 17.5 or 18.5 or 9.805 or 9.815 |       | 3 | B1 | Accept 27.349 or 27.3499... or 18.49 or 18.499... or 9.8149 or 9.81499...                                                               |
|  | $(t =) \frac{27.25 - 18.5}{9.815}$               |       |   | M1 | For $\frac{LB - UB_1}{UB_2}$ oe where<br><br>27.25 ≤ LB < 27.3<br>and 18 < UB <sub>1</sub> ≤ 18.5<br>and 9.81 < UB <sub>2</sub> ≤ 9.815 |
|  |                                                  | 0.891 |   | A1 | dep on seeing $\frac{27.25 - 18.5}{9.815}$<br>Correct working must be seen<br>Accept 0.891 - 0.8915                                     |

## 28 - (4MA0-W 2017-Paper 4HR-Q7) - ALGEBRA

|     |                                                            |                |   |
|-----|------------------------------------------------------------|----------------|---|
| (a) |                                                            | $12p + 15$     | 1 |
| (b) |                                                            | $2(3r + 7)$    | 1 |
| (c) | $(-5)^2 - 3 \times -5$ oe                                  | 40             | 2 |
| (d) | $\frac{w^{13}}{w^4}$ or $w \times w^8$ or $w^5 \times w^4$ | $w^9$          | 2 |
| (e) |                                                            |                |   |
|     |                                                            | $3 \leq x < 9$ |   |

## 29 - (4MA0-W 2017-Paper 4HR-Q13) - ALGEBRA

|     |                                                                  |                        |   |
|-----|------------------------------------------------------------------|------------------------|---|
| (a) | $P = \frac{k}{q^2}$                                              | $p = \frac{51.2}{q^2}$ | 3 |
|     | $12.8 = \frac{k}{2^2}$ oe or $k = 12.8 \times 2^2$ or $k = 51.2$ |                        |   |
|     |                                                                  |                        |   |
| (b) | $\frac{51.2}{8^2}$                                               | 0.8                    | 1 |



**30** - (4MA0-W 2017-Paper 4HR-Q15) - ALGEBRA

|     |                                                                                               |                          |   |
|-----|-----------------------------------------------------------------------------------------------|--------------------------|---|
| (a) |                                                                                               | $(y - 8)(y + 6)$         | 2 |
| (b) | $4 = 5(e - 3)$ or $4 = 5e - 15$ or $\frac{4}{5} = e - 3$                                      |                          |   |
|     |                                                                                               | $\frac{19}{5}$           | 2 |
| (c) | $\frac{3(x-1)-2(x+1)}{(x+1)(x-1)}$ or $\frac{3(x-1)}{(x+1)(x-1)} - \frac{2(x+1)}{(x+1)(x-1)}$ |                          | 3 |
|     | $\frac{3x-3-2x-2}{(x+1)(x-1)}$ oe                                                             |                          |   |
|     |                                                                                               | $\frac{x-5}{(x+1)(x-1)}$ |   |

**31** - (4MA0-W 2017-Paper 4HR-Q20) - ALGEBRA

|     |                                                                            |                    |   |
|-----|----------------------------------------------------------------------------|--------------------|---|
| (a) | $6\sqrt{c} - 9 + 2c - 3\sqrt{c}$ or $3\sqrt{c} - 9 + 2c$                   |                    | 3 |
|     |                                                                            | $c = 5$<br>$k = 3$ |   |
| (b) | $\frac{1}{p \times p^{\frac{2}{3}}}$ or $p^{m+1+\frac{2}{3}} = 1$          |                    | 3 |
|     | $\frac{1}{p^{\frac{5}{3}}}$ or $p^{\frac{-5}{3}}$ or $m+1+\frac{2}{3} = 0$ |                    |   |
|     |                                                                            | $-\frac{5}{3}$     |   |

**32** - (4MA0-S 2018-Paper 4HR-Q7) - ALGEBRA

|                                                                                                                                                                       |                      |   |    |                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---|----|-------------------------------------------------------|
| e.g. $7x = 4x - 13.5$ or $7x - 4x = -13.5$<br>or $7x + 13.5 = 4x$ or $4y - 7y = 54$<br>e.g. $y = 4 \times "-4.5"$ or $4x = "-18"$ or<br>$7 \times "-4.5" - y = -13.5$ | $x = -4.5$ $y = -18$ | 3 | M1 | For correctly eliminating $y$ or $x$                  |
|                                                                                                                                                                       |                      |   | M1 | dep on first M1<br>For method to find second variable |
|                                                                                                                                                                       |                      |   | A1 | dep on first M1 for both answers                      |



## 33 - (4MA0-S 2018-Paper 4HR-Q9) - ALGEBRA

|     |                                                                                                                                                                                                          |                 |   |                                                                                                                                                                                                                                                                                |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) |                                                                                                                                                                                                          | $27a^6b^{12}$   | 2 | B2 fully correct<br>B1 for 2 of the three terms correct in a product.                                                                                                                                                                                                          |
| (b) | $4g - 8h + 10g - 15h$                                                                                                                                                                                    | $14g - 23h$     | 2 | M1 Expanding brackets with 3 of 4 terms correct.<br>A1 Fully correct                                                                                                                                                                                                           |
| (c) | $y^2 - 7y + 5y - 35$                                                                                                                                                                                     | $y^2 - 2y - 35$ | 2 | M1 Any 3 terms correct or 4 correct terms ignoring signs or $y^2 - 2y + \dots$ or $\dots - 2y - 35$<br>A1                                                                                                                                                                      |
| (d) | $-5 - 3 \leq 2p < 13 - 3$ or<br>$-5 - 3 \leq 2p$ and $2p < 13 - 3$ or<br>$-\frac{5}{2} \leq \frac{2p+3}{2} < \frac{13}{2}$ or<br>$-\frac{5}{2} \leq \frac{2p+3}{2}$ and $p + \frac{3}{2} < \frac{13}{2}$ | $-4 \leq p < 5$ | 3 | M2 Correctly subtracting 3 from each part of the inequality or dividing each term by 2<br>or $(p =) -4$ and $(p =) 5$<br>M1 for one end correct<br>e.g. $2p \geq -5 - 3$ or $\frac{2p+3}{2} < \frac{13}{2}$<br>or $(p =) -4$ or $(p =) 5$<br>A1 accept $p \geq -4$ and $p < 5$ |

## 34 - (4MA0-S 2018-Paper 4HR-Q12) - ALGEBRA

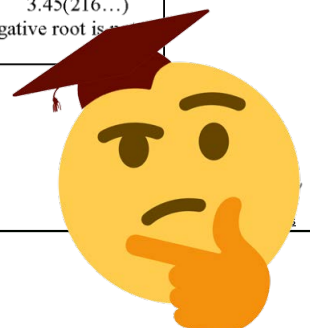
|                                                                                                                             |     |   |                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------|-----|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| e.g. $4(5x-2) + 3(3-5x) = 2 \times 12$ or<br>$\frac{4(5x-2)}{12} + \frac{3(3-5x)}{12}$ or $\frac{4(5x-2) + 3(3-5x)}{12}$    | 4.6 | 4 | M1 For clear intention to multiply all terms by 12 or a multiple of 12 or to express LHS as a single fraction or as the sum of a pair of fractions with a common denominator of 12 or a multiple of 12 |
| $20x - 8 + 9 - 15x = 2 \times 12$ or<br>$\frac{20x - 8 + 9 - 15x}{12} = 2$ or $\frac{20x - 8}{12} + \frac{9 - 15x}{12} = 2$ |     |   | M1 Expanding brackets correctly in a correct equation.                                                                                                                                                 |
| $5x = 23$ or $20x - 15x = 24 + 8 - 9$ or<br>$20x - 15x = 24 - 1$ oe                                                         |     |   | M1 For correct rearrangement of a correct equation with fractions cleared and terms in $x$ isolated.<br>A1oe dep on at least M1                                                                        |

## 35 - (4MA0-S 2018-Paper 4HR-Q16) - ALGEBRA

|                                                 |                            |   |                                                      |
|-------------------------------------------------|----------------------------|---|------------------------------------------------------|
| $p^2 = \frac{w+4}{w-2}$                         | $w = \frac{2p^2+4}{p^2-1}$ | 4 | M1 For squaring both sides                           |
| $p^2(w-2) = w+4$                                |                            |   | M1 For multiplying both sides by $(w-2)$             |
| $p^2w - w = 4 + 2p^2$ or $-4 - 2p^2 = w - p^2w$ |                            |   | M1 For isolating terms in $w$ in a correct equation. |
|                                                 |                            |   | A1 oe $w = \frac{-2p^2-4}{1-p^2}$                    |

## 36 - (4MA0-S 2018-Paper 4HR-Q19) - ALGEBRA

|     |                                                                                                                        |                                             |   |                                                                                                                                                                                                                                                                                                                                        |
|-----|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) | $(2x+1)(x+3) - 2 \times 3 (=45)$ or<br>$(2x+1)(x+3) - 6 (=45)$<br>$2x + 6x + x + 3 - 6 = 45$                           | $2x^2 + 7x - 48 = 0$<br>obtained correctly. | 2 | M1 A correct unsimplified expression or equation for shaded area<br>A1dep Convincingly arriving at given equation. Expansion of brackets must be shown (3 or 4 terms).                                                                                                                                                                 |
| (b) | $(x =) \frac{-7 \pm \sqrt{7^2 - 4 \times 2 \times -48}}{2 \times 2} \left( = \frac{-7 \pm \sqrt{49 + 384}}{4} \right)$ | 3.45                                        | 3 | M1 Correct substitution into the quadratic formula, allow one sign error in numbers and + instead of $\pm$ ; discriminant must not be simplified as far as 433<br>M1 dep on first M1 for simplification of discriminant to $\sqrt{433}$ or $\sqrt{49 + 384}$<br>A1 dep on first M1 3.45(216...) Award A0 if negative root is excluded. |



## 37 - (4MA0-S 2018-Paper 4HR-Q21) - ALGEBRA

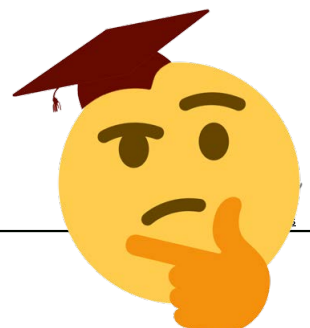
|                                                                                                                                                                                                                                                                     |                        |   |                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---|-------------------------------------------------------------------------------------------|
| $\frac{(x+3)(x-3)-(x+4)(x-4)}{(x-3)(x-4)} \text{ or } \frac{(x+3)(x-3)-(x+4)(x-4)}{(x-3)(x-4)} \text{ oe}$ $\frac{(x^2-3x+3x-9)-(x^2-4x+4x-16)}{(x-3)(x-4)} \text{ or } \frac{(x^2-9)-(x^2-16)}{(x-3)(x-4)} \text{ or } \frac{x^2-9-x^2+16}{(x-3)(x-4)} \text{ oe}$ | $\frac{7}{(x-3)(x-4)}$ | 3 | M1 For a correct expression as one fraction or as two fractions with a common denominator |
|                                                                                                                                                                                                                                                                     |                        |   | M1 Correct expansion of $(x-3)(x+3)$ and $(x-4)(x+4)$ in a single correct fraction        |
|                                                                                                                                                                                                                                                                     |                        |   | A1 Accept $\frac{7}{x^2-7x+12}$                                                           |

## 38 - (4MA0-S 2018-Paper 4HR-Q22) - ALGEBRA

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |   |                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| $\frac{5^{n^2+n^2-5n}}{5^{6+3}} (=125) \text{ or } 5^{n^2-6} \times 5^{n^2-5n-3} (=125) \text{ or } 5^{n^2+n^2-5n-9} (=125) \text{ or } 5^{n^2+n^2-5n} = 125 \times 5^9$ $5^{n^2+n^2-5n} = 5^{12} \text{ or } 5^{n^2+n^2-5n-9} = 5^3 \text{ or } 5^{n^2+n^2-5n-9-3} = 5^0$ $\text{e.g. } 2n^2-5n-12 (=0) \text{ or } 2n^2-5n=12$ $(2n+3)(n-4) (=0) \text{ or } n = \frac{5 \pm \sqrt{(-5)^2 - 4 \times 2 \times -12}}{2 \times 2} (= \frac{5 \pm \sqrt{25+96}}{4})$ | 4 | 5 | M1 For simplifying the LHS to a product or quotient of two single powers of 5 or for an equation with 125 and at most a single power of 5 on each side. |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |   | M1 For simplifying both sides to a single power of 5                                                                                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |   | A1 A correct quadratic equation in $n$ , simplified to three terms in any position.                                                                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |   | M1 A correct factorisation or correct substitution into the quadratic formula or correctly completing the square.                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |   | A1 dep on correct quadratic equation<br>Award A0 if negative root is not excluded.                                                                      |

## 39 - (4MA0-W 2018-Paper 4HR-Q7) - ALGEBRA

|     |                                                                                                            |                    |   |                                                                                                                                         |
|-----|------------------------------------------------------------------------------------------------------------|--------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------|
| (a) |                                                                                                            | $a(4b+7a-1)$       | 2 | B2 B1 for factors which, when expanded and simplified, give three terms, at least one of which is correct.                              |
| (b) | $4 > 11 + 8p \text{ or } -8p > 11 - 4 \text{ or } -8p > 7$<br>$\text{or } 8p < 4 - 11 \text{ or } 8p < -7$ | $p < -\frac{7}{8}$ | 2 | M1 Accept $4 = 11 + 8p$ or $-8p = 11 - 4$ or $\frac{-7}{8}$ or $8p = 4 -$<br>A1 11<br>Condone $p < -0.875$<br>Mark the final answer     |
| (c) | $x^2 + 3x - 6x - 18$                                                                                       | $x^2 - 3x - 18$    | 2 | M1 For 3 correct terms or For 4 correct terms ignoring signs or For $x^2 - 3x + c$ for any non-zero value of $c$ or For ... - $3x - 18$ |
| (d) |                                                                                                            | $y^8$              | 1 | A1 B1                                                                                                                                   |
| (e) |                                                                                                            | $9e^2$             | 2 | B2 B1 for 9 or $e^2$ as part of a product or for $3^2 \times e^2$                                                                       |



## 40 - (4MA0-W 2018-Paper 4HR-Q11) - ALGEBRA

|     |                                                                                                           |                    |   |                                                                                                                                                                |
|-----|-----------------------------------------------------------------------------------------------------------|--------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) |                                                                                                           | $8a^5b^9$          | 2 | M1 For two correct from 8, $a^5$ or $b^9$ written as a product.<br>A1                                                                                          |
| (b) | Eg $\frac{1}{c^{2/4}}$ or $c^{2/4}$ or $(c^k)^4 = \frac{1}{c^2}$ or $c^{4k} = \frac{1}{c^2}$ or $4k = -2$ | $-\frac{1}{2}$ oe  | 2 | M1 For a correct first step<br>A1 Eg $-\frac{2}{4}$                                                                                                            |
| (c) |                                                                                                           | $\frac{2(x+2)}{3}$ | 2 | M1 For $\frac{4(x+2)}{6}$ or $\frac{4x+8}{6}$ or $\frac{2(x+2)^2}{3(x+2)}$<br>A1 Accept $\frac{2x+4}{3}$ or $\frac{2}{3}(x+2)$ or $\frac{2}{3}x + \frac{4}{3}$ |
| (d) | $3(x^2 - 25y^2)$                                                                                          | $3(x+5y)(x-5y)$    | 2 | M1 For $3(x^2 - 25y^2)$ or $(3x - 15y)(x + 5y)$ or $(x - 5y)(3x + 15y)$ or $(\sqrt{3}x + \sqrt{75}y)(\sqrt{3}x - \sqrt{75}y)$ oe<br>A1                         |

## 41 - (4MA0-W 2018-Paper 4HR-Q14) - ALGEBRA

|     |                                                                                           |               |   |                                                                                                                                                                                                                                                                                                                   |
|-----|-------------------------------------------------------------------------------------------|---------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) | $P = kQ^2$ or $P \propto kQ^2$<br>Eg $180 = k \times 12^2$ or $180 \propto k \times 12^2$ | $P = 1.25Q^2$ | 3 | M1 Allow $Q^2 = kP$ or $Q^2 \propto kP$<br>M1 For a correct substitution into a correct equation<br>Implies first M1<br>Award M2 if $k = 1.25$ oe stated unambiguously in (a) or (b)<br>A1 oe<br>Only award if $P$ is the subject.<br>M2A1 for $P = kQ^2$ on answer line if $k = 1.25$ oe seen in part (a) or (b) |
| (b) |                                                                                           | 1125          | 1 | B1 Ft if (a) in form $P = kQ^2$                                                                                                                                                                                                                                                                                   |

## 42 - (4MA0-W 2018-Paper 4HR-Q19) - ALGEBRA

|  |                                                                                                                                                                                                                                                                                                      |                                          |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Eg $x^2 - 105 + x^2 - 65 + 470 - 30x + 510 - 30x = 360$ or $2x^2 - 60x + 810 = 360$<br><br>Eg $2x^2 - 60x + 450 (= 0)$ or $2x^2 - 60x = -450$ or $x^2 - 30x + 225 (= 0)$<br><br>Eg $(x - 15)(x - 15) (= 0)$<br>or $\frac{30 \pm \sqrt{(-30)^2 - 4 \times 1 \times 225}}{2 \times 1}$<br><br>$x = 15$ |                                          | 6 | M1 For a correct equation<br><br>M1 For a correct three term quadratic<br><br>M1 For $(x - 15)(x - 15) (= 0)$ or $2(x - 15)(x - 15) (= 0)$ or $(2x - 30)(x - 15) (= 0)$ or $\frac{30 \pm \sqrt{(-30)^2 - 4 \times 1 \times 225}}{2 \times 1}$ oe<br>(may be partially evaluated; Condone lack of brackets)<br><br>Dep on first 2 method marks<br>A1 For substitution of $x = 15$ into $x^2 - 65$ and $470 - 30x$ or $x^2 - 105$ and $510 - 30x$<br>M1<br>A1 |
|  |                                                                                                                                                                                                                                                                                                      | 160 and 20 or 120 and 60 with conclusion | 6 | A1                                                                                                                                                                                                                                                                                                                                                                                                                                                          |



|                                                                                                                                                                                                                                                                                                                                                       |  |                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Alternative</b><br/> Eg <math>x^2 - 65 + 470 - 30x = 180</math> or <math>x^2 - 105 + 510 - 30x = 180</math><br/> <math>x^2 - 30x + 225 (= 0)</math> or <math>x^2 - 30x = -225</math></p> <p><math>(x - 15)(x - 15) (= 0)</math> or <math>\frac{30 \pm \sqrt{(-30)^2 - 4 \times 1 \times 225}}{2 \times 1}</math></p> <p><math>x = 15</math></p> |  | <p>160 and 20 or<br/> 120 and 60<br/> with conclusion</p> | <p>M1 For a correct equation<br/> M1 For a correct three term quadratic</p> <p>M1 For <math>(x - 15)(x - 15) (= 0)</math> or <math>\frac{30 \pm \sqrt{(-30)^2 - 4 \times 1 \times 225}}{2 \times 1}</math> oe<br/> (may be partially evaluated;<br/> Condone lack of brackets)</p> <p>Dep on first 2 method marks</p> <p>A1 For a substitution of <math>x = 15</math> into the other pairs of co-interior angles.<br/> cso</p> <p>A1</p> |
|                                                                                                                                                                                                                                                                                                                                                       |  | 6                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## 43 - (4MA0-W 2019-Paper 4HR-Q5) - ALGEBRA

|     |                                                                |                |   |                                                                                                                                                                                                                                                                                                                                                                  |
|-----|----------------------------------------------------------------|----------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) | $5x - x = 8 + 2$                                               | $2.5\text{oe}$ | 3 | <p>M2 collecting <math>x</math> terms on one side <b>and</b> all numbers on the other side (accept <math>4x = 10</math>)</p> <p>M1 for collecting <math>x</math> terms on one side <b>or</b> all numbers on one side (e.g. <math>6x = 8 + 2</math> or <math>4x = 8 - 2</math>)</p> <p>A1 dep on at least M1 Accept <math>x = 10/4</math> or <math>5/2</math></p> |
| (b) |                                                                | $t(3 - 5y)$    | 1 | B1                                                                                                                                                                                                                                                                                                                                                               |
| (c) |                                                                | $k^6$          | 1 | B1                                                                                                                                                                                                                                                                                                                                                               |
| (d) | $\frac{5}{2h} - \frac{2}{2h}$ or $\frac{5h - 2h}{2h \times h}$ | $\frac{3}{2h}$ | 2 | <p>M1 for a correct (but possibly unsimplified) common denominator</p> <p>A1</p>                                                                                                                                                                                                                                                                                 |

## 44 - (4MA0-W 2019-Paper 4HR-Q11) - ALGEBRA

|     |                            |                       |   |                                                                                                                               |
|-----|----------------------------|-----------------------|---|-------------------------------------------------------------------------------------------------------------------------------|
| (a) |                            | $10n + 1$             | 2 | <p>M1 <math>10n + k</math> oe (<math>k</math> any integer <math>\neq 1</math>)</p> <p>A1</p>                                  |
| (b) |                            | $(x - 6)(x - 1)$      | 2 | <p>B2 cao</p> <p>If not B2 then B1 for <math>(x - a)(x - b)</math> with <math>ab = 6</math> or <math>a + b = \pm 7</math></p> |
| (c) | $6e^2 - 9ef - 8ef + 12f^2$ | $6e^2 - 17ef + 12f^2$ | 2 | <p>M1 for 4 correct terms excluding signs or 3 correct terms with correct signs</p> <p>A1</p>                                 |

## 45 - (4MA0-W 2019-Paper 4HR-Q16) - ALGEBRA

|  |                                                                              |              |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--|------------------------------------------------------------------------------|--------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | $x^2 < 16$ or $x^2 < 32/2$<br>$\pm 4$ or $\pm \sqrt{16}$ or $(x - 4)(x + 4)$ | $-4 < x < 4$ | 4 | <p>M1 accept <math>x^2 = 16</math> or <math>x^2 - 16 = 0</math> or <math>x^2 - 16 &lt; 0</math> or <math>(x + 4)(x - 4) = 0</math> or <math>&gt; 0</math></p> <p>ignore <math>\leq</math> in place of <math>&lt;</math> at this stage.</p> <p>B1 ( must see <math>\pm</math>)</p> <p>A2 accept <math>x &lt; 4</math> <b>and</b> <math>x &gt; -4</math></p> <p>if not A2 then A1 for <math>x &lt; 4</math> <b>or</b> <math>x &gt; -4</math></p> <p>A marks dep on M1</p> |
|--|------------------------------------------------------------------------------|--------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



## 46 - (4MA0-W 2019-Paper 4HR-Q19) - ALGEBRA

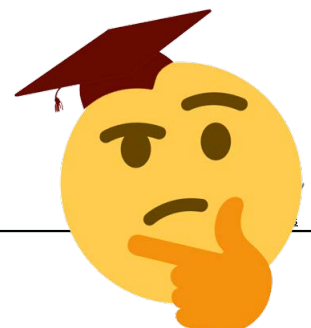
|                                                                                                                                   |                                                 |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $x^2 + (8 - 2x)^2 = 29$<br>$x^2 + 64 - 32x + 4x^2 = 29$<br>$5x^2 - 32x + 35 = 0$<br>$(x - 5)(5x - 7) = 0$<br><br>$x = 5, x = 1.4$ | $x = 5, y = -\frac{2}{5}$<br>$x = 1.4, y = 5.2$ | 6 | M1 substitution for $y$<br>M1 (indep) correct expansion of $(8 - 2x)^2$<br>A1 correct 3 term quadratic = 0<br>M1 ft or formula $\frac{-(-32) \pm \sqrt{(-32)^2 - 4 \times 5 \times 35}}{2 \times 5}$ or better<br><u>NB. 1 method mark can be awarded here for solving a 3 term quadratic provided the first M1 has been awarded.</u><br>A1 Correct two $x$ values or correct two $y$ values<br>A1 Correct pairing. Accept $y = 26/5, x = 7/5, (1.4, 5.2)$ or $(7/5, 26/5)$<br>(both A marks dep on first 2 method marks) |
|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 47 - (4MA0-W 2019-Paper 4HR-Q20) - ALGEBRA

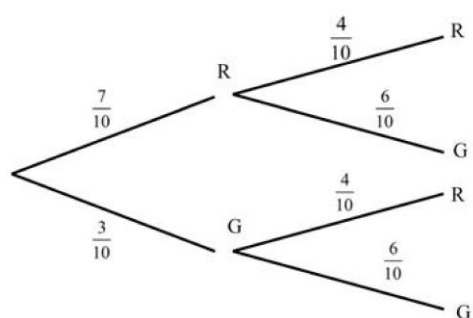
|                                                                                                                   |     |   |                                                                               |
|-------------------------------------------------------------------------------------------------------------------|-----|---|-------------------------------------------------------------------------------|
| $(2^2)^n \times (2^3)^{n+1} = 24$ or $4^n \times (4)^{1.5(n+1)} = 4^2$<br>$2n + 3(n+1) = 4$ or $n + 1.5(n+1) = 2$ | 0.2 | 3 | M1 Expressing all 3 terms as powers of 2 or powers of 4<br>M1<br>A1 dep on M2 |
|-------------------------------------------------------------------------------------------------------------------|-----|---|-------------------------------------------------------------------------------|

## 48 - (4MA0-W 2019-Paper 4HR-Q22) - ALGEBRA

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                       |   |                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $1 - \frac{2x+1+\frac{1}{3x-2}}{2x+1+\frac{1}{x-1}}$<br>$a + \frac{1}{b} = \frac{6x^2 - x - 1}{3x - 2} = \frac{(3x+1)(2x-1)}{3x-2}$<br>$a + \frac{1}{c} = \frac{2x^2 - x}{x-1} = \frac{x(2x-1)}{x-1}$<br>$1 - \frac{(3x+1)(x-1)}{x(3x-2)}$<br>$\frac{(3x^2 - 2x) - (3x^2 - 2x - 1)}{x(3x-2)}$<br>Alt:<br>$1 - \frac{2x+1+\frac{1}{3x-2}}{2x+1+\frac{1}{x-1}}$<br>$\frac{2x+1+\frac{1}{x-1} - \left(2x+1+\frac{1}{3x-2}\right)}{2x+1+\frac{1}{x-1}}$<br>$\frac{\frac{1}{x-1} - \frac{1}{3x-2}}{2x+1+\frac{1}{x-1}}$ | $\frac{1}{3x^2 - 2x}$ | 5 | M1 correct substitution<br><br>M1(ind) expressing $a + \frac{1}{b}$ as a single fraction<br>M1 (ind) expressing $a + \frac{1}{c}$ as a single fraction<br><br>M1 expressing unsimplified answer as a single fraction<br>A1 accept $\frac{1}{x(3x-2)}$<br><br>M1 correct substitution<br>M1 correct expression over a common denominator<br><br>M1<br><br>M1<br>A1 accept $\frac{1}{x(3x-2)}$ |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



|      |                                                                                                                                                                                        |                     |   |                                                                                                                                                             |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | $\frac{2x-1}{(x-1)(3x-2)} \text{ or } \frac{2x-1}{(x-1)(3x-2)}$ $\frac{2x^2-x}{(x-1)} \quad \frac{x(2x-1)}{(x-1)}$                                                                     |                     |   |                                                                                                                                                             |
| Alt: | $1 - \frac{1}{\frac{a+\frac{1}{b}}{c}} = 1 - \frac{ab+1}{ac+1}$ $1 - \frac{c(ab+1)}{b(ac+1)}$ $\frac{b-c}{b(ac+1)}$ $\frac{(3x-2)-(x-1)}{(3x-2)(2x^2-x)}$ $\frac{2x-1}{(3x-2)x(2x-1)}$ | $\frac{1}{3x^2-2x}$ | 5 | M1<br>M1<br>M1 expressing as a single fraction in $a, b, c$<br><br>M1 expressing as a single fraction fully factorised<br><br>A1 accept $\frac{1}{x(3x-2)}$ |





**1** - (4MA0-S 2015-Paper 4HR-Q4) - *FUNCTIONS & GRAPHS*

|     |                                                       |                                                            |
|-----|-------------------------------------------------------|------------------------------------------------------------|
| (a) | $(-2, -4), (-1, -1), (0, 2), (1, 5), (2, 8), (3, 11)$ | correct line drawn<br>from between $x = -2$<br>and $x = 3$ |
| (b) |                                                       |                                                            |
|     |                                                       | correct point                                              |

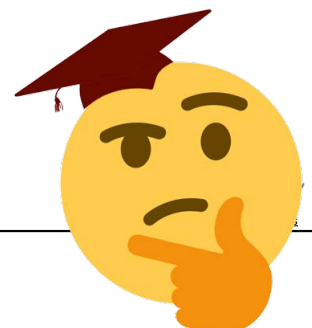


2 - (4MA0-S 2015-Paper 4HR-Q12) - *FUNCTIONS & GRAPHS*

|  |                                                     |                            |
|--|-----------------------------------------------------|----------------------------|
|  | (Gradient =) $-\frac{3}{5}$ or $(m =) -\frac{3}{5}$ | $y = -\frac{3}{5}x + 3$ oe |
|--|-----------------------------------------------------|----------------------------|

3 - (4MA0-S 2015-Paper 4HR-Q15) - *FUNCTIONS & GRAPHS*

|     |                    |               |
|-----|--------------------|---------------|
| (a) |                    | 1, 5, 21      |
| (b) |                    | correct curve |
| (c) |                    | -1.1          |
| (d) | $y = 1 - 2x$ drawn | -0.8          |



## 4 - (4MA0-W 2015-Paper 4HR-Q19) - FUNCTIONS &amp; GRAPHS

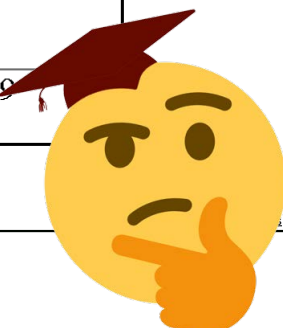
|   |                                                                                     |                             |
|---|-------------------------------------------------------------------------------------|-----------------------------|
| a | $kx = \frac{N}{x}$ oe or $kp = \frac{N}{p}$ oe                                      |                             |
|   |                                                                                     | $p = \sqrt{\frac{N}{k}}$ oe |
|   |                                                                                     | $q = \sqrt{Nk}$ oe          |
| b | $\sqrt{\frac{N}{k}} = 2\sqrt{Nk}$ or<br>$q = k \times 2q$ or<br>$\frac{1}{2}p = kp$ |                             |
|   |                                                                                     | $\frac{1}{2}$               |

## 5 - (4MA0-S 2016-Paper 4HR-Q5) - FUNCTIONS &amp; GRAPHS

|   |  |               |   |
|---|--|---------------|---|
| a |  | 7, -1, -2, 7  | 2 |
| b |  | Correct curve | 2 |
| c |  | 4.4 – 4.5     | 1 |

## 6 - (4MA0-W 2016-Paper 4HR-Q14) - FUNCTIONS &amp; GRAPHS

|     |                                                                 |                               |
|-----|-----------------------------------------------------------------|-------------------------------|
| (a) |                                                                 | -10, (4), 6, 2, (-2), 0, (14) |
| (b) | (-3, -10), (-2, 4), (-1, 6), (0, 2), (1, -2), (2, 0), ((3, 14), | Correct curve                 |
| (c) | $1^3 - 6 \times 1 + m = 0$ or<br>$1 - 6 + m = 0$                | 5                             |
| (d) |                                                                 | -2.7 to -2.9                  |



## 7 - (4MA0-S 2017-Paper 4HR-Q12) - FUNCTIONS &amp; GRAPHS

|     |                                                                |                                   |   |      |                                                                                                                                                                                                                     |
|-----|----------------------------------------------------------------|-----------------------------------|---|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) |                                                                | $y = \frac{1}{2}x - 1$ oe         | 2 | M1   | For $(y=) \frac{3}{6}x + c$ (c may be any number or letter) or<br>For $(y=)mx - 1$ where $m$ is non-zero or for<br>Gradient = $\frac{3}{6}$ oe or $m = \frac{3}{6}$ oe<br>clearly stated                            |
|     |                                                                |                                   |   | A1   | For a fully a correct equation for L<br>Eg<br>$y = \frac{3}{6}x - 1$ or $2y = x - 2$ or<br>$y - 1 = \frac{1}{2}(x - 4)$ or<br>$y - 2 = \frac{1}{2}(x - 2)$<br>M1A0 for $L = \frac{1}{2}x - 1$ or $\frac{1}{2}x - 1$ |
| (b) | $4 = \frac{1}{2} \times 5 + c$ or $y - 4 = \frac{1}{2}(x - 5)$ | $y = \frac{1}{2}x + 1\frac{1}{2}$ | 2 | M1ft | For correct substitution of given coordinate into their equation<br>Follow through their gradient in (a)                                                                                                            |
|     |                                                                |                                   |   | A1   | oe<br>Eg $y = \frac{1}{2}(x + 3)$<br>SCB1 for $(l=) \frac{1}{2}x + 1\frac{1}{2}$                                                                                                                                    |

## 8 - (4MA0-S 2017-Paper 4HR-Q20) - FUNCTIONS &amp; GRAPHS

|     |                                                                                                                                                            |                 |   |                                         |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---|-----------------------------------------|
| (a) |                                                                                                                                                            | -5              | 1 | B1                                      |
| (b) |                                                                                                                                                            | 23              | 1 | B1                                      |
| (c) | $(f(-7)) = \frac{1}{-7+5}$ or $(f(-7)) = -\frac{1}{2}$ or<br>$2\left(\frac{1}{-7+5}\right) + 3$ or $2 \times -\frac{1}{2} + 3$                             | 2               | 2 | M1                                      |
|     |                                                                                                                                                            |                 |   | A1                                      |
| (d) | $x - 3 = 2y$ or $\frac{x}{2} = y + \frac{3}{2}$ or<br>$y - 3 = 2x$ or $\frac{y}{2} = x + \frac{3}{2}$ or<br>$\frac{y-3}{2}$ or $\frac{y}{2} - \frac{3}{2}$ | $\frac{x-3}{2}$ | 2 | M1                                      |
|     |                                                                                                                                                            |                 |   | A1 oe<br>Eg $\frac{x}{2} - \frac{3}{2}$ |

## 9 - (4MA0-W 2017-Paper 4HR-Q18) - FUNCTIONS &amp; GRAPHS

|     |  |      |   |
|-----|--|------|---|
| (a) |  | -3.4 | 2 |
| (b) |  |      | 3 |
|     |  | -2.5 |   |



**10** - (4MA0-S 2018-Paper 4HR-Q15) - *FUNCTIONS & GRAPHS*

|     |                                         |                    |   |      |                                                                                                                                                                                        |
|-----|-----------------------------------------|--------------------|---|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) |                                         | -18, 2, 24         | 2 | B2   | For 3 correct values or<br>B1 for 2 correct values                                                                                                                                     |
| (b) |                                         | Correct curve      | 2 | M1ft | if at least B1 scored in (a)<br>At least 5 points plotted correctly<br>Plotting tolerance $\pm \frac{1}{2}$ sq                                                                         |
| (c) | $x^3 - 2x + 3 = 3x + 2$<br>$y = 3x + 2$ | -2.3<br>0.2<br>2.1 | 3 | A1   | Through 7 correct points                                                                                                                                                               |
|     |                                         |                    |   | M1   | For identifying $(y =) 3x + 2$                                                                                                                                                         |
|     |                                         |                    |   | M1   | For drawing correct line                                                                                                                                                               |
|     |                                         |                    |   | A1   | dep on correct line drawn<br>3 correct $x$ values in intervals:<br>[-2.5, -2.2]<br>[0.1, 0.3]<br>[2.0, 2.2]<br>ft dep on M1 in (b), correct line<br>drawn and 3 points of intersection |

**11** - (4MA0-W 2018-Paper 4HR-Q13) - *FUNCTIONS & GRAPHS*

|     |                                                |                         |   |          |                                                          |
|-----|------------------------------------------------|-------------------------|---|----------|----------------------------------------------------------|
| (a) |                                                | 4.06                    | 1 | B1       | Accept 4 – 4.1                                           |
| (b) |                                                | 1 or $k = -8.5$ (1d.p.) | 2 | B1<br>B1 | For $k = 1$<br>$k = -8.5$ (accept $k = -8.6$ to $-8.4$ ) |
| (c) | $y = ax + 3$ or $y = -x + b$ or for $3 - x$ oe | $y = 3 - x$             | 2 | M1<br>A1 | For $y = ax + 3$ or $y = -x + b$ or for<br>$3 - x$       |



## 1 - (4MA0-S 2015-Paper 4HR-Q11) - MENSURATION

|  |                                                                                                                                                                                                                                |     |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|  | $2\pi \times 3.5 \times 8.2 + 2\pi \times 3.5^2$ or $57.4\pi + 24.5\pi$ or<br>$81.9\pi$ or $180(.327..)+76.9(690...)$ or<br>$2\pi \times 3.5 \times 8.2 + \pi \times 3.5^2$<br>or $180(.327..)+38.4(845...)$ or $218(.81....)$ | 257 |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|

## 2 - (4MA0-S 2015-Paper 4HR-Q20) - MENSURATION

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|  | $(AC^2 =) 8^2 + 8^2 - 2 \times 8 \times 8 \cos 120^\circ$ or $(AC^2 =) 192$ oe or<br>$\frac{AC}{\sin 120^\circ} = \frac{8}{\sin 30}$ oe or<br>$8 \cos(30^\circ)$ or $8 \sin(60^\circ)$ or $4\sqrt{3}$ or $6.92(820...)$ oe<br>$(AC =) 2 \times 8 \sin(60^\circ)$ oe or $(AC =) 2 \times 8 \cos(30^\circ)$ oe or<br>$(AC =) \frac{8}{\sin 30} \times \sin 120$ oe or<br>$(AC =) \sqrt{8^2 + 8^2 - 2 \times 8 \times 8 \cos 120^\circ}$ or $\sqrt{128 + 64}$ or<br>$\sqrt{192}$ or $8\sqrt{3}$ or $13.8(56...)$ oe<br>$(\text{arc } ABC) = \frac{120}{360} \times 2\pi \times 8$ or<br>$(\text{arc } ABC) = \frac{120}{360} \times \pi \times 16$ or<br>$(\text{arc } ABC) = \frac{2\pi \times 8}{3}$ or $\frac{\pi \times 16}{3}$ oe or $16.7(55...)$<br>“13.8(56...)” + “16.7(55...)” | 30.6 |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|

## 3 - (4MA0-S 2016-Paper 4HR-Q7) - MENSURATION

|                                                                                    |      |   |
|------------------------------------------------------------------------------------|------|---|
| $\pi \times 3^2 (= 9\pi = 28.27..)$ or<br>$\pi \times (3+2)^2 (= 25\pi = 78.53..)$ |      | 3 |
| $\pi \times 5^2 - \pi \times 3^2$ oe eg $16\pi$                                    |      |   |
|                                                                                    | 50.3 |   |



## 4 - (4MA0-W 2016-Paper 4HR-Q5) - MENSURATION

|  |                            |    |
|--|----------------------------|----|
|  | $48 \div 8 (=6)$           |    |
|  | $(8 + "6") \times 2 (=28)$ |    |
|  | $"28" \div 4 (=7)$         |    |
|  |                            | 49 |

## 5 - (4MA0-W 2016-Paper 4HR-Q11) - MENSURATION

|  |                                                                                                                            |      |
|--|----------------------------------------------------------------------------------------------------------------------------|------|
|  | $\pi \times (20 - 2 \times 4)$ oe or $\pi \times 12$ oe or $2 \times \pi \times 6$ or 37.6... or 37.7 or                   |      |
|  | $\frac{1}{2} \times \pi \times (20 - 2 \times 4)$ oe or $\frac{1}{2} \times \pi \times 12$ oe or $\pi \times 6$ or 18.8... |      |
|  | $4 + 10 + 20 + 10 + 4 + \frac{1}{2} \times "37.6..."$ or<br>$4 + 10 + 20 + 10 + 4 + "18.8..."$                             |      |
|  |                                                                                                                            | 66.8 |

## 6 - (4MA0-W 2017-Paper 4HR-Q4) - MENSURATION

|                                                 |     |   |
|-------------------------------------------------|-----|---|
| $30 \times 20$ or 600                           |     | 4 |
| $\pi \times 8^2$ or 201.(0619298...) or $64\pi$ |     |   |
| $30 \times 20 - \pi \times 8^2$                 |     |   |
|                                                 | 399 |   |

## 7 - (4MA0-W 2017-Paper 4HR-Q19) - MENSURATION

|                                                                     |      |   |
|---------------------------------------------------------------------|------|---|
| $(\pi \times 5^2) + \pi \times 5 \times l$<br>$(25\pi) + 5\pi l$    |      | 5 |
| $(l =) 13$                                                          |      |   |
| $(h =) \sqrt{13^2 - 5^2}$ or $\sqrt{144}$ or 12                     |      |   |
| $(V =) \frac{1}{3} \times \pi \times 5^2 \times 12 (= 314 - 314.3)$ |      |   |
|                                                                     | 100π |   |



## 8 - (4MA0-W 2017-Paper 4HR-Q21) - MENSURATION

|     |                                                                    |                |   |
|-----|--------------------------------------------------------------------|----------------|---|
| (a) |                                                                    | $3x - 13 - 50$ | 1 |
| (b) | $x - 52$                                                           | 73             | 5 |
|     | $25(3x - 63)(x - 52) (= 81900)$                                    |                |   |
|     | eg $3x^2 - 156x - 63x + 3276 (= 3276)$                             |                |   |
|     | or $75x^2 - 3900x - 1575x + 81900 (= 81900)$                       |                |   |
|     | eg $3x^2 - 219x = 0$ or $3x(x - 73) = 0$<br>or $75x^2 - 5475x = 0$ |                |   |
|     | $(x = 0)$ or $x = 73$                                              |                |   |

## 9 - (4MA0-W 2018-Paper 4HR-Q2) - MENSURATION

|     |                                                                                                                                                                                                                                                  |      |   |                                                                               |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|-------------------------------------------------------------------------------|
| (a) | Eg $3 \times 6$ or $18$ or $3 \times 4$ or $12$ or $8 \times 2$ or $16$ or $5 \times 2$ or $10$<br>or $8 \times 6$ or $48$ or $4 \times 5$ or $20$<br><br>Eg $3 \times 6 + 5 \times 2$ or $3 \times 4 + 8 \times 2$ or $8 \times 6 - 4 \times 5$ | 28   | 3 | M1 For method to find the area of a rectangle<br><br>M1 Complete method<br>A1 |
| (b) | $\frac{350}{28}$ or " $28$ " $\times h = 350$                                                                                                                                                                                                    | 12.5 | 2 | M1ft<br>A1ft                                                                  |

## 10 - (4MA0-W 2019-Paper 4HR-Q2) - MENSURATION

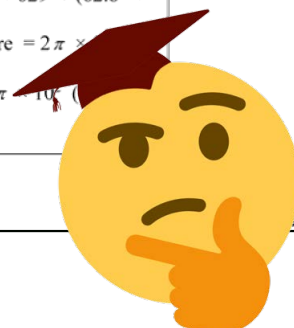
|  |                                         |      |   |                                                                     |
|--|-----------------------------------------|------|---|---------------------------------------------------------------------|
|  | $\sqrt{400} = 20$<br>$\pi \times 20$ oe | 62.8 | 3 | M1<br>M1 dep<br>A1 62.83185 ... Accept 62.8 $\rightarrow$ 62.9 inc. |
|--|-----------------------------------------|------|---|---------------------------------------------------------------------|

## 11 - (4MA0-W 2019-Paper 4HR-Q8) - MENSURATION

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |      |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $6 \times 12 (=72)$ or $0.5 \times 7 \times 4 (=14)$<br>or $6 \times 5 (=30)$ or $7 \times 6 (=42)$<br>$0.5 \times \{6+10\} \times 7 (=56)$<br><br>'30' + '42' + '14' or '72' + '14' or '30' + '56'<br><br>'86' $\times 25$<br><br>Alt:<br>$6 \times 12 \times 25 (=1800)$ or $0.5 \times 7 \times 4 \times 25 (=350)$<br>or $6 \times 5 \times 25 (=750)$ or $7 \times 6 \times 25 (=1050)$<br>or $0.5 \times \{6+10\} \times 7 (=1400)$<br><br>'1800' + '350' or '750' + '1400'<br>or '750' + '1050' + '350' | 2150 | 2150 | 4 | M1 for any correct calculation of a component of the cross-section (i.e. leading to 72 or 14 or 30 or 56 or 42)<br><br>M1 dep correct cross-section components added to get total cross section (=86)<br><br>M1 (dep on previous M1)<br>A1 cao<br>M1 for any correct calculation seen of one volume block (i.e. leading to 1800 or 350 or 750 or 1050 or 1400) (M2 for any two correct volume calculations seen)<br><br>M1 (dep on previous M2) correct volume components selected to be added<br><br>A1 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 12 - (4MA0-W 2019-Paper 4HR-Q14) - MENSURATION

|                                                                     |    |   |                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------|----|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $1000\pi = 2\pi \times 10^2 + 2\pi \times 10h + \pi \times 10^2$ oe | 35 | 3 | M2<br>( $\pi$ as a decimal: $3140 \rightarrow 3143 = 628 \rightarrow 629 + (62.8 \rightarrow 62.9)h + 314$ )<br>If not M2 then M1 for SA of hemisphere $= 2\pi \times 200 \pi$ oe)<br>or for TSA of cylinder $= 2\pi \times 10h + \pi \times 10^2$ oe)<br>+ $100\pi$ oe)<br>A1 |
|---------------------------------------------------------------------|----|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|





## 1 - (4MA0-S 2015-Paper 4HR-Q13) - GEOMETRY

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| (a) | <p>Eg. <math>\frac{12}{12+8}</math> or <math>\frac{3}{5}</math> or 0.6 or <math>\frac{12+8}{12}</math> or <math>\frac{5}{3}</math> or 1.66(66...) or</p> <p><math>\frac{MN}{13.5} = \frac{12}{12+8}</math> oe or <math>(MN =) \frac{12}{12+8} \times 13.5</math> oe</p>                                                                                                                                                                                                         | 8.1               |
| (b) | <p>Eg. <math>\frac{PQ}{9} = \frac{12+8}{12}</math> oe or <math>\frac{PQ}{9} = \frac{13.5}{"8.1"}</math> or <math>PQ = 9 \times \frac{12+8}{12}</math> oe or</p> <p><math>PQ = 9 \times \frac{13.5}{"8.1"}</math> oe or <math>PQ = 15</math></p> <p>or <math>\frac{LQ}{9} = \frac{8}{12}</math> oe or <math>(LQ =) 9 \times \frac{8}{12}</math> oe</p>                                                                                                                           | 6                 |
| (c) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $\frac{25}{9}$ oe |
| (d) | <p>Eg. <math>"\left(\frac{25}{9}\right)"A - A = 105.6</math> or <math>A\left(" \left(\frac{25}{9}\right)" - 1\right) = 105.6</math> or</p> <p><math>A\left(" \left(\frac{16}{9}\right)"\right) = 105.6</math> or <math>"\left(\frac{25}{9}\right)"A = 105.6 + A</math> or</p> <p><math>\frac{105.6+A}{"25/9"} = A</math></p> <p><math>(A =) \frac{105.6}{\frac{25}{9}-1}</math> or <math>(A =) \frac{105.6}{1.77...}</math> or <math>(A =) \frac{105.6 \times 9}{16}</math></p> | 59.4              |



## 2 - (4MA0-S 2015-Paper 4HR-Q17) - GEOMETRY

|     |                                                                                                                                                                                     |    |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| (a) |                                                                                                                                                                                     | 21 |
| (b) |                                                                                                                                                                                     | 62 |
| (c) | $\angle KJL = 37^\circ$ or $\angle PJM = 60^\circ$ or $\angle LKM = 60^\circ$<br>or $\angle LMP = 37^\circ$ or $\angle MPJ = 58^\circ$ or $MPL = 122^\circ$<br>or $JPK = 122^\circ$ | 58 |

## 3 - (4MA0-W 2015-Paper 4HR-Q2) - GEOMETRY

|   |                                                      |                          |
|---|------------------------------------------------------|--------------------------|
| a | $\pi \times 150$ oe                                  |                          |
|   |                                                      | 471                      |
| b | $30 \times 60 (=1800)$ or<br>“471” $\div 30 (=15.7)$ |                          |
|   | “471” $\div$ ”1800” or<br>“15.7” $\div 60$           |                          |
|   |                                                      | 0.262                    |
| c | Radius = $x - h$ or<br>$\frac{D}{2} = x - h$ oe      |                          |
|   |                                                      | $h = x - \frac{D}{2}$ oe |

## 4 - (4MA0-W 2015-Paper 4HR-Q3) - GEOMETRY

|  |                                                                                              |     |
|--|----------------------------------------------------------------------------------------------|-----|
|  | Angle $DAB = 110$                                                                            |     |
|  | Angle $BAX = 110 \div 2 (= 55)$ or<br>Angle $DAX = 110 \div 2 (= 55)$ or<br>Angle $AXD = 55$ |     |
|  | Angle $AXD = 55$ or<br>Angle $CBA = 180 - 110 (=70)$ or<br>Angle $ADC = 180 - 110 (=70)$     |     |
|  |                                                                                              | 125 |



## 5 - (4MA0-W 2015-Paper 4HR-Q7) - GEOMETRY

|   |                                                                                     |     |
|---|-------------------------------------------------------------------------------------|-----|
| a | $\frac{1}{2}(14 + 20) \times 8$ or<br>$8 \times 14 + \frac{1}{2} \times 6 \times 8$ |     |
|   |                                                                                     | 136 |
| b | $20 - 14 (= 6)$                                                                     |     |
|   | $6^2 + 8^2$ or $36 + 64$ or $100$                                                   |     |
|   | $\sqrt{6^2 + 8^2}$                                                                  |     |
|   |                                                                                     | 10  |

## 6 - (4MA0-W 2015-Paper 4HR-Q10) - GEOMETRY

|   |                                                                                                                   |      |
|---|-------------------------------------------------------------------------------------------------------------------|------|
| a | $\frac{CE}{17} = \frac{22.5}{9}$ oe or $22.5 \div 9 (=2.5)$<br>or $9 \div 22.5 (=0.4)$                            |      |
|   |                                                                                                                   | 42.5 |
| b | $\frac{AE}{10} = \frac{22.5}{9}$ $DE = 10 \times 2.5 - 10$<br>or $10 \times \frac{13.5}{9}$ or $10 \times 1.5$ oe |      |
|   |                                                                                                                   | 15   |
| c | $2.5^2 \times 36 (=225)$                                                                                          |      |
|   | "225" – 36                                                                                                        |      |
|   |                                                                                                                   | 189  |

## 7 - (4MA0-W 2015-Paper 4HR-Q16) - GEOMETRY

|   |                                                |    |
|---|------------------------------------------------|----|
| a | $\angle ADB = 90^\circ$                        |    |
|   | $180 - 90 - 70$                                | 20 |
| b | Position of $T$ shown on diagram               |    |
|   | $\angle TDC (= \angle DBC) = 50^\circ$         |    |
|   | $180 - 70 - 50$ or<br>$180 - 50 - (180 - 110)$ | 60 |



8 - (4MA0-S 2016-Paper 4HR-Q4) - GEOMETRY

|   |                                                                                                                                                                                   |     |   |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|
| a | $360 - 2 \times 111 - 90$                                                                                                                                                         | 48  | 2 |
| b | $111 - 90$                                                                                                                                                                        | 21  | 2 |
| c | $540 - 90 - 90 - 111 - 111$<br><b>or</b> $180 - 2 \times '21'$<br><b>or</b> $2 \times (180 - 111)$<br><b>or</b> $360 - 111 = 249$<br>$180 - (360 - '21' - 249 - 48)$<br><b>or</b> | 138 | 3 |

9 - (4MA0-S 2016-Paper 4HR-Q11) - GEOMETRY

|                                              |      |   |
|----------------------------------------------|------|---|
| $SR = (60 \div 15) \times 2 (=8)$            | 28.1 | 4 |
| $\tan SQR = \frac{'8'}{15}$                  |      |   |
| $SQR = \tan^{-1}\left(\frac{'8'}{15}\right)$ |      |   |
|                                              |      |   |

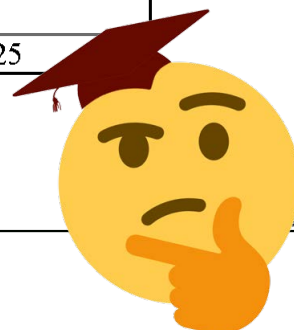


## 10 - (4MA0-S 2016-Paper 4HR-Q20) - GEOMETRY

|                                                     |             |   |
|-----------------------------------------------------|-------------|---|
| $x^2 + 4 = x + 10$                                  |             | 6 |
| $x^2 - x - 6 (= 0)$                                 |             |   |
| $(x - 3)(x + 2) (= 0)$                              |             |   |
| $x = 3, x = -2$                                     |             |   |
| $x = 3, y = 13, x = -2, y = 8$                      |             |   |
|                                                     | (0.5, 10.5) |   |
| <b>or</b>                                           |             |   |
| $x^2 + 4 = x + 10$                                  |             | 6 |
| $x^2 - x - 6 (= 0)$                                 |             |   |
| Sum of roots = 1 so midpoint has $x$ coordinate 0.5 |             |   |
|                                                     |             |   |
|                                                     |             |   |
|                                                     | (0.5, 10.5) |   |
| <b>or</b>                                           |             |   |
| $y = (y - 10)^2 + 4$                                |             | 6 |
| $y^2 - 21y + 104 (= 0)$                             |             |   |
| $(y - 8)(y - 13) (= 0)$                             |             |   |
| $y = 8, y = 13$                                     |             |   |
| $x = 3, y = 13, x = -2, y = 8$                      |             |   |
|                                                     | (0.5, 10.5) |   |

## 11 - (4MA0-W 2016-Paper 4HR-Q2) - GEOMETRY

|         |                                                                                                                     |                                |
|---------|---------------------------------------------------------------------------------------------------------------------|--------------------------------|
| (a) (i) |                                                                                                                     | 57                             |
| (ii)    |                                                                                                                     | <u>Corresponding</u><br>angles |
| (b)     | $(5 - 2) \times 180$ or $3 \times 180$ or $(2 \times 5 - 4) \times 90$ or $6 \times 90$ or $360 + 180$ or 540       |                                |
|         | '540' - $(86 + 142 + 72 + 115)$ oe                                                                                  |                                |
|         |                                                                                                                     | 125                            |
|         | <b>Alternative method (exterior angles)</b><br>$360 - ("94" + "38" + "108" + "65") (= 55)$ or<br>$360 - 305 (= 55)$ |                                |
|         | $180 - "55"$                                                                                                        |                                |
|         |                                                                                                                     | 125                            |



**12** - (4MA0-W 2016-Paper 4HR-Q13) - *GEOMETRY*

|     |                                                  |      |
|-----|--------------------------------------------------|------|
| (a) | eg. $22 \times \frac{24}{20}$ or $22 \times 1.2$ |      |
|     |                                                  | 26.4 |
| (b) | eg. $28.2 - 28.2 \div "1.2"$ or $28.2 \div 6$ oe |      |
|     |                                                  | 4.7  |

**13** - (4MA0-W 2016-Paper 4HR-Q21) - *GEOMETRY, TRIGONOMETRY*

|  |                                                                                                                                                                                                                                                                                                                                                |     |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|  | (BD <sup>2</sup> or AC <sup>2</sup> =) $15^2 + 15^2$ or $\sqrt{450}$ or $15\sqrt{2}$ or 21.2 ...                                                                                                                                                                                                                                               |     |
|  | eg. " $\sqrt{450}$ " <sup>2</sup> = $12^2 + 12^2 - 2 \times 12 \times 12 \times \cos BED$<br>or $\sin BEX = \frac{0.5 \sqrt{450}}{12}$<br>or $\cos EBD = \frac{0.5 \sqrt{450}}{12}$                                                                                                                                                            |     |
|  | eg $DEB = \cos^{-1} \left( \frac{12^2 + 12^2 - "450"}{2 \times 12 \times 12} \right)$<br>or $DEB = 2 \times \sin^{-1} \left( \frac{0.5 \times \sqrt{450}}{12} \right)$<br>or $DEB = 180 - 2 \times \cos^{-1} \left( \frac{0.5 \times \sqrt{450}}{12} \right)$<br>or $DEB = 55.7... \text{ or } 56^\circ$<br>(from ambiguous case of Sine Rule) |     |
|  |                                                                                                                                                                                                                                                                                                                                                | 124 |



## 14 - (4MA0-S 2017-Paper 4HR-Q8) - GEOMETRY

|  |                                                                                                                                                                                    |      |   |       |                               |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|-------|-------------------------------|
|  | $(x^2 =) 18^2 - 13^2$ or $324 - 169$ or $155$<br>$(x =) \sqrt{18^2 - 13^2}$ or $\sqrt{155}$                                                                                        | 12.4 | 3 | M1    | Squaring and subtracting      |
|  |                                                                                                                                                                                    |      |   | M1dep | for square rooting            |
|  |                                                                                                                                                                                    |      |   | A1    | Accept 12.4 – 12.46 inclusive |
|  | Alternative Methods - Using Trigonometry<br>Eg $\sin^{-1}(\frac{13}{18})$ and $18\cos^{-1}(\frac{13}{18})$ oe or<br>$\cos^{-1}(\frac{13}{18})$ and $18\sin^{-1}(\frac{13}{18})$ oe |      |   | M2    | For a complete method         |
|  |                                                                                                                                                                                    |      |   | A1    | Accept 12.4 – 12.46 inclusive |

## 15 - (4MA0-S 2017-Paper 4HR-Q15) - GEOMETRY

|      |                           |                           |   |    |                                                                                                                                                                                                                                          |
|------|---------------------------|---------------------------|---|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (ii) |                           | Alternate segment theorem | 1 | B1 | Dep on B1 for (a)(i)<br>Accept alternate segment(s)<br>Accept angles in <b>alternate segments</b> are equal or<br>Accept Angle between a chord and a tangent is equal to the angle on the circumference subtended/made by the same chord |
| (b)  | $180 - (180 - (61 + 53))$ | 114°                      | 2 | M1 | For $61 + 53$ or $180 - 66$                                                                                                                                                                                                              |
|      |                           |                           |   | A1 | cao                                                                                                                                                                                                                                      |

## 16 - (4MA0-W 2017-Paper 4HR-Q6) - GEOMETRY

|                                                 |      |   |
|-------------------------------------------------|------|---|
| $12.8^2 - 9.7^2$ or $163.84 - 94.09$ or $69.75$ | 8.35 | 3 |
| $\sqrt{12.8^2 - 9.7^2}$                         |      |   |
|                                                 |      |   |

## 17 - (4MA0-W 2017-Paper 4HR-Q8) - GEOMETRY

|                                                                                                        |    |   |
|--------------------------------------------------------------------------------------------------------|----|---|
| $160 - 3x + 7x - 20 = 180$ or<br>$2(160 - 3x) + 2(7x - 20) = 360$ oe                                   | 10 | 3 |
| e.g. $4x = 180 - 140$ or $-3x + 7x = 180 + 20 - 160$<br>or $4x = 40$ or $14x - 6x = 360 - 320 + 40$ oe |    |   |
|                                                                                                        |    |   |



## 18 - (4MA0-W 2017-Paper 4HR-Q11) - GEOMETRY

|               |   |
|---------------|---|
| $y = -2x + 1$ | 2 |
|---------------|---|

## 19 - (4MA0-W 2017-Paper 4HR-Q14) - GEOMETRY

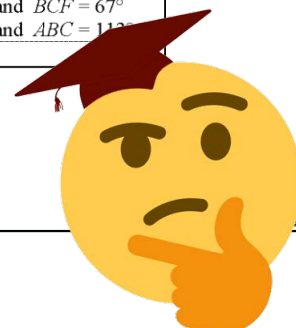
|     |                                                                                                                                                                                             |       |   |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---|
| (a) | e.g. $\frac{8}{5}$ or 1.6 or $\frac{5}{8}$ or 0.625 or<br>e.g. $4 \times \frac{8}{5}$ or $4 \div \frac{5}{8}$ oe or<br>e.g. $\frac{AZ}{4} = \frac{8}{5}$ or $\frac{AZ}{8} = \frac{4}{5}$ oe | 6.4   | 2 |
| (b) | Eg $6 \div \frac{8}{5}$ or $6 \times \frac{5}{8}$ or $\frac{6 \times 4}{8}$ oe                                                                                                              | 3.75  | 2 |
| (c) | $52.48 - \frac{52.48}{1.6^2}$                                                                                                                                                               | 31.98 | 3 |

## 20 - (4MA0-W 2017-Paper 4HR-Q17) - GEOMETRY

|     |                                                                                    |    |   |
|-----|------------------------------------------------------------------------------------|----|---|
| (a) | $0.5 \times (360 - 260)$ or $0.5 \times 100$                                       | 50 | 2 |
| (b) | e.g. $360 - ("50" + 260 + 30) (= 20)$ , $90 - "20"$<br>or $\frac{180-100}{2} + 30$ | 70 | 2 |

## 21 - (4MA0-S 2018-Paper 4HR-Q2) - GEOMETRY

|        |                                                                                                                                                      |               |   |                                                                                                                                                                                                  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a)(i) |                                                                                                                                                      | 67            | 1 | B1                                                                                                                                                                                               |
| (ii)   |                                                                                                                                                      | <u>reason</u> | 1 | B1 dep on B1 or a fully correct method shown in (i)<br>e.g. <u>alternate angles</u> are equal or other fully correct method                                                                      |
| (b)    | e.g. $180 - (67 + 60)$ or $120 - 67$ or<br>$(180 - 67) - (180 - 120)$ or $113 - 60$ or<br>$180 - 67 = 60 + y$ or $113 = 60 + y$ or<br>$120 - y = 67$ | 53            | 2 | M1 Correct calculation for $y$ or correct equation in $y$ ,<br>or $BFC = 60^\circ$ and $BCF = 67^\circ$<br>or $ABF = 60^\circ$ and $BCF = 67^\circ$<br>or $ABF = 60^\circ$ and $ABC = 113^\circ$ |
|        |                                                                                                                                                      |               |   | A1                                                                                                                                                                                               |





## 22 - (4MA0-S 2018-Paper 4HR-Q17) - GEOMETRY

|  |                                                                           |   |   |    |
|--|---------------------------------------------------------------------------|---|---|----|
|  | $AP \times 4.4 = 5.5 \times 2.4$ or $\frac{AP}{5.5} = \frac{2.4}{4.4}$ oe | 3 | 2 | M1 |
|  |                                                                           |   |   | A1 |

## 23 - (4MA0-S 2018-Paper 4HR-Q24) - GEOMETRY

|  |                                                                                                                                                                                                                                   |      |   |    |                                                                                                 |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|----|-------------------------------------------------------------------------------------------------|
|  | $\frac{360}{5} (= 72)$ oe or $\frac{1}{2} \times \frac{(5-2)180}{5} (= 54)$ oe                                                                                                                                                    | 16.5 | 4 | M1 | A correct method to find an angle in a triangle formed by two radii and a side of the pentagon. |
|  | $\frac{72}{360} \times 2 \times \pi \times 6.8 (= \frac{68\pi}{25} = 8.54(5)...) \text{ oe}$                                                                                                                                      |      |   | M1 | A correct method to find arc length                                                             |
|  | $2 \times 6.8 \times \sin 36^\circ$ or $2 \times 6.8 \times \cos 54^\circ$ or $\sqrt{6.8^2 + 6.8^2 - 2 \times 6.8 \times 6.8 \times \cos 72^\circ}$ or $\frac{6.8}{\sin 54^\circ} \times \sin 72^\circ (= 7.99(3)...) \text{ oe}$ |      |   | M1 | indep<br>A correct method to find length of chord                                               |
|  |                                                                                                                                                                                                                                   |      |   | A1 | Allow 16.5 – 16.6                                                                               |

## 24 - (4MA0-W 2018-Paper 4HR-Q3) - GEOMETRY

|  |                                    |          |   |    |                                                                        |
|--|------------------------------------|----------|---|----|------------------------------------------------------------------------|
|  | $\frac{1+7}{2}$ or $\frac{3+8}{2}$ | (4, 5.5) | 2 | M1 | Or for correct x coordinate of 4 or for correct y coordinate of 5.5 oe |
|  |                                    |          |   | A1 | oe                                                                     |

## 25 - (4MA0-W 2018-Paper 4HR-Q15) - GEOMETRY

|     |                                                                                                                                                                                        |         |   |    |                                                           |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---|----|-----------------------------------------------------------|
| (a) | $(BD^2 =) 8^2 + (6+5)^2 - 2 \times 8 \times (6+5) \times \cos 25$<br>$(BD^2 =) 64 + 121 - 159(.510...) \text{ or } 25.4(898...) \text{ or}$<br>$(BD =) \sqrt{64 + 121 - 159(.510...)}$ | 5.05    | 3 | M1 | For the correct use of Cosine rule                        |
|     |                                                                                                                                                                                        |         |   | M1 | For correct order of operations                           |
|     |                                                                                                                                                                                        |         |   | A1 | Accept 5.04(8745...) rounded or truncated to at least 3SF |
| (b) | Eg $AC \times 8 = (6+5) \times 6$ or $(AC =) \frac{(6+5) \times 6}{8}$ or $\frac{11 \times 6}{8}$ oe<br>$(8+BC) \times 8 = (6+5) \times 6$ oe                                          | 8.25 oe | 2 | M1 | For a correct equation involving AC or BC                 |
|     |                                                                                                                                                                                        |         |   | A1 | Eg $\frac{66}{8}$ or $\frac{33}{4}$                       |

## 26 - (4MA0-W 2019-Paper 4HR-Q6) - GEOMETRY

|  |                                                          |      |   |    |                                                                                                                                                                                                                                                                                                                  |
|--|----------------------------------------------------------|------|---|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | $9^2 - 6^2 (= 45)$<br>$\sqrt{(9^2 - 6^2)} (= \sqrt{45})$ | 6.71 | 3 | M1 | M1 or $9^2 = h^2 + 6^2$ or for a complete method to find an unknown angle, x (correct to 1 d.p) in the triangle e.g. $\cos^{-1}(6/9) (= 48.2^\circ)$ or $\sin^{-1}(6/9) (= 41.8^\circ)$<br>M1 for a complete method, using x, to find h e.g. $6 \times \tan 48.2^\circ$<br>A1 Accept 6.7 $\rightarrow$ 6.71 inc. |
|--|----------------------------------------------------------|------|---|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 27 - (4MA0-W 2019-Paper 4HR-Q13) - GEOMETRY

|     |                                                                             |        |   |    |                                                               |
|-----|-----------------------------------------------------------------------------|--------|---|----|---------------------------------------------------------------|
| (a) | $\frac{5}{4} = \frac{5+CE}{7}$ oe                                           | 3.75oe | 2 | M1 | accept $(\frac{7}{4} \times 5 - 5)$ or $\frac{3}{4} \times 5$ |
|     |                                                                             |        |   | A1 |                                                               |
| (b) | $ASF = \left(\frac{7}{4}\right)^2 (= 3.0625)$<br>'3.0625' $\times 8 - 8$ oe | 16.5   | 3 | M1 | complete method                                               |
|     |                                                                             |        |   | A1 |                                                               |



## 28 - (4MA0-W 2019-Paper 4HR-Q17) - GEOMETRY

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>Either <math>\angle BAD = 180 - 112 (=68)</math> or (reflex) <math>\angle BOD = 2 \times 112 (=224)</math></p> <p>Either <math>\angle ABD = 90</math> or (obtuse) <math>\angle BOD = 136</math> or <math>\angle BOA = 44</math></p> <p>Alt:</p> <p><math>\angle ACD = 90</math> (Angles in a semicircle)<br/> <math>\angle ACB = 112 - 90 = 22</math><br/> <math>\angle ADB = 22</math> (Angles in the same segment / angles from the same chord)</p> | 22 | <p>M1 A1 can be marked on diagram (must be associated with correct angle)</p> <p>A1 2<sup>nd</sup> angle calculated</p> <p>A1 angle <math>\angle ADB</math></p> <p>B1 fully correct reasons for their paths</p> <p>NB: This is the most economical method (only requires 2 reasons)</p> <p>A1<br/> M1 A1<br/> A1 + B1 for both reasons</p> <p>Reasons:<br/> <u>Opposite angles in a cyclic quadrilateral add up to 180 degrees</u><br/> <u>Angles in a semicircle = 90 degrees / right angle or triangle with a diameter has a right angle / 90 degrees</u><br/> <u>Angles in a triangle add up to 180 degrees</u><br/> <u>Angles at centre = <math>2 \times</math> angles at circumference</u><br/> <u>Base angles in an isosceles triangle are equal</u><br/> <u>Angles on a straight line add up to 180 degrees</u><br/> <u>Angles in the same segment / Angles from the same chord are equal</u><br/> <b>NB: Be careful here <math>\angle CBD</math> and <math>\angle CDB \neq 34</math> but this still gives correct answer</b></p> |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



1 - (4MA0-S 2015-Paper 4HR-Q7) - TRIGONOMETRY

|  |                                                 |     |
|--|-------------------------------------------------|-----|
|  | $180 + 43$ or $360 - (180 - 43)$ or $360 - 137$ | 223 |
|--|-------------------------------------------------|-----|

2 - (4MA0-S 2015-Paper 4HR-Q10) - TRIGONOMETRY

|  |                                                                                                                                                                                         |      |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|  | $\cos 56^\circ = \frac{7.4}{x}$ or $7.4 = x \cos 56$ or<br>$\sin(90 - 56) = \frac{7.4}{x}$ or $7.4 = x \sin(90 - 56)$<br><br>$(x =) \frac{7.4}{\cos 56}$ or $\frac{7.4}{\sin(90 - 56)}$ | 13.2 |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|

3 - (4MA0-S 2016-Paper 4HR-Q17) - TRIGONOMETRY

|                                                                                                                                                                                                                             |      |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|
|                                                                                                                                                                                                                             |      | 5 |
| $PQ(ML) = 20 \sin 30^\circ (=10)$ or<br><br>$MR = \sqrt{12^2 + 20^2} = \sqrt{544} = 4\sqrt{34}$<br>$= 23.32..)$<br><br>$LR = \sqrt{12^2 + (RQ)^2} =$<br>$\sqrt{12^2 + (10\sqrt{3})^2} = \sqrt{444} = 2\sqrt{111} = 21.07..$ |      |   |
| $\sin MRL = \frac{10}{4\sqrt{34}} \left( \frac{ML}{MR} \right)$ or<br>$\cos MRL = \frac{2\sqrt{111}}{4\sqrt{34}} \left( \frac{LR}{MR} \right)$ or<br>$\tan MRL = \frac{10}{2\sqrt{111}} \left( \frac{ML}{LR} \right)$       | 25.4 |   |

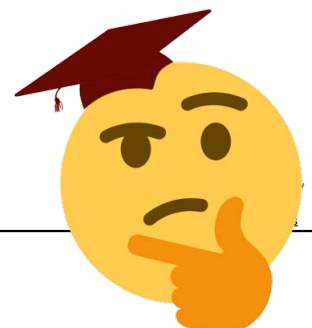


## 4 - (4MA0-W 2016-Paper 4HR-Q21) - GEOMETRY, TRIGONOMETRY

|  |                                                                                                                                                                                                                                                                                                                                                |     |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|  | $(BD^2 \text{ or } AC^2 =) 15^2 + 15^2 \text{ or } \sqrt{450} \text{ or } 15\sqrt{2} \text{ or } 21.2 \dots$                                                                                                                                                                                                                                   |     |
|  | eg. " $\sqrt{450}$ " $= 12^2 + 12^2 - 2 \times 12 \times 12 \times \cos BED$<br>or $\sin BEX = \frac{0.5 \times \sqrt{450}}{12}$<br>or $\cos EBD = \frac{0.5 \times \sqrt{450}}{12}$                                                                                                                                                           |     |
|  | eg $DEB = \cos^{-1} \left( \frac{12^2 + 12^2 - 450}{2 \times 12 \times 12} \right)$<br>or $DEB = 2 \times \sin^{-1} \left( \frac{0.5 \times \sqrt{450}}{12} \right)$<br>or $DEB = 180 - 2 \times \cos^{-1} \left( \frac{0.5 \times \sqrt{450}}{12} \right)$<br>or $DEB = 55.7\dots \text{ or } 56^\circ$<br>(from ambiguous case of Sine Rule) |     |
|  |                                                                                                                                                                                                                                                                                                                                                | 124 |

## 5 - (4MA0-W 2016-Paper 4HR-Q23) - TRIGONOMETRY

|  |                                              |             |
|--|----------------------------------------------|-------------|
|  | $0.5 \times 12 \times 14 \times \sin x = 72$ |             |
|  | $\sin x = \frac{72}{84}$                     |             |
|  |                                              | $59^\circ$  |
|  |                                              | $121^\circ$ |



## 6 - (4MA0-S 2017-Paper 4HR-Q13) - TRIGONOMETRY

|                                                                                                                                                                                                                                                                                                                                                                                                                      |    |   |    |                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $(\text{Angle } ABD =) \tan^{-1}\left(\frac{5}{9}\right)$ or $(\text{Angle } ADB =) \tan^{-1}\left(\frac{9}{5}\right)$ or<br>$(\text{Angle } ABC =) \cos^{-1}\left(\frac{9}{15}\right)$ or $(\text{Angle } ACB =) \sin^{-1}\left(\frac{9}{15}\right)$<br>$(BD =) \sqrt{9^2 + 5^2}$ or $(AC =) \sqrt{15^2 - 9^2}$ $(DC =) \sqrt{15^2 - 9^2} - 5$                                                                      |    | 4 | M1 | For correct method to find angle $ABD$ or $ADB$ or $ABC$ or $ACB$ or for correct method to find side $BD$ , $AC$ or $DC$ .                                                                                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                      |    |   | A1 | For angle $ABD = 29.(0546\dots)$ or for angle $ADB = 60.(9453\dots)$ or for angle $ABC = 53.(1301\dots)$ or for angle $ACB = 36.(8698\dots)$ or For $BD = \sqrt{106}$ or $10.(2956\dots)$ or for $AC = 12$ or for $DC = 7$<br>Accept rounded or truncated to at least 2SF |
| Eg $(x =) \cos^{-1}\left(\frac{9}{15}\right) - \tan^{-1}\left(\frac{5}{9}\right)$ or<br>$(x =) 180 - 90 - "29.(0546\dots)" - "36.(8698\dots)"$ or<br>$\cos x = \frac{15^2 + "10.(2956\dots)"^2 - 7^2}{2 \times 15 \times "10.(2956\dots)"}$ or $\cos x = 0.913(009)$ or<br>$\sin x = \frac{7 \sin "36.(8698\dots)" }{\sqrt{106}}$ or $\sin x = \frac{7 \sin "119.(054\dots)" }{15}$ or<br>$\sin x = 0.407(940\dots)$ |    |   | M1 | For a complete method to find $x$ or $\sin x$ or $\cos x$<br><br>Accept $0.912 \leq \cos x \leq 0.9152$<br><br>Accept $0.407 \leq \sin x \leq 0.413$                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                      | 24 |   | A1 | Awrt 24                                                                                                                                                                                                                                                                   |

## 7 - (4MA0-S 2017-Paper 4HR-Q22) - TRIGONOMETRY

|                                                                                                                                                                                                                                                                 |                                           |   |    |                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---|----|---------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                 |                                           | 4 | B1 | Identifying correct triangle                                                                |
|                                                                                                                                                                                                                                                                 | $\sqrt{8^2 + 15^2}$ or $\sqrt{289}$ or 17 |   | M1 | Complete method to find $MG$                                                                |
| Eg $\tan 24 = \frac{BG}{\sqrt{8^2 + 15^2}}$ or $\tan 24 = \frac{BG}{17}$<br>or $\frac{BG}{\sin 24} = \frac{\sqrt{8^2 + 15^2}}{\sin(90 - 24)}$ or $\frac{BG}{\sin 24} = \frac{17}{\sin 66}$<br>$(BG =) 17 \tan 24$ or $(BG =) \frac{17}{\sin 66} \times \sin 24$ |                                           |   | M1 | Dep<br>For a correct equation involving $BG$ or a correct expression for $BG$<br>Implies B1 |
|                                                                                                                                                                                                                                                                 | 7.57                                      |   | A1 | Accept 7.56 – 7.57                                                                          |

## 8 - (4MA0-S 2017-Paper 4HR-Q24) - TRIGONOMETRY

|                                                                                                                                                                                                                                                                                             |      |   |    |                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Eg $12.6^2 = 10.4^2 + 18^2 - 2 \times 10.4 \times 18 \times \cos L$ or<br>$158.76 = 108.16 + 324 - 374.4 \cos L$<br><br>Note: $\cos K = \frac{-57.08}{262.08} (= -0.217(796\dots))$ and $K = 102.(579\dots)$<br>$\cos M = \frac{374.6}{453.6} (= 0.825(837\dots))$ and $M = 34.3(264\dots)$ |      | 5 | M1 | Correct substitution into cosine rule to find $L$ or<br><br>For $\cos K = \frac{10.4^2 + 12.6^2 - 18^2}{2 \times 10.4 \times 12.6}$ oe<br><b>AND</b><br>$\sin L = \frac{12.6 \sin "102.(579\dots)" }{18}$ or<br><br>For $\cos M = \frac{18^2 + 12.6^2 - 10.4^2}{2 \times 18 \times 12.6}$ oe<br><b>AND</b><br>$\sin L = \frac{12.6 \sin "34.3(264\dots)" }{10.4}$ |
| Eg $\cos L = \frac{10.4^2 + 18^2 - 12.6^2}{2 \times 10.4 \times 18}$ or $\cos L = \frac{273.4}{374.4}$ or<br>$\cos L = 0.73(0235\dots)$ oe or $L = 43.0(938\dots)$                                                                                                                          |      |   | A1 | Rearranging cosine rule correctly.<br>Accept $L = 43^\circ$<br>Accept $43.0(938\dots)$ rounded or truncated to at least 3 SF                                                                                                                                                                                                                                      |
| $(\text{Area of sector} =) \frac{"43.0(938\dots)" }{360} \times \pi \times 10.4^2$ or $40.6(752\dots)$                                                                                                                                                                                      |      |   | M1 | Dep on at least M1<br>Accept 40.5 – 40.7                                                                                                                                                                                                                                                                                                                          |
|                                                                                                                                                                                                                                                                                             |      |   | B1 | For (area of triangle =) $63.9(471\dots)$<br>Accept 63.8 – 64.0                                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                                                                                                                             | 23.3 |   | A1 | Accept 23.2 – 23.3                                                                                                                                                                                                                                                                                                                                                |



## 9 - (4MA0-W 2017-Paper 4HR-Q9) - TRIGONOMETRY

|         |                                                          |      |   |
|---------|----------------------------------------------------------|------|---|
| (a)     | $\cos x = \frac{60}{110}$ or $\cos x = 0.545(4545\dots)$ |      | 3 |
|         | $(x =) \cos^{-1}\left(\frac{60}{110}\right)$             |      |   |
|         |                                                          | 56.9 |   |
| (b)     | $90 - 56.9(4426885\dots)$ oe                             | 033  | 2 |
| (c)(i)  |                                                          | 105  | 2 |
| (c)(ii) |                                                          | 115  |   |

## 10 - (4MA0-S 2018-Paper 4HR-Q8) - TRIGONOMETRY

|                                                                                        |     |   |                                                                                                                                                             |
|----------------------------------------------------------------------------------------|-----|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $\cos A = \frac{43}{70} (=0.6142)$ or $\sin B = \frac{43}{70} (=0.6142)$               | 142 | 4 | M1 $\cos B = \frac{55.23\dots}{70}$ , $\sin A = \frac{55.23\dots}{70}$                                                                                      |
| $A = \cos^{-1}\left(\frac{43}{70}\right)$ or $B = \sin^{-1}\left(\frac{43}{70}\right)$ |     |   | M1 $A = \sin^{-1}(0.7890\dots)$<br>$B = \cos^{-1}(0.7890\dots)$                                                                                             |
| $A = 52.1^\circ$ or $B = 37.9^\circ$                                                   |     |   | A1 $52^\circ - 52.1^\circ$ or $37.9^\circ - 38^\circ$<br><b>SC B1</b> If M0 M0 A0 award B1 for $52.1^\circ$ or $37.9^\circ$ not identified as $A$ or as $B$ |
|                                                                                        |     |   | B1 ft for an angle identified as $A$ or $B$<br>Correct bearing $(142 - 142.1)$                                                                              |

## 11 - (4MA0-S 2018-Paper 4HR-Q23) - TRIGONOMETRY

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |   |                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $\frac{1}{2}$ side of square = $11\cos 72 = (3.3991\dots)$ or $11\sin 18$<br>side of square = $\frac{11\sin 36}{\sin 72} (= 6.7983\dots)$ or $\sqrt{11^2 + 11^2 - 2 \times 11 \times 11 \times \cos(36)}$ or $2 \times 11\cos 72$<br>ht of triangular face = $11\sin 72 (= 10.4616\dots)$ or $11\cos 18$ or $\sqrt{11^2 - ("3.3991\dots")^2}$<br>diagonal of base = $\frac{"6.7983\dots"}{\cos 45} (= 9.6143\dots)$ or $\frac{"6.7983\dots"}{\sin 45}$ or $\sqrt{("6.7983\dots")^2 + ("6.7983\dots")^2}$<br>$\frac{1}{2}$ diagonal of base = $\frac{"3.3991\dots"}{\cos 45} (= 4.8071\dots)$ or $\frac{"3.3991\dots"}{\sin 45}$ or $\sqrt{("3.3991\dots")^2 + ("3.3991\dots")^2}$ or $"6.7983\dots" \cos 45$ or $"6.7983\dots" \sin 45$<br>$OP = \sqrt{("10.4616\dots")^2 - ("3.3991\dots")^2}$ or $\sqrt{11^2 - (\frac{1}{2} \times "9.6143\dots")^2}$ or $\sqrt{11^2 - ("4.8071\dots")^2}$ | 9.89 | 4 | M1 For a complete correct method to find a length identified as side of square or $\frac{1}{2}$ side of square.<br>M1 For complete correct method to find a length identified as height of triangular face, or diagonal of base or $\frac{1}{2}$ diagonal of base<br>M1 A correct method to find $OP$<br>A1 Allow 9.8 – 9.95<br><b>SC B1</b> If no other marks are scored, award B1 for $11\sin 72$ seen. |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



**12** - (4MA0-W 2018-Paper 4HR-Q8) - *TRIGONOMETRY*

|  |                                                                                                                                                                                                                                                                     |      |   |                                                                                                                                                                                                                                                                                                                                                                  |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>Eg <math>\sin 20 = \frac{BC}{8.4}</math> or <math>\frac{BC}{\sin 20} = \frac{8.4}{\sin 90}</math> or</p> $\frac{\sin 20}{BC} = \frac{\sin 90}{8.4}$ <p><math>8.4\sin 20</math> or <math>\frac{8.4}{\sin 90} \times \sin 20</math> or <math>8.4\cos 70</math></p> | 2.87 | 3 | <p>M1 Or for <math>AC</math> or angle <math>B</math> evaluated correctly <b>AND</b> then used in a correct method to find <math>BC</math><br/> Eg <math>BC^2 + (7.89(34\dots))^2 = 8.4^2</math> or<br/> Eg <math>\tan 20 = \frac{BC}{7.89(34\dots)}</math></p> <p>M1 For a complete method<br/> A1 Accept 2.87(296...) rounded or truncated to at least 3 SF</p> |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



## 1 - (4MA0-S 2015-Paper 4HR-Q1) - SETS

|      |  |                          |
|------|--|--------------------------|
| (i)  |  | {i, a}                   |
| (ii) |  | {c, h, i, n, a, t, l, y} |

## 2 - (4MA0-W 2015-Paper 4HR-Q9) - SETS

|   |  |                  |
|---|--|------------------|
| a |  | 3, 6, 9          |
| b |  | {2,3,4,6,8,9,10} |
| c |  | {6}              |
| d |  | 3, 9             |

## 3 - (4MA0-S 2016-Paper 4HR-Q18) - SETS

|    |  |                                                    |   |
|----|--|----------------------------------------------------|---|
| a  |  | 5 and 6 in the correct regions of the Venn diagram | 2 |
| bi |  | 25                                                 | 2 |
| ii |  | 12                                                 |   |

## 4 - (4MA0-W 2016-Paper 4HR-Q4) - SETS

|  |  |                        |
|--|--|------------------------|
|  |  | 5, 10, 20, 25, 50, 100 |
|--|--|------------------------|

## 5 - (4MA0-S 2017-Paper 4HR-Q2) - SETS

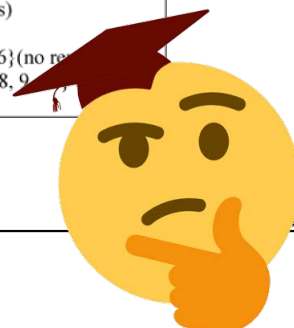
|         |  |                         |   |                                                                                                                    |
|---------|--|-------------------------|---|--------------------------------------------------------------------------------------------------------------------|
| (a) (i) |  | 5, 15                   | 1 | B1                                                                                                                 |
| (ii)    |  | 5, 7, 9, 10, 11, 13, 15 | 1 | B1                                                                                                                 |
| (b)     |  | 4, 6, 8, 10, 12, 14     | 2 | B2 B2 for all correct and none incorrect.<br>If not B2 then B1 for 4 or more correct and no more than 1 incorrect. |

## 6 - (4MA0-W 2017-Paper 4HR-Q5) - SETS

|         |  |                    |   |
|---------|--|--------------------|---|
| (a)(i)  |  | {3, 5, 7}          | 2 |
| (a)(ii) |  | {1, 2, 3, 5, 7, 9} |   |
| (b)     |  | 6                  | 1 |

## 7 - (4MA0-W 2019-Paper 4HR-Q10) - SETS

|     |  |                |   |                                                                                                                                                                                                                                                            |
|-----|--|----------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) |  | 1,3,5,7,8,9,10 | 1 | B1                                                                                                                                                                                                                                                         |
| (b) |  | 3, 9           | 1 | B1                                                                                                                                                                                                                                                         |
| (c) |  | e.g. 1,2,4,5   | 2 | B2 any set of 4 elements, one of which is 5 and the other three are from {1, 2, 3, 4, 6} (no repeats)<br>If not B2 then B1 for either any set of 4 elements, from {1, 2, 3, 4, 6} (no repeats) or 5 and the other three are from {6, 7, 8, 9} (no repeats) |



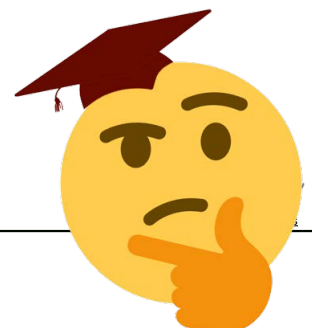


**1 - (4MA0-S 2015-Paper 4HR-Q5) - STATISTICS**

|     |                                                                                                                                                                                                                  |   |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| (a) | $\frac{4+9+7+1+6+3}{2}$ or $\frac{(4+9+7+1+6+3)+1}{2}$ or<br>$\frac{30}{2}$ or $\frac{31}{2}$ or 15 or $15\frac{1}{2}$                                                                                           | 2 |
| (b) | $\frac{4+9+7+1+6+3}{4}$ or $\frac{(4+9+7+1+6+3)+1}{4}$ or<br>$\frac{30}{4}$ oe (=7.5) or $\frac{31}{4}$ oe (= 7.75) or 8 or<br>$3 \times \frac{30}{4}$ oe (= 22.5) or $3 \times \frac{31}{4}$ oe (= 23.25) or 23 | 3 |

**2 - (4MA0-S 2015-Paper 4HR-Q18) - STATISTICS**

|  |                                                                                                                                                                                        |              |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|  | $\frac{90}{0.6}$ or 150 or $\frac{120}{0.4}$ or 300 or $\frac{95}{0.5}$ or 190 or $\frac{45}{1.5}$ or 30<br><br>Frequency density = 150, 300, 190, 30<br><br>heights 3, 6, 3.8, 0.6 cm | correct bars |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|



**3 - (4MA0-W 2015-Paper 4HR-Q6) - STATISTICS**

|   |                                                                                                                                                                                |          |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| a |                                                                                                                                                                                | 16 to 20 |
| b | $3 \times 8 + 8 \times 10 + 13 \times 18 + 18 \times 20 + 23 \times 10 + 28 \times 4$ <b>or</b><br>$24 + 80 + 234 + 360 + 230 + 112$<br><b>or</b><br>1040                      |          |
|   | $\frac{3 \times 8 + 8 \times 10 + 13 \times 18 + 18 \times 20 + 23 \times 10 + 28 \times 4}{8 + 10 + 18 + 20 + 10 + 4}$ <b>or</b><br>“1040” $\div (8 + 10 + 18 + 20 + 10 + 4)$ |          |
|   |                                                                                                                                                                                | 14.9     |

**4 - (4MA0-W 2015-Paper 4HR-Q18) - STATISTICS**

|  |                                                                                                                                                       |     |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|  | $360 \div 9 = 40$ (per cm sq) <b>or</b><br>$360 \div (9 \times 25) = 1.6$                                                                             |     |
|  | “40” $\times 19$ <b>or</b><br>$7 \times “40” + 6 \times “40” + 6 \times “40”$ <b>or</b><br>$280 + 240 + 240$ <b>or</b><br>$19 \times 25 \times “1.6”$ |     |
|  |                                                                                                                                                       | 760 |
|  |                                                                                                                                                       |     |
|  | <b>Alternative method</b><br>$2a \times 12 + 6a \times 8 = 360$                                                                                       |     |
|  | $a = \frac{360}{72} = 5$ <b>and</b><br>$14 \times 5 \times 4 + 12 \times 5 \times 4 + 4 \times 5 \times 12$                                           |     |
|  |                                                                                                                                                       | 760 |

**5 - (4MA0-S 2016-Paper 4HR-Q6) - STATISTICS**

|                                         |          |   |
|-----------------------------------------|----------|---|
|                                         | $x = 10$ | 3 |
| $3 + 6 + x + y = 4 \times 11$ <b>oe</b> |          |   |
|                                         | $y = 25$ |   |



6 - (4MA0-S 2016-Paper 4HR-Q9) - STATISTICS

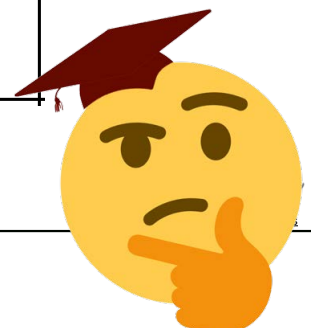
|                                                           |        |   |
|-----------------------------------------------------------|--------|---|
| $30 \times 120 (= 3600) \text{ or } 10 \times 95 (= 950)$ |        | 3 |
| $(("3600" + "950") \div (30 + 10))$                       |        |   |
| $(= "4550" \div "40")$                                    |        |   |
|                                                           | 113.75 |   |

7 - (4MA0-S 2016-Paper 4HR-Q12) - STATISTICS

|    |                         |                                    |   |
|----|-------------------------|------------------------------------|---|
| a  | 12, 53, 78, 90, 96, 100 | Correct table                      | 1 |
| b  |                         | Correct cumulative frequency graph | 2 |
| ci |                         | 18000-20000                        | 3 |
| ii |                         | 13000 – 17000                      |   |

8 - (4MA0-W 2016-Paper 4HR-Q7) - STATISTICS

|     |                                                                                                             |         |
|-----|-------------------------------------------------------------------------------------------------------------|---------|
| (a) |                                                                                                             | 15 - 19 |
| (b) | $2 \times 1 + 7 \times 5 + 12 \times 6 + 17 \times 10 + 22 \times 8$<br>or $2 + 35 + 72 + 170 + 176$ or 455 |         |
|     | $\frac{2 \times 1 + 7 \times 5 + 12 \times 6 + 17 \times 10 + 22 \times 8}{30}$                             |         |
|     | or<br>"455" $\div$ 30                                                                                       |         |
|     |                                                                                                             | 15.2    |



## 9 - (4MA0-W 2016-Paper 4HR-Q18) - STATISTICS

|     |                                                                                                                                                                                                            |    |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| (a) | 1cm $\times$ 1cm square = 2.5 people or<br>1 large square = 10 people or<br>4.8 on axis corresponding to top of 20-25 bar or<br>Correct scale marked on vertical axis or<br>10 small squares = 1 person oe |    |
|     |                                                                                                                                                                                                            | 31 |
| (b) | Freq densities:<br>38/10 (=3.8), 63/15 (=4.2), 24/30 (=0.8)                                                                                                                                                |    |
|     |                                                                                                                                                                                                            |    |

## 10 - (4MA0-S 2017-Paper 4HR-Q6) - STATISTICS

|     |                                                                                                                       |                  |   |    |                                                                                                                                                                                                                                                                                                                                                                   |
|-----|-----------------------------------------------------------------------------------------------------------------------|------------------|---|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) |                                                                                                                       | $30 < d \leq 40$ | 1 | B1 | Accept 30 – 40                                                                                                                                                                                                                                                                                                                                                    |
| (b) | $5 \times 5 + 15 \times 12 + 25 \times 17 + 35 \times 20 + 45 \times 6$ or<br>$25 + 180 + 425 + 700 + 270$ or<br>1600 | 26.7             | 4 | M2 | $f \times d$ for at least 4 products with correct mid- interval values <b>and</b> intention to add.<br><br>If not M2 then award M1 for $d$ used consistently for at least 4 products within interval (including end points) <b>and</b> intention to add<br><b>or</b><br>for at least 4 correct products with correct mid-interval values with no intention to add |
|     | $\frac{25+180+425+700+270}{5+12+17+20+6}$ or $\left( \frac{1600}{60} \right)$                                         |                  |   | M1 | dep on M1 (fit their products)<br>NB: accept their 60 if addition of frequencies is shown                                                                                                                                                                                                                                                                         |
|     |                                                                                                                       |                  |   | A1 | Accept 26.6 – 26.7 inclusive<br>Accept 27 if M3 awarded<br>Do not accept fractions or mixed numbers, eg $\frac{80}{3}$ or $26\frac{2}{3}$                                                                                                                                                                                                                         |

## 11 - (4MA0-S 2017-Paper 4HR-Q19) - STATISTICS

|     |                                                                                                                                                                                                  |                           |   |    |                                                                                                                                                       |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---|----|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) | Frequency densities: 1.2, 2.8, 1.6, 0.4, 0.2                                                                                                                                                     | A fully correct histogram | 3 | M1 | For 3 or more correctly calculated freq densities or<br>For a correct scale indicated or<br>1 small square = 1 (person)<br>1 big square = 25 (people) |
|     |                                                                                                                                                                                                  |                           |   | M1 | For at least 2 additional correct bars (with or without scale)<br>Implies first M1                                                                    |
|     |                                                                                                                                                                                                  |                           |   | A1 | All 4 additional bars correct                                                                                                                         |
| (b) | $\frac{100}{150} \times 240 + 100$ or $1.6 \times 100 + 100$ or “160” + 100<br>oe<br>or $600 - (120 + 140 + \frac{1}{3} \times 240)$ or<br>$600 - (120 + 140 + 50 \times 1.6)$ or $600 - 340$ oe | 260                       | 2 | M1 | A fully complete method to find the number of people who took from 200 to 300 minutes + 100                                                           |
|     |                                                                                                                                                                                                  |                           |   | A1 |                                                                                                                                                       |



## 12 - (4MA0-W 2017-Paper 4HR-Q16) - STATISTICS

|     |                                |             |   |
|-----|--------------------------------|-------------|---|
| (a) | $\frac{10}{2.72 - 2.47}$ or 40 | Correct bar | 2 |
| (b) |                                |             |   |
|     |                                | 5           | 1 |

## 13 - (4MA0-S 2018-Paper 4HR-Q1) - STATISTICS

|                    |                                                                               |           |   |                                                                                                                                          |
|--------------------|-------------------------------------------------------------------------------|-----------|---|------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                                                                               | 2, 20, 29 | 3 | M2 for 3 number selected with at least two of the properties: mean = 17, median = 20, range = 27<br>else M1 with one of these properties |
|                    |                                                                               |           |   | A1 in any order                                                                                                                          |
| <b>Alternative</b> |                                                                               |           |   |                                                                                                                                          |
|                    | $17 \times 3 (= 51)$<br>$17 \times 3 - 20 (= 31)$                             | 2, 20, 29 | 3 | M1 method to find sum of 3 numbers                                                                                                       |
|                    |                                                                               |           |   | M1 method to find sum of smallest and largest numbers                                                                                    |
|                    |                                                                               |           |   | A1 in any order                                                                                                                          |
| <b>Alternative</b> |                                                                               |           |   |                                                                                                                                          |
|                    | $x, 20, z$<br>or $x, y, z$ and $y = 20$                                       | 2, 20, 29 | 3 | M1 use of different letters with 20 shown as the middle value                                                                            |
|                    | $x + z = 31$ or $\frac{x+20+z}{3} = 17$ oe<br>or $z - x = 27$ or $x - z = 27$ |           |   | M1 an equation for the sum or for the difference of the two unknown numbers                                                              |
|                    |                                                                               |           |   | A1 in any order                                                                                                                          |

## 14 - (4MA0-S 2018-Paper 4HR-Q3) - STATISTICS

|     |                                                                                                                |    |   |                                                               |
|-----|----------------------------------------------------------------------------------------------------------------|----|---|---------------------------------------------------------------|
| (a) | $(0 \times 2) + 1 \times 7 + 2 \times 3 + 3 \times 4 + 4 \times 3 + 5 \times 1$<br>$(0 +) 7 + 6 + 12 + 12 + 5$ | 42 | 2 | M1 For at least 4 correct products with the intention to add. |
| (b) |                                                                                                                | 2  | 1 | A1 SC B1 for 2.1                                              |

## 15 - (4MA0-S 2018-Paper 4HR-Q11) - STATISTICS

|  |        |   |   |                        |
|--|--------|---|---|------------------------|
|  | 10 - 3 | 7 | 2 | M1 10 and 3 identified |
|  |        |   |   | A1                     |

## 16 - (4MA0-S 2018-Paper 4HR-Q18) - STATISTICS

|     |                                                                                                                                                                                                                           |                    |   |                                                                                                                                                                                                                 |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) | $15 \div (80 - 50) (= 0.5)$                                                                                                                                                                                               | 28, 18             | 2 | M1 correct method to find fd for interval $50 < t \leq 80$ or one correct frequency for $80 < t \leq 120$ or $120 < t \leq 180$ or 0.5 shown correctly on fd axis (1cm = 0.1) or 10 small squares = 1 person oe |
|     |                                                                                                                                                                                                                           |                    |   | A1 Both values correct                                                                                                                                                                                          |
| (b) | $\frac{10}{50-0} (= 0.2), \frac{12}{240-180} (= 0.2),$<br>$\frac{8}{320-240} (= 0.1)$<br>$0 < t \leq 50$ fd = 0.2 (height 2 cm)<br>$180 < t \leq 240$ fd = 0.2 (height 2 cm)<br>$240 < t \leq 320$ fd = 0.1 (height 1 cm) | Correct bars drawn | 2 | M1 For method to find one correct frequency density.<br>Accept one bar drawn with correct height<br>Accept $10 \times 10 = 100$ or $12 \times 10 = 120$ or $8 \times 10 = 80$ small squares.                    |
|     |                                                                                                                                                                                                                           |                    |   | A1 Three bars with correct widths and heights                                                                                                                                                                   |



## 17 - (4MA0-W 2018-Paper 4HR-Q6) - STATISTICS

|     |                                                                                                                                                                               |                 |   |                                                                                                                                                                                                                                                                                           |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) | $0 \times 1, 1 \times 8, 2 \times 12, 3 \times 15, 4 \times 4$ or 0, 8, 24, 45, 16, 93<br>$\frac{1 \times 8 + 2 \times 12 + 3 \times 15 + 4 \times 4}{40}$ or $\frac{93}{40}$ | 2.325           | 3 | M1 For at least 4 products (may not be evaluated.<br>M1 (dep) for division by 40<br>NB. If division is by something other than 40 this must clearly come from adding the frequencies.<br>A1 Accept 2.33 or 2 if 2.325 or $\frac{93}{40}$ seen<br>Accept $2\frac{13}{40}$<br>SCB2 for 2.35 |
| (b) |                                                                                                                                                                               | 1               | 2 | M1 For Lower Quartile (Q1) = 2 AND Upper Quartile (Q3) = 3<br>Accept a correct ordered list of the 40 numbers with both quartiles clearly identified in the correct position.<br>A1                                                                                                       |
| (c) | $\frac{15}{40} + \frac{4}{40}$ oe                                                                                                                                             | $\frac{19}{40}$ | 2 | M1 oe<br>A1 Eg 0.475<br>SCB1 for $\frac{31}{40}$ or 0.775                                                                                                                                                                                                                                 |

## 18 - (4MA0-W 2019-Paper 4HR-Q12) - STATISTICS

|     |                                                              |    |   |                                                                                                    |
|-----|--------------------------------------------------------------|----|---|----------------------------------------------------------------------------------------------------|
| (a) | 20 28 <u>32</u> 32 36 36 37 37 <u>40</u><br>41 42<br>40 – 32 | 8  | 3 | M1 ordering all 11 numbers correctly<br>M1 identifying 32 as LQ and 40 as UQ<br>A1 dependent on M1 |
| (b) |                                                              | 42 | 2 | M1 identifying 11 <sup>th</sup> data item in a new (correct) ordered list<br>A1 (no working reqd)  |

## 19 - (4MA0-W 2019-Paper 4HR-Q21) - STATISTICS

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                             |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $10 \times 1 + 20 \times 1.7 + 30 \times 2 + 20 \times 0.8$<br>$(= 10 + 34 + 60 + 16 = 120)$<br>$\frac{(110 - 90) \times h}{"120" + (110 - 90) \times h} \times 100 = 4$ oe<br>$2000h = 4("120" + 20h)$<br>$h = 0.25$<br><br>Alt:<br>$10 \times 1 + 20 \times 1.7 + 30 \times 2 + 20 \times 0.8$<br>$(= 10 + 34 + 60 + 16 = 120)$<br>$\frac{x}{"120" + x} \times 100 = 4$ oe<br>$100x = 4("120" + x)$<br>$x = 5$ or 125<br><br>Alt:<br>$5 \times 10 + 10 \times 17 + 15 \times 20 + 10 \times 8$<br>$(= 50 + 170 + 300 + 80 = 600)$<br>$\frac{600}{96} \times 4$<br>(small squares) = 25<br><br>Alt:<br>$2 + 6.8 + 12 + 3.2 (= 24)$<br>$\frac{24}{96} \times 4$ (big squares) = 1 | Bar drawn<br><br>Bar drawn<br><br>Bar drawn | 4 | M1 calculating areas of existing 4 bars<br><br>M1 dep setting up equation for height of bar<br>$0.04 \times ["120" + (110 - 90)h] = (110 - 90)h$<br>$4.8 + 0.8h = 20h$<br>A1 calculated height (fd) of 110 ~ 90 bar<br>A1 bar at height 0.25 and width 20<br><br>M1 calculating areas of existing 4 bars<br><br>M1 dep setting up equation / calculation for freq of 90 → 110 bar or total freq) $0.04 \times ["120" + x] = x$ or $(x =)$<br>$\frac{120}{96} \times 4$ or $(x =) \frac{120}{96} \times 100$<br>$4.8 + 0.04x = x$<br>A1 calculated freq of 110 ~ 90 bar or total frequency<br>A1 bar at height 0.25 and width 20<br><br>M1 calculating number of existing small squares<br><br>M1 calculating number of small squares for 4%<br>A1<br>A1 bar at height 0.25 and width 20<br><br>M1 calculating number of existing big squares<br>M1 calculating number of big squares for 4%<br>A1<br>A1 bar at height 0.25 and width 20 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



**1 - (4MA0-S 2015-Paper 4HR-Q6) - PROBABILITY**

|     |                                       |         |
|-----|---------------------------------------|---------|
| (a) | $1 - 0.44 - 0.42 - 0.04$ or $1 - 0.9$ | 0.1 oe  |
| (b) |                                       | 0.86 oe |
| (c) | $1200 \times 0.04$                    | 48      |

**2 - (4MA0-S 2015-Paper 4HR-Q16) - PROBABILITY**

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
|  | $4\left(\frac{1}{6}\right)\left(\frac{5}{6}\right)^3 + 6\left(\frac{1}{6}\right)^2\left(\frac{5}{6}\right)^2 + 4\left(\frac{1}{6}\right)^3\left(\frac{5}{6}\right) + \left(\frac{1}{6}\right)^4$ or<br>$\left(\frac{1}{6}\right) + \left(\frac{5}{6}\right) \times \left(\frac{1}{6}\right) + \left(\frac{5}{6}\right) \times \left(\frac{5}{6}\right) \times \left(\frac{1}{6}\right) + \left(\frac{5}{6}\right) \times \left(\frac{5}{6}\right) \times \left(\frac{5}{6}\right) \times \left(\frac{1}{6}\right)$ or<br>$1 - \left(\frac{5}{6}\right)^4$ | $\frac{671}{1296}$ |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|

**3 - (4MA0-W 2015-Paper 4HR-Q13) - PROBABILITY**

|          |                                                                                                                                                       |                                 |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>a</b> |                                                                                                                                                       | $p$ and $1 - p$ on the branches |
| <b>b</b> |                                                                                                                                                       | $p^2$                           |
| <b>c</b> | $p \times (1 - p)$ oe or<br>$p \times "(1 - p)"$ or<br>$0.2 \times 0.8 (=0.16)$                                                                       |                                 |
|          | $p \times (1 - p) + (1 - p) \times p$ or<br>$p \times "(1 - p)" + "(1 - p)" \times p$ or<br>$0.8 \times 0.2 + 0.2 \times 0.8$ or<br>$2 \times "0.16"$ |                                 |
|          |                                                                                                                                                       | 0.32 oe                         |



## 4 - (4MA0-S 2016-Paper 4HR-Q15) - PROBABILITY

|   |                                                                     |                   |   |
|---|---------------------------------------------------------------------|-------------------|---|
| a | $\frac{7}{10} \times \frac{5}{8} + \frac{3}{10} \times \frac{3}{8}$ | $\frac{44}{80}$   | 3 |
| b | $\frac{12}{18} \times \frac{11}{17}$                                | $\frac{132}{306}$ | 2 |

## 5 - (4MA0-W 2016-Paper 4HR-Q17) - PROBABILITY

|     |                                 |                                          |
|-----|---------------------------------|------------------------------------------|
| (a) |                                 | 0.4, 0.9, 0.3, 0.7 in appropriate places |
| (b) | 0.6 × 0.1                       |                                          |
|     |                                 | 0.06                                     |
| (c) | (0.6 × '0.9') + ('0.4' × '0.7') |                                          |
|     |                                 | 0.82                                     |

## 6 - (4MA0-S 2017-Paper 4HR-Q16) - PROBABILITY

|     |                                                                                                                                                                                                                                                                                   |                |   |    |                                                                                                   |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---|----|---------------------------------------------------------------------------------------------------|
| (a) | $\frac{2}{6} \times \frac{1}{5}$ oe                                                                                                                                                                                                                                               | $\frac{1}{15}$ | 2 | M1 | For a complete method                                                                             |
|     |                                                                                                                                                                                                                                                                                   |                |   | A1 | oe<br>Eg $\frac{2}{30}$<br>Accept 0.066(666...) rounded or truncated to at least 3 decimal places |
| (b) | $\frac{4}{6} \times \frac{3}{5}$ or 0.4 or $\frac{2}{6} \times \frac{1}{5}$ or 0.066(666...) or<br>$\frac{1}{6} \times \frac{3}{5}$ or $\frac{3}{6} \times \frac{1}{5}$ or 0.1 or $\frac{3}{6} \times \frac{2}{5}$ or 0.2 or $\frac{2}{6} \times \frac{1}{5}$ or<br>0.066(666...) | $\frac{7}{15}$ | 3 | M1 | One correct product that gives an even number                                                     |
|     | $\frac{4}{6} \times \frac{3}{5} + \frac{2}{6} \times \frac{1}{5}$ or<br>$\frac{1}{6} \times \frac{3}{5} + \frac{3}{6} \times \frac{1}{5} + \frac{3}{6} \times \frac{2}{5} + \frac{2}{6} \times \frac{1}{5}$                                                                       |                |   | M1 | Sum of correct products                                                                           |
|     |                                                                                                                                                                                                                                                                                   |                |   | A1 | oe<br>Accept 0.466(666...) rounded or truncated to at least 3 decimal places                      |





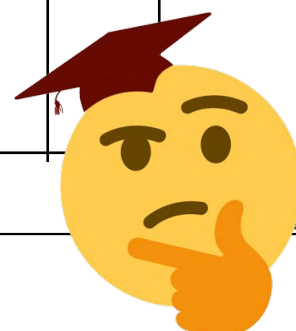
|  |                                                                                                                                                                                                                                                                                                                                                                                     |                |   |                                                                                          |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---|------------------------------------------------------------------------------------------|
|  | <b>With Replacement</b><br>$\frac{4}{6} \times \frac{4}{6}$ or 0.444(444) or $\frac{2}{6} \times \frac{2}{6}$ or 0.111(111...) or<br>$\frac{1}{6} \times \frac{3}{6}$ or $\frac{3}{6} \times \frac{1}{6}$ or 0.083(333...) or $\frac{2}{6} \times \frac{2}{6}$ or 0.111(111...) or<br>$\frac{3}{6} \times \frac{3}{6}$ or 0.25 or $\frac{1}{6} \times \frac{1}{6}$ or 0.027(777...) |                |   | M1                                                                                       |
|  | $\frac{4}{6} \times \frac{4}{6} + \frac{2}{6} \times \frac{2}{6}$ oe or<br>$\frac{1}{6} \times \frac{3}{6} + \frac{3}{6} \times \frac{1}{6} + \frac{2}{6} \times \frac{2}{6} + \frac{3}{6} \times \frac{3}{6} + \frac{1}{6} \times \frac{1}{6}$ oe or<br>or $\frac{5}{9}$ or 0.555(555...)                                                                                          |                |   | M1                                                                                       |
|  | <b>Alternative method</b><br>$1 - (\frac{2}{6} \times \frac{4}{5} + \frac{4}{6} \times \frac{2}{5})$ oe                                                                                                                                                                                                                                                                             | $\frac{7}{15}$ | 3 | M2<br>A1<br>oe<br>Accept 0.466(666...) rounded or truncated to at least 3 decimal places |

## 7 - (4MA0-W 2017-Paper 4HR-Q2) - PROBABILITY

|     |                                                           |      |   |
|-----|-----------------------------------------------------------|------|---|
| (a) | $0.15 + 0.4$                                              | 0.55 | 1 |
| (b) | $\frac{1 - (0.15 + 0.4)}{3}$ or $\frac{0.45}{3}$ (= 0.15) |      | 2 |
|     |                                                           | 0.3  |   |
| (c) | $160 \times 0.4$                                          |      | 2 |
|     |                                                           | 64   |   |

## 8 - (4MA0-W 2017-Paper 4HR-Q12) - PROBABILITY

|     |                                                                                                                                                                                          |                       |   |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---|
| (a) |                                                                                                                                                                                          | Correct probabilities | 2 |
| (b) |                                                                                                                                                                                          | 0.42                  | 2 |
| (c) | $0.6 \times "0.3" \times "0.8" + "0.4" \times 0.7 \times "0.8" + "0.4" \times "0.3" \times 0.2$ (= 0.144 + 0.224 + 0.024) oe                                                             |                       | 3 |
|     |                                                                                                                                                                                          | 0.392                 |   |
|     | <b>Alternative method</b><br>$1 - [(0.6 \times 0.7 \times 0.2) + (0.4 \times 0.3 \times 0.8) + (0.6 \times 0.7 \times 0.8) + (0.6 \times 0.3 \times 0.2) + (0.4 \times 0.7 \times 0.2)]$ |                       |   |
|     |                                                                                                                                                                                          | 0.392                 |   |



## 9 - (4MA0-S 2018-Paper 4HR-Q14) - PROBABILITY

|     |                                  |                                                      |   |    |                                                                               |
|-----|----------------------------------|------------------------------------------------------|---|----|-------------------------------------------------------------------------------|
| (a) |                                  | $\frac{4}{7}$                                        | 2 | B1 | For left branch correct<br>0.57(142...)                                       |
|     |                                  | $\frac{4}{9}, \frac{5}{9}, \frac{4}{9}, \frac{5}{9}$ |   | B1 | For right branches correct<br>0.44(4...), 0.55(5...)                          |
| (b) | $\frac{3}{7} \times \frac{4}{9}$ | $\frac{4}{21}$                                       | 2 | M1 | ft their tree                                                                 |
|     |                                  |                                                      |   | A1 | ft their tree for fractions less than<br>1 oe $\frac{12}{63}$ , 0.19(0476...) |

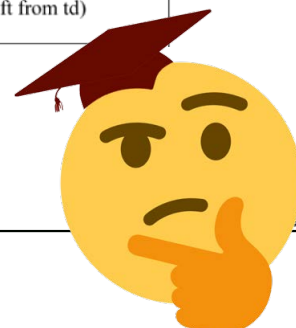
## 10 - (4MA0-W 2018-Paper 4HR-Q12) - PROBABILITY

|     |                                                                                                                                                                                                                                                                                                                                                        |                            |   |    |                                                                                                                                                     |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---|----|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) |                                                                                                                                                                                                                                                                                                                                                        |                            |   | B1 | For $\frac{7}{20}$ on lower LH branch                                                                                                               |
|     |                                                                                                                                                                                                                                                                                                                                                        |                            |   | B1 | Correct binary structure with 4 branches needed on RHS                                                                                              |
|     |                                                                                                                                                                                                                                                                                                                                                        | Fully correct tree diagram | 3 | B1 | For fully correct tree diagram with all probabilities ( $\frac{7}{20}, \frac{12}{19}, \frac{7}{19}, \frac{13}{19}$ and $\frac{6}{19}$ ) and labels. |
| (b) | $\frac{13}{20} \times \frac{12}{19}$                                                                                                                                                                                                                                                                                                                   | $\frac{156}{380}$          | 2 | M1 | ft from their tree diagram in (a)                                                                                                                   |
|     |                                                                                                                                                                                                                                                                                                                                                        |                            |   | A1 | oe<br>eg $\frac{78}{190}$ or $\frac{39}{95}$<br>Accept 0.41(0526...) rounded or truncated to at least 2dp.                                          |
| (c) | $\frac{13}{20} \times \frac{12}{19} \times \frac{7}{18}$ or $\frac{91}{570}$ or 0.15(9649...) oe<br>$\frac{13}{20} \times \frac{12}{19} \times \frac{7}{18} + \frac{13}{20} \times \frac{7}{19} \times \frac{12}{18} + \frac{7}{20} \times \frac{13}{19} \times \frac{12}{18}$<br>or $3 \times \frac{13}{20} \times \frac{12}{19} \times \frac{7}{18}$ | $\frac{91}{190}$           | 3 | M1 | Ft from (a)                                                                                                                                         |
|     |                                                                                                                                                                                                                                                                                                                                                        |                            |   | M1 | Ft from (a)<br>Dep. For full correct method                                                                                                         |
|     |                                                                                                                                                                                                                                                                                                                                                        |                            |   | A1 | oe<br>Accept 0.47(894...) rounded or truncated to at least 2dp.<br>ft method marks if probabilities <1                                              |

|  |                                                                                                                                                                                                                                    |  |  |    |  |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|----|--|
|  | <b>With Replacement</b><br>$\frac{13}{20} \times \frac{13}{20} \times \frac{7}{20}$ or $\frac{1183}{8000}$ or 0.14(7875)<br>$3 \times \frac{13}{20} \times \frac{13}{20} \times \frac{7}{20}$ or $\frac{3549}{8000}$ or 0.44(3625) |  |  | M1 |  |
|  |                                                                                                                                                                                                                                    |  |  | M1 |  |

## 11 - (4MA0-W 2019-Paper 4HR-Q15) - PROBABILITY

|     |                                                                                                                                                          |         |   |    |                                                                                                                                                                    |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) | 3/10 oe and label g or green<br>Three extra branches drawn<br>All labels and values correct on six branches                                              |         | 3 | B1 | correct label and value for first green branch<br>B1 correct binary structure<br>B1 see diagram at end                                                             |
| (b) | $7/10 \times '6/10'$ oe                                                                                                                                  | 0.42 oe | 2 | M1 | ft from td with correctly labelled 2 <sup>nd</sup> green branch                                                                                                    |
|     |                                                                                                                                                          |         |   | A1 |                                                                                                                                                                    |
| (c) | $P(RR) + P(RG) + P(GR)$<br>$= 7/10 \times '4/10' + 7/10 \times '6/10' + '3/10' \times '4/10'$<br><br>Alt:<br>$1 - P(GG)$<br>$= 1 - '3/10' \times '6/10'$ | 0.82 oe | 3 | M2 | ft from td 3 correctly labelled branches with an intention to add<br>If not M2 then M1 for any 2 correctly labelled branches (ft from td) with an intention to add |
|     |                                                                                                                                                          |         |   | M2 | ft from td 2 correctly labelled branches<br>If not M2 then M1 for $'3/10' \times '6/10'$ (ft from td)                                                              |
|     |                                                                                                                                                          |         |   | A1 |                                                                                                                                                                    |



## 1 - (4MA0-W 2015-Paper 4HR-Q15) - VECTORS

|   |                                                                                                                                                                                                    |                                          |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| a | $\sqrt{1^2 + 2^2}$ or $\sqrt{5}$                                                                                                                                                                   |                                          |
|   |                                                                                                                                                                                                    | 2.24                                     |
| b | $\vec{AC} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} + \begin{pmatrix} 5 \\ 3 \end{pmatrix} = \begin{pmatrix} 6 \\ 5 \end{pmatrix}$<br>or $B(4+5, 3+2)$ or $(9, 5)$                                    |                                          |
|   | $\vec{OC} = \begin{pmatrix} 6 \\ 5 \end{pmatrix} + \begin{pmatrix} 4 \\ 2 \end{pmatrix} = \begin{pmatrix} 10 \\ 7 \end{pmatrix}$<br>or $C(4+5+1, 3+2+2)$                                           |                                          |
|   |                                                                                                                                                                                                    | $(10, 7)$                                |
| c | $\vec{AE} = \frac{1}{2} \begin{pmatrix} 6 \\ 5 \end{pmatrix} = \begin{pmatrix} 3 \\ 2.5 \end{pmatrix}$ or<br>$\vec{AE} = \frac{1}{2} \vec{AC}$ or<br>$E\left(\frac{4+10}{2}, \frac{2+7}{2}\right)$ |                                          |
|   | $\vec{OE} = \begin{pmatrix} 4 \\ 2 \end{pmatrix} + \frac{1}{2} \begin{pmatrix} 6 \\ 5 \end{pmatrix}$ or<br>$\vec{OE} = \vec{OA} + \vec{AE}$ or<br>$E(7, 4.5)$                                      |                                          |
|   |                                                                                                                                                                                                    | $\begin{pmatrix} 7 \\ 4.5 \end{pmatrix}$ |



## 2 - (4MA0-S 2016-Paper 4HR-Q19) - VECTORS

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |   |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---|
| a | $\vec{BC} = -4\mathbf{a} + 2\mathbf{b} + 8\mathbf{a} (=4\mathbf{a} + 2\mathbf{b})$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | $2\mathbf{a} + \mathbf{b}$ | 2 |
| b | $\vec{AM} = 4\mathbf{a} + '2\mathbf{a} + \mathbf{b}' (=6\mathbf{a} + \mathbf{b})$ and<br>$\vec{AN} = 2\mathbf{b} + 8\mathbf{a} + 4\mathbf{a} (=12\mathbf{a} + 2\mathbf{b})$<br><b>or</b><br>$\vec{AM} = 4\mathbf{a} + '2\mathbf{a} + \mathbf{b}' (=6\mathbf{a} + \mathbf{b})$ and<br>$\vec{MN} = '\mathbf{b} + 2\mathbf{a}' + 4\mathbf{a} (=6\mathbf{a} + \mathbf{b})$<br><b>or</b><br>$\vec{AN} = 2\mathbf{b} + 8\mathbf{a} + 4\mathbf{a} (=12\mathbf{a} + 2\mathbf{b})$ and<br>$\vec{MN} = '\mathbf{b} + 2\mathbf{a}' + 4\mathbf{a} (=6\mathbf{a} + \mathbf{b})$<br><b>oe</b> | Show                       | 2 |

## 3 - (4MA0-S 2017-Paper 4HR-Q21) - VECTORS

|         |                                                                                       |                             |   |                                                                                                                                                                                                                                                                                                                              |
|---------|---------------------------------------------------------------------------------------|-----------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) (i) |                                                                                       | $3\mathbf{b} - 6\mathbf{a}$ | 1 | B1<br>Oe<br>Need not be simplified<br>Mark the final answer                                                                                                                                                                                                                                                                  |
| (ii)    |                                                                                       | $2\mathbf{b} - 4\mathbf{a}$ | 1 | B1ft<br>oe eg $\frac{2}{3}(3\mathbf{b} - 6\mathbf{a})$<br>Need not be simplified<br>Mark the final answer                                                                                                                                                                                                                    |
| (iii)   |                                                                                       | $6\mathbf{b} - 3\mathbf{a}$ | 1 | B1<br>oe<br>Need not be simplified<br>Mark the final answer                                                                                                                                                                                                                                                                  |
| (b)     | Eg $\vec{XY} = 2\mathbf{b} - \mathbf{a}$ oe or $\vec{YB} = 4\mathbf{b} - 2\mathbf{a}$ | shown                       | 2 | M1 Work out $\vec{XY}$ or $\vec{YX}$ or $\vec{YB}$ or $\vec{BY}$<br>A1 Dep on M1<br>Correct conclusion from correct simplified vectors<br>Eg $\vec{XB} = 3\vec{XY}$ or $\vec{YB} = 2\vec{XY}$ or $\vec{XB} = 1.5\vec{YB}$<br>or $XB$ and $XY$ are parallel<br>or $YB$ and $XY$ are parallel<br>or $XB$ and $YB$ are parallel |



## 4 - (4MA0-W 2018-Paper 4HR-Q17) - VECTORS

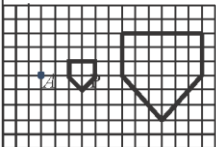
|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                             |   |                                                                                                                                                                                                                                                     |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a)(i)  |                                                                                                                                                                                                                                                                                                                                                                                                                                                            | $6\mathbf{a} + 4\mathbf{b} + 2\mathbf{c}$                                   | 1 | B1 oe                                                                                                                                                                                                                                               |
| (a)(ii) |                                                                                                                                                                                                                                                                                                                                                                                                                                                            | $3\mathbf{a} + 2\mathbf{b}$                                                 | 1 | B1 oe                                                                                                                                                                                                                                               |
| (b)     | Eg $(\overrightarrow{UX}) \Rightarrow -\frac{3}{4}(6\mathbf{a} + 4\mathbf{b} + 2\mathbf{c}) + 6\mathbf{a} + 4\mathbf{b} + 1.5\mathbf{c}$ or<br>$(\overrightarrow{UX}) \Rightarrow -4.5\mathbf{a} - 3\mathbf{b} - 1.5\mathbf{c} + 6\mathbf{a} + 4\mathbf{b} + 1.5\mathbf{c}$ or<br>$(\overrightarrow{UX}) \Rightarrow \frac{1}{4}(6\mathbf{a} + 4\mathbf{b} + 2\mathbf{c} - 2\mathbf{c})$<br>$(\overrightarrow{UX}) \Rightarrow 1.5\mathbf{a} + \mathbf{b}$ | $\overrightarrow{UX} = \frac{1}{2}\overrightarrow{VW}$ oe<br>and conclusion | 3 | M1 For a correct expression for $\overrightarrow{UX}$<br><br>A1 For $(\overrightarrow{UX}) \Rightarrow 1.5\mathbf{a} + \mathbf{b}$<br><br>A1 NB: A correct simplified expression for $\overrightarrow{UX}$ and $\overrightarrow{VW}$ must be given. |
| (c)     | $6^2 + (-5)^2$ or $6^2 + 5^2$ or 61                                                                                                                                                                                                                                                                                                                                                                                                                        | $\sqrt{61}$                                                                 | 2 | M1<br>A1 Note: M1A0 for 7.81(024...) rounded or truncated to at least 3SF                                                                                                                                                                           |



## 1 - (4MA0-S 2016-Paper 4HR-Q1) - TRANSFORMATION

|   |  |                                                           |   |
|---|--|-----------------------------------------------------------|---|
| a |  | Vertices at<br>(3,5)(7,5)(7,7)(5,7)                       | 2 |
| b |  | <u>Enlargement</u> SF<br><u>0.5</u> , centre <u>(1,1)</u> | 1 |

## 2 - (4MA0-S 2018-Paper 4HR-Q5) - TRANSFORMATION

|     |                                                                                   |                                                |   |                |                                                                                                                |
|-----|-----------------------------------------------------------------------------------|------------------------------------------------|---|----------------|----------------------------------------------------------------------------------------------------------------|
| (a) |  | A correct enlargement in the correct position  | 2 | M1<br>A1       | Enlargement of given shape by SF 3 anywhere on grid or completely correct enlargement by SF 2<br>Fully correct |
| (b) |                                                                                   | Rotation<br>(Centre) (0,0)<br>90° clockwise oe | 3 | B1<br>B1<br>B1 | O or origin<br>-90°, 270°<br>If more than one transformation mentioned then no marks                           |

## 3 - (4MA0-W 2018-Paper 4HR-Q5) - TRANSFORMATION

|     |  |                                       |   |          |                                                                                                                                                                                                 |
|-----|--|---------------------------------------|---|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) |  | Translation 4 to the right and 1 down | 2 | B2<br>B1 | For translation and 4 to the right and 1 down<br>B1 for translation or 4 to the right and 1 down<br>Accept $\begin{pmatrix} 4 \\ -1 \end{pmatrix}$<br>NB: No marks for multiple transformations |
| (b) |  | Triangle in correct position          | 2 | B2<br>B1 | For vertices at (2, -3), (2, -2), and (0, -3)<br>B1 for correct orientation but in wrong position or<br>For vertices at (2, 6), (2, 7), (4, 7)                                                  |



**1 - (4MA0-S 2015-Paper 4HR-Q21) - DIFFERENTIATION & KINEMATICS**

|     |                                                                         |                       |
|-----|-------------------------------------------------------------------------|-----------------------|
| (a) | $(-)\frac{16}{x} = (-)16x^{-1}$                                         | $2x + \frac{16}{x^2}$ |
| (b) | $2x + \frac{16}{x^2} = 0$<br>$2x^3 = -16$ or $x^3 = -8$<br><br>$x = -2$ | $(-2, 12)$            |

**2 - (4MA0-W 2018-Paper 4HR-Q16) - DIFFERENTIATION & KINEMATICS**

|     |                                                                                                                                                    |                  |   |                                                                                                                            |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---|----------------------------------------------------------------------------------------------------------------------------|
| (a) |                                                                                                                                                    | $6x^2 - 18x$     | 2 | M1 For $6x^2$ or $2 \times 3 \times x^2$ oe or $-18x$ or $-2 \times 9 \times x$ oe<br>A1                                   |
| (b) | $6x^2 - 18x = 0$<br>$6x(x - 3) = 0$<br>$x = 3$ (or $x = 0$ )<br><br>$(y = ) 2 \times 3^3 - 9 \times 3^2 + 31$ or 4<br><br>Gradient = $\frac{4}{3}$ | $\frac{4}{3}$ oe | 4 | M1 fit their part (a) = 0 if quadratic<br>A1 For $x = 3$<br>Dep on M1<br>M1 For substituting 3 in $2x^3 - 9x^2 + 31$<br>A1 |

**3 - (4MA0-W 2019-Paper 4HR-Q18) - DIFFERENTIATION & KINEMATICS**

|     |                                   |              |   |                                                                                            |
|-----|-----------------------------------|--------------|---|--------------------------------------------------------------------------------------------|
| (a) | $\frac{ds}{dt} = 1 - 36/t^2$      | $1 - 36/t^2$ | 2 | M1 for 1 or $-36/t^2$ Do <u>not</u> accept $(+)36/t^2$ or 1 from dividing $s$ by $t$<br>A1 |
| (b) | $1 - 36/t^2 = 0$<br>$t^2 = 36$    | 6            | 2 | M1 fit part (a) = 0 followed by isolating $t$ or $t^2$<br>A1 cao (ignore answer of $-6$ )  |
| (c) | $\frac{dv}{dt} = 2 \times 36/t^3$ | 9            | 2 | M1 fit (a)<br>A1 cao                                                                       |

