

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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# GCSE MATHEMATICS

# H

Higher Tier

Paper 2 Calculator

Thursday 8 June 2017

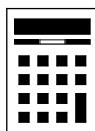
Morning

Time allowed: 1 hour 30 minutes

## Materials

For this paper you must have:

- a calculator
- mathematical instruments.



## Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

## Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

## Advice

- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24–25	
26–27	
<b>TOTAL</b>	



Please note that these worked solutions have neither been provided nor approved by AQA and may not necessarily constitute the only possible solutions. Please refer to the original mark schemes for full guidance.

Any writing in blue indicates what must be written in order to answer the questions and get the marks. The worked solutions have been designed to show the smallest amount of work which needs to be done to answer the question.

Anything written in green in a cloud doesn't have to be written in the exam.

Anything written in orange in a rectangle doesn't have to be written in the exam and is there to show what should be put into a calculator or measured using a ruler or protractor.

If you find any mistakes or have any requests or suggestions, please send an email to [curtis@cgmaths.co.uk](mailto:curtis@cgmaths.co.uk)

Answer **all** questions in the spaces provided

- 1 Circle the decimal that is closest in value to  $\frac{39}{800} = 0.04875$  [1 mark]

0.04

0.048

0.049

0.05

0.04 is 0.00875 away, 0.048 is 0.00075 away, 0.049 is 0.00025 away, 0.05 is 0.00125 away.  
Working out how far away they are by working out the difference, largest subtract smallest

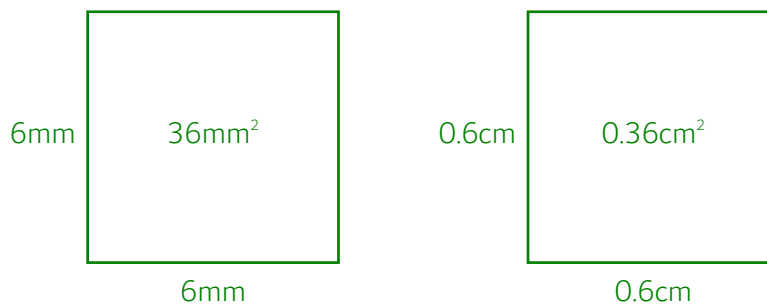
- 2 Circle the area that is equal to  $36 \text{ mm}^2$  [1 mark]

360  $\text{cm}^2$ 3600  $\text{cm}^2$ 3.6  $\text{cm}^2$ 0.36  $\text{cm}^2$ 

There are 10mm in a cm so dividing by 10 converts mm into cm. However this is a squared unit so the effect will be squared.

$$36 \div 10^2 = 36 \div 100 = 0.36$$

We could also test it on a square to see what would happen.



<https://youtu.be/sTbYueUZJUQ>



- 3 A is (2, 12) and B is (8, 2)  
Circle the midpoint of AB.

[1 mark]

(3, 5)

(4, 6)

(5, 7)

(6, 10)

The midpoint will be in the middle of the  $x$ -coordinates and the  $y$ -coordinates. Finding the mean is a quick way of finding the middle value. The mean of the  $x$ -coordinates is  $(2 + 8)/2 = 5$

- 4 Here is a sequence.

90 82 74 66 58

Circle the expression for the  $n$ th term of the sequence.

[1 mark]

 $n - 8$  $98 - 8n$  $8n + 82$  $8n - 98$ 

The sequence goes down by 8 each time so the coefficient of  $n$  must be  $-8$

Turn over for the next question

[https://youtu.be/Nm45H-uMY\\_k](https://youtu.be/Nm45H-uMY_k)

<https://youtu.be/9jhD4pz9IH0>

Turn over ►



- 5** A code has 4 digits.  
Each digit is a number from 0 to 9  
Digits may be repeated.

The code starts 5 4 1

5	4	1	
---	---	---	--

- 5 (a)** Amy knows the last digit is odd but **not** 7  
She chooses a different odd number at random.

What is the probability that she chooses the correct number?

[1 mark]

The possible odd digits are 1, 3, 5 and 9. Out of these, only one is correct.

$$\frac{1}{4}$$

Answer \_\_\_\_\_

- 5 (b)** The 4-digit code is changed to an even number.  
The first digit is 3  
How many possible codes are there?

[2 marks]

$$1 \times 10 \times 10 \times 5$$

Using the product rule for counting. Multiplying the number of outcomes for each digit gives the total number of outcomes. There is only 1 possibility for the first digit as it must be 3. There are 10 possibilities for the second and third digit as they can be any single digit (there are 10 including 0). There are 5 possibilities for the fourth digit as it must end in a 0, 2, 4, 6, 8 in order to be even.

Answer \_\_\_\_\_ 500

<https://youtu.be/-A0wAQXxkwU>



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

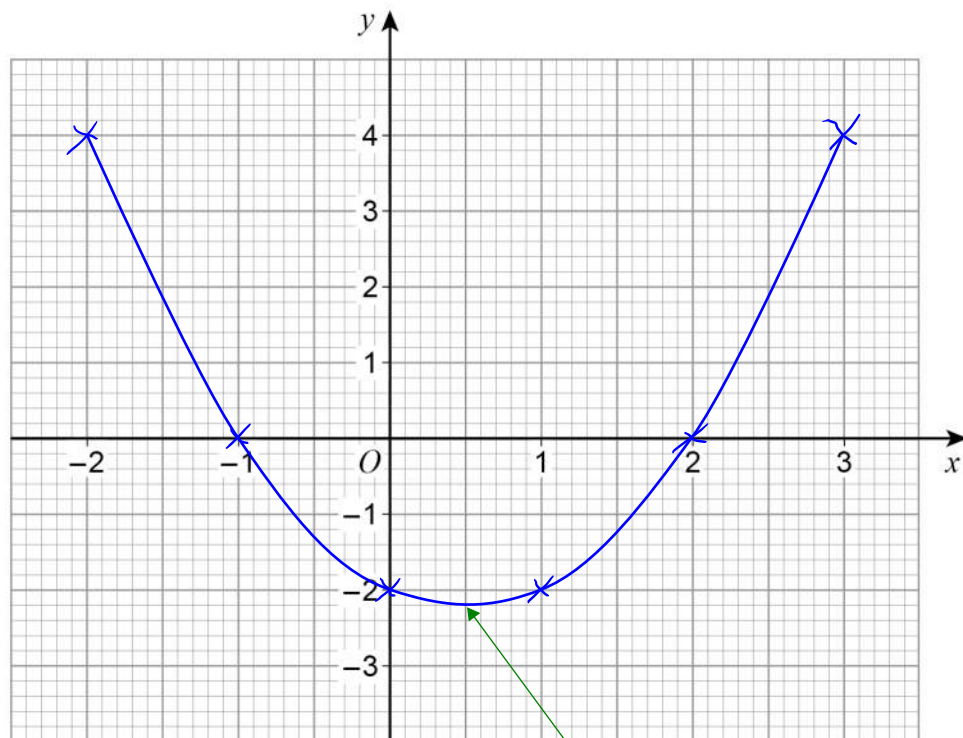
[2 marks]

$$(-2)^2 - (-2) - 2 = 4 \quad (-1)^2 - (-1) - 2 = 0 \quad 2^2 - 2 - 2 = 0$$

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

6 (b) Draw the graph of  $y = x^2 - x - 2$  for values of  $x$  from -2 to 3

[2 marks]



6 (c) Write down the  $x$ -coordinate of the turning point of the graph.

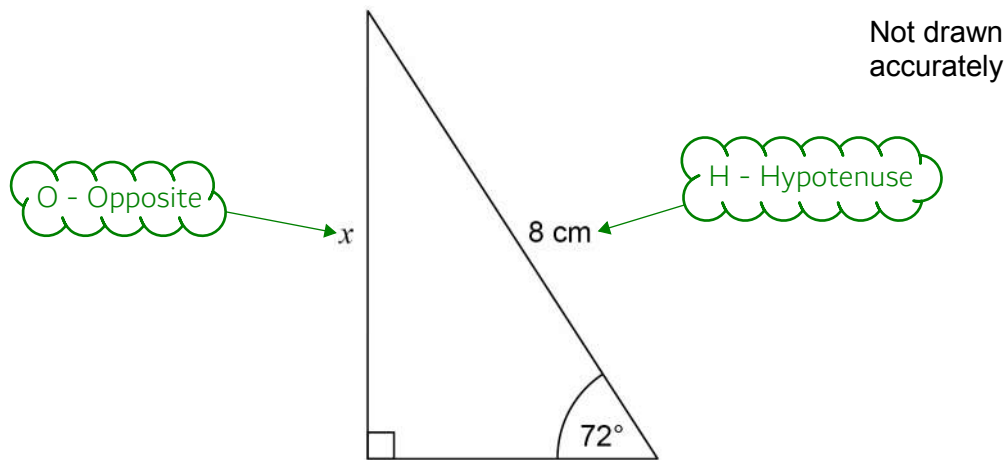
[1 mark]

Quadratics are symmetrical so the minimum point must be halfway between 0 and 1.

Answer 0.5



7 Use trigonometry to work out the length  $x$ .



[2 marks]

SỐ HỌC CÁNH TỐA

Two ticks on SOH so we use this formula triangle. Covering over O (what we are trying to find) gives:  
Opposite = Sin of the angle x Hypotenuse



$$x = \sin 72 \times 8$$

$$\sin(72) \times 8 = 7.60845213$$

Answer 7.6 cm

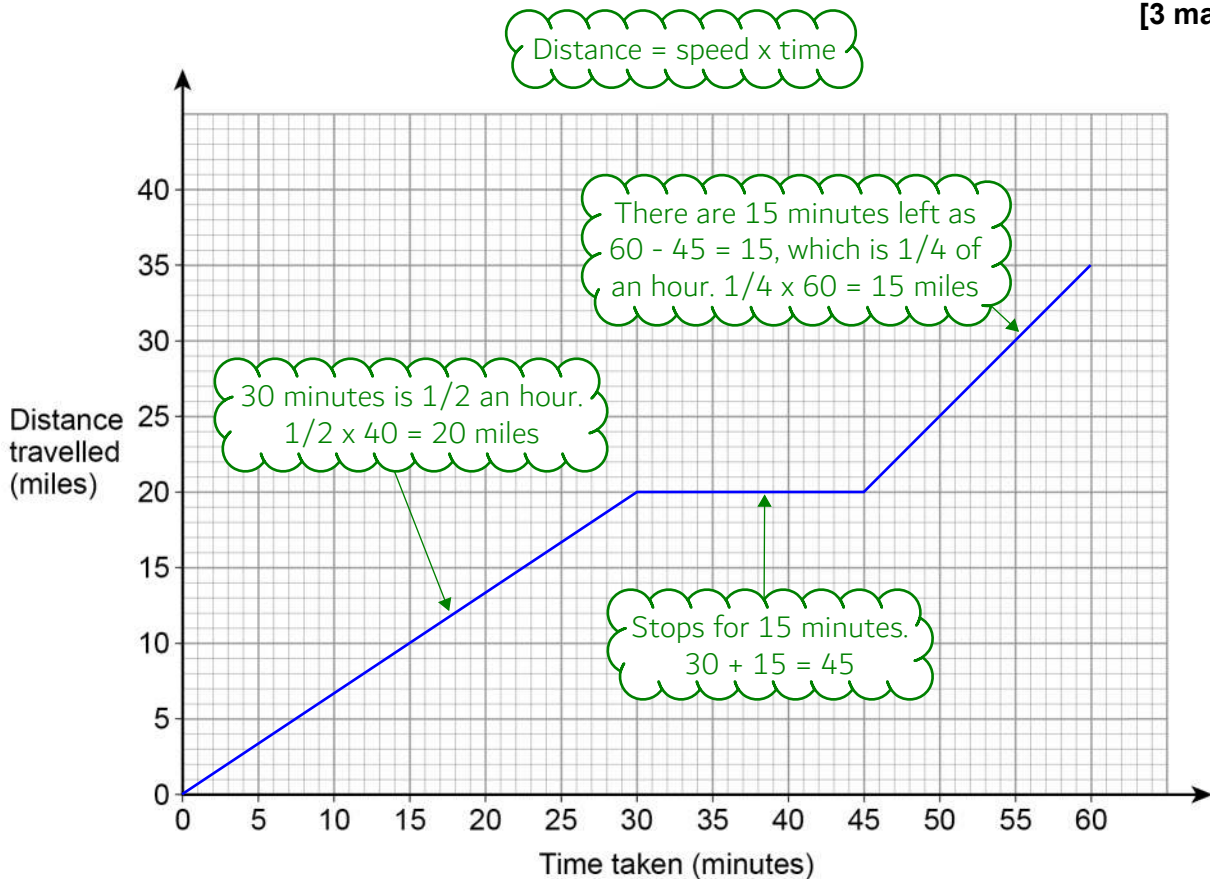
[https://youtu.be/f8rA-dU7J\\_o](https://youtu.be/f8rA-dU7J_o)



- 8** Lily goes on a car journey.  
For the first 30 minutes her average speed is 40 miles per hour.  
She then stops for 15 minutes.  
She then completes the journey at an average speed of 60 miles per hour.  
The total journey time is 1 hour.

- 8 (a)** Draw a distance-time graph for her journey.

[3 marks]



- 8 (b)** Write down the average speed for the total journey.

[1 mark]

Answer \_\_\_\_\_ 35 \_\_\_\_\_ mph

35 miles were travelled in an hour.

Turn over for the next question





- 9 The table shows information about some CDs.

Type	Rock	Pop	Jazz
Number of CDs	2	$x$	$2x + 5$

A CD is chosen at random.

The probability it is **rock** is  $\frac{1}{20}$

Work out the probability it is jazz.

[4 marks]

1/20 of the CDs are Rock as the probability is 1/20, so there must be 40 CDs in total as  
 $2 \times 20 = 40$

Adding up all the expressions for the number of CDs for each type would give 40.

$$2 + x + 2x + 5 = 40$$

$$3x + 7 = 40$$

$$3x = 33$$

$$x = 11$$

$$2 \times 11 + 5 = 27$$

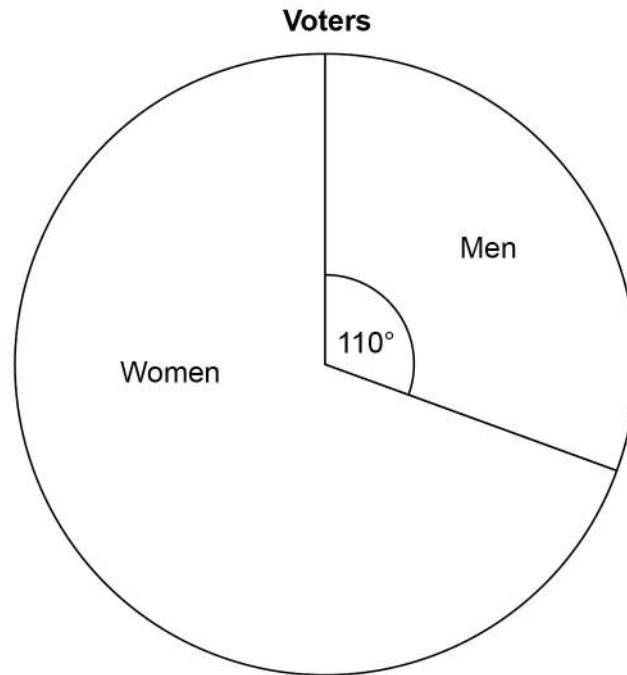
Answer  $\frac{27}{40}$

<https://youtu.be/dDDAatr95BA>



10

The pie chart shows information about voters in an election.

3360 **more** women voted than men.

Work out the total number of voters.

The number of degrees which represents the women.

**[3 marks]**

$$360 - 110 = 250$$

$$250 - 110 = 140$$

The number of degrees which represents the difference between the men and women.

$$\frac{3360}{24} = 140$$

The number of voters represented by 1°.

$$140$$

$$24 \times 360$$

360° represents all of the voters.

Answer \_\_\_\_\_

8640

[https://youtu.be/oMiyMrII\\_38](https://youtu.be/oMiyMrII_38)

7

Turn over ►



11 Write these numbers in **descending** order.

9563

 $9.56 \times 10^3$  $9.56 \times 3^{10}$ 

$$9.56 \times 10^3 = 9560$$
$$9.56 \times 3^{10} = 564508.44$$

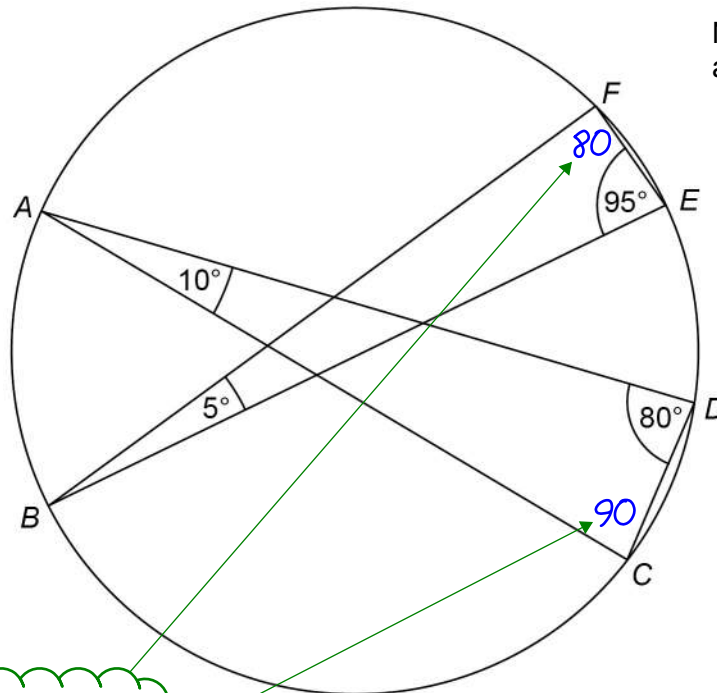
**[2 marks]**

Answer  $9.56 \times 3^{10}$  , 9563 ,  $9.56 \times 10^3$

<https://youtu.be/hNhvFJ0xJpY>



12 A, B, C, D, E and F are points on a circle.



There are  $180^\circ$  in total in a triangle.

$$180 - (95 + 5) = 80$$

$$180 - (80 + 10) = 90$$

Circle the line that is a diameter of the circle.

[1 mark]

BE

AD

AC

BF

The angle in a semicircle is 90 degrees, so AD must be the diameter

Turn over for the next question

<https://youtu.be/7GZbsPP-Cuk>



13

To make one cheese sandwich, Gina uses one bread roll and two cheese slices.

**Pack of 15 bread rolls**

£1.88

**Pack of 20 cheese slices**

£2.15

She is going to buy enough packs to  
have exactly twice as many cheese slices as bread rolls  
make **more than** 100 cheese sandwiches.

Work out the least amount she can spend.

[4 marks]

For the bread rolls, keep adding 15 on the calculator until we get a number above 100.

$$7 \times 15 = 105$$

$$8 \times 15 = 120$$

$$120 \times 2 = 240$$

$$\frac{240}{20} = 12$$

$$20$$

Double 105 is 210 and this isn't a multiple of 20. This won't work so we add another pack of bread rolls.

Double 120 gives 240 and this is a multiple of 20. 12 packs of cheese slices gives 240.

$$8 \times 1.88 + 12 \times 2.15$$

Working out the cost of 8 packs of bread rolls and 12 packs of cheese slices.

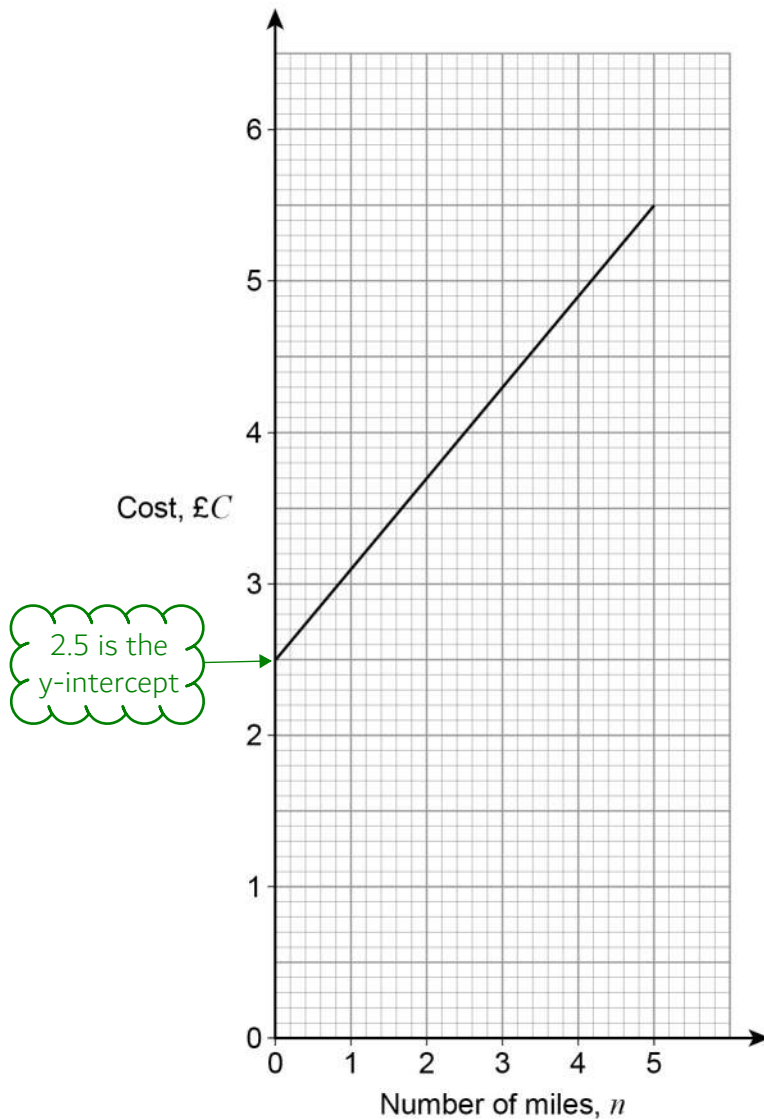
Answer £

40.84

<https://youtu.be/2arCtKrEKCI>



- 14 The graph shows the cost of some taxi journeys.



Work out a formula for  $C$  in terms of  $n$ .

$$\frac{5.5 - 2.5}{5 - 0} = 0.6$$

Working out the gradient using  
(change in  $y$ )/(change in  $x$ )

[3 marks]

The general equation of a straight line is  $y = mx + c$ , where  $m$  is the gradient and  $c$  is the  $y$ -intercept.  
 $y$  needs to be changed for  $C$  and  $x$  needs to be changed for  $n$  as these are the variables given

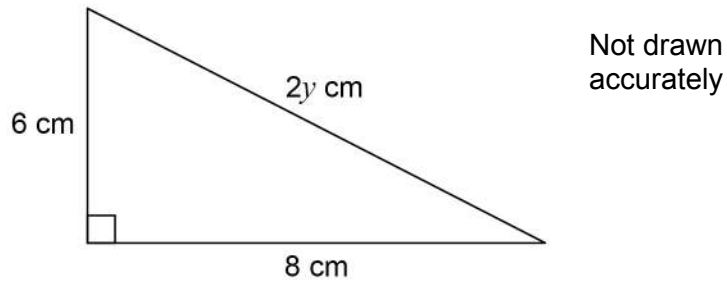
Answer

$$C = 0.6n + 2.5$$

<https://youtu.be/G4VoAOZqfhc>



- 15 Sami is trying to work out the exact value of  $y$  using Pythagoras' theorem.



Here is her working.

$$(2y)^2 = 6^2 + 8^2$$

$$2y^2 = 36 + 64$$

$$2y^2 = 100$$

$$y^2 = 100 \div 2$$

$$y^2 = 50$$

$$y = \sqrt{50}$$

- 15 (a) What error has she made in her working?

[1 mark]

$$(2y)^2 = 4y^2, \text{ not } 2y^2$$

$$(2y)^2 = 2y \times 2y = 2 \times 2 \times y \times y$$

<https://youtu.be/H3uj-zPU4pw>



15 (b) Kai works out that  $y = 5$

Mel says,

“ $y$  cannot be 5 because the hypotenuse should be the longest side and the other sides are longer than 5 cm”

Is Mel correct?

Tick a box.

The side is  $2y$ , not  $y$ .

Yes

No

Give a reason for your answer.

[1 mark]

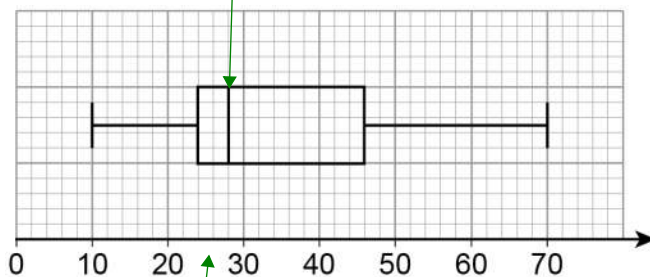
$2y = 10$      $10 > 8$

This means that her reasoning is wrong as  $10$  is longer than the side of  $8$  cm.

<https://youtu.be/H3uj-zPU4pw>

16 Here is a box plot.

This line represents the median in a box plot.



Each box represents 2 as there is a gap of 10 across 5 boxes and  $10/5 = 2$

Circle the median value.

[1 mark]

28

35

24

22

<https://youtu.be/IR6X7G1i1qM>

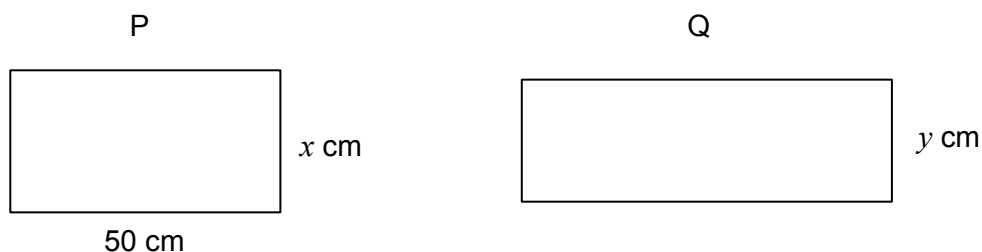
3

Turn over ►





17

P is a rectangle with length 50 cm and width  $x$  cmQ is a rectangle with width  $y$  cmNot drawn  
accuratelyThe length of Q is 20% **more** than the length of P.The area of Q is 10% **less** than the area of P.Work out the ratio  $x : y$ 

Give your answer in its simplest form.

**[4 marks]**

$$50 \times 1.2 = 60$$

Multiplying by 1.2 increases the length by 20% and finds the length of Q.

$$50 \times x \times 0.9 = 60 \times y$$

$$45x = 60y$$

$50 \times x$  finds the area of P. Multiplying by 0.9 finds 90%, which must be equal to the area of Q.  $60 \times y$  finds the area of Q.

$$x : y = 60 : 45$$

$$\boxed{60/45 = 4/3}$$

Ratios simplify in a similar way to fractions.

$45 \times 60 = 60 \times 45$ , so  $x$  could equal 45 and  $y$  could equal 45.

Answer \_\_\_\_\_

4

:

3

<https://youtu.be/gnnbnWU5n5g>



18 A school has 86 teachers.

42 are male and 44 are female.

$\frac{1}{3}$  of the male teachers have blue eyes.

$$\begin{aligned} \frac{1}{3} \times 42 &= 14 \\ 42 - 14 &= 28 \end{aligned}$$

$\frac{1}{4}$  of the female teachers have blue eyes.

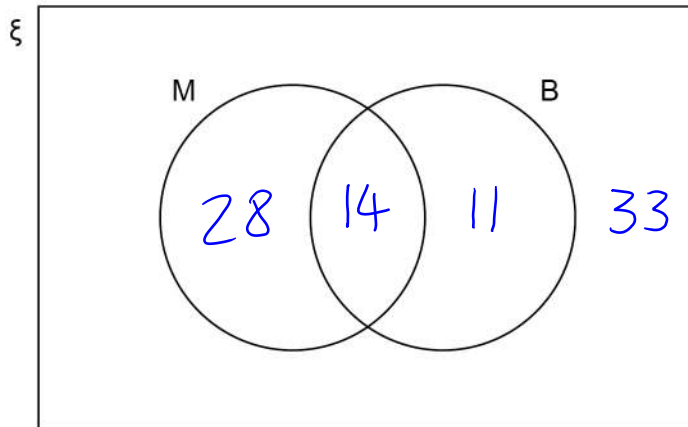
$$\begin{aligned} \frac{1}{4} \times 44 &= 11 \\ 44 - 11 &= 33 \end{aligned}$$

18 (a)  $\xi$  = teachers in the school

M = male teachers

B = teachers who have blue eyes

14 are male with blue eyes.  
28 are male without blue eyes.  
11 are female with blue eyes.  
33 are female without blue eyes.



Complete the Venn diagram.

[3 marks]

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18 (b) One teacher who has blue eyes is chosen at random.

Work out the probability that the teacher is male.

[1 mark]

14 males out of 25 (14 + 11) teachers with blue eyes.

Answer \_\_\_\_\_

$$\frac{14}{25}$$

<https://youtu.be/5rlmR3uWfyQ>



19 Rana sells 192 cakes in the ratio small : medium : large = 7 : 6 : 11

The profit for one medium cake is twice the profit for one small cake.

The profit for one large cake is three times the profit for one small cake.

Her total profit is £532.48

Work out the profit for one small cake.

Let  $x$  be the price of one small cake.  $2x$  is the price of a medium and  $3x$  is large.  
(number of small  $\times x$ ) + (medium  $\times 2x$ ) + (large  $\times 3x$ ) = £532.48  
This is an equation only involving  $x$  so can be rearranged and solved.

[5 marks]

$$\frac{192}{7+6+11} = 8$$

$$\begin{aligned} 8 \times 7 &= 56 \\ 8 \times 6 &= 48 \\ 8 \times 11 &= 88 \end{aligned}$$

Each part of the ratio is worth 8 cakes. 56 small, 48 medium and 88 large cakes were sold.

$$56x + 48 \times 2x + 88 \times 3x = 532.48$$

$$56 + 48 \times 2 + 88 \times 3 = 416$$

$$416x = 532.48$$

$$x = \frac{532.48}{416}$$

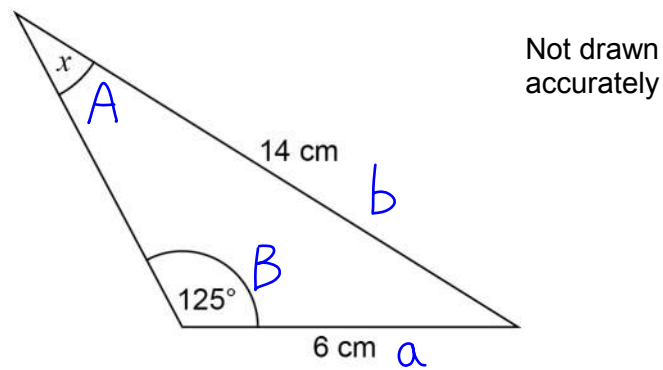
$$532.48/416 = 1.28$$

Answer £ 1.28

<https://youtu.be/9jCb3Fr0h-Y>



20

Work out the size of angle  $x$ .

[3 marks]

This is not a right-angled triangle and we have pairs of sides and their opposite angles. Therefore we should use the sine rule.

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

$$A = \sin^{-1}\left(\frac{a \sin B}{b}\right) = \sin^{-1}\left(\frac{6 \sin 125}{14}\right)$$

Answer 20.6 degrees

<https://youtu.be/M4u5JtviW4I>

Turn over for the next question

Turn over ►



21

Solve  $5x^2 = 10x + 4$

Give your answers to 2 decimal places.

**[4 marks]**

Its a quadratic. As the question wants an answer to 2 decimal places, it will not be possible to factorise. We could complete the square but it is faster to use the quadratic formula. The equation needs to be rearranged into the form  $ax^2 + bx + c = 0$

$$5x^2 - 10x - 4 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(5)(-4)}}{2(5)}$$

Put into calculator twice, once with an addition and then changed to a subtraction. Putting negative numbers in brackets when squaring.

Answer 2.34 or -0.34

[https://youtu.be/\\_GWCHhnEbzc](https://youtu.be/_GWCHhnEbzc)



22

A ball, dropped vertically, falls  $d$  metres in  $t$  seconds.

$d$  is directly proportional to the square of  $t$ .

The ball drops 45 metres in the first 3 seconds.

How far does the ball drop in the **next** 7 seconds?

[4 marks]

Distance in the next 7 seconds = distance in 10s - distance in first 3s.  
We can use the the data given and the proportion to find an equation for the distance given a certain time.

$$d \propto t^2$$

$$d = kt^2$$

$$k = \frac{d}{t^2} = \frac{45}{3^2} = 5$$

$$d = 5t^2$$

$$= 5 \times 10^2 = 500$$

$$500 - 45$$

Subtracting the first 3 seconds  
to get the last 7 seconds.

Substitute in the values for time and  
distance we know must satisfy the equation.

Distance travelled in 10 seconds.

Answer 455 metres

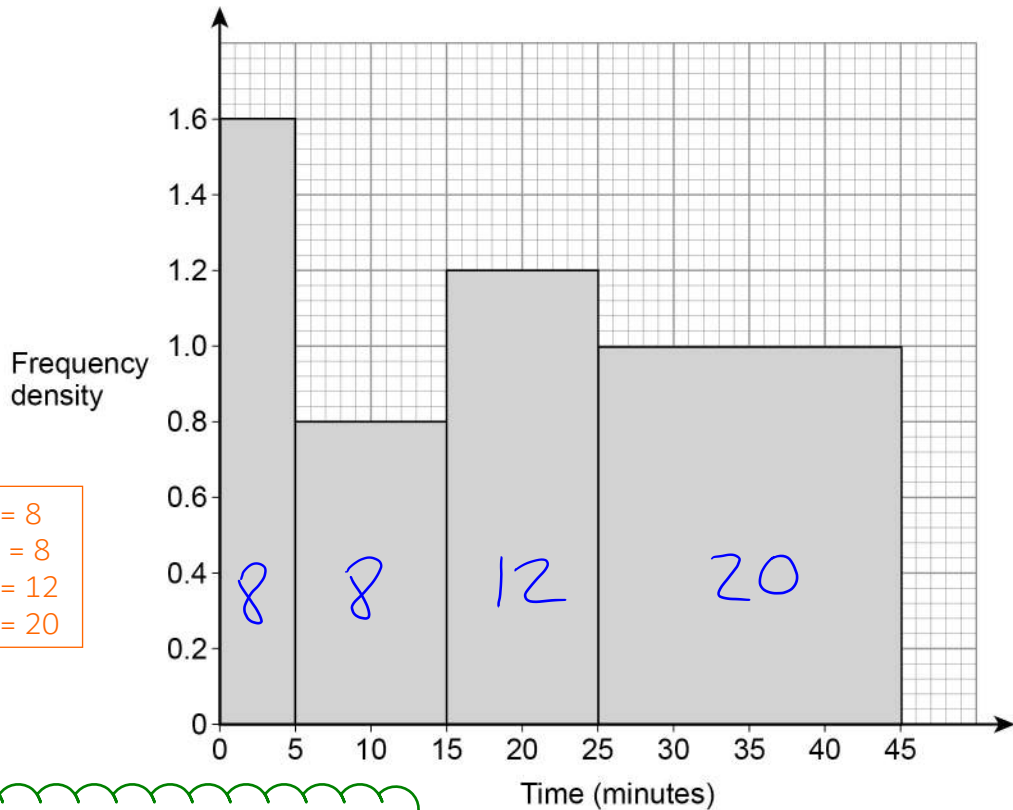
<https://youtu.be/q9jLxPguZJ4>

Turn over for the next question





24 48 students completed some homework.  
This histogram shows information about the times taken.



Frequency = class width x frequency density

Work out an estimate of the interquartile range.  
You **must** show your working.

[4 marks]

$$\frac{48}{4} = 12$$

$$12 \times 3 = 36$$

$$8, 16, 28, 48$$

The lower quartile is roughly 1/4 of the way through the data, so is the 12th value. The upper quartile is roughly 3/4 of the way through the data, so is the 36th value.

Working out the cumulative frequency to work out that the 12th value is in the second category and the 36th value is in the last category.

$$(25 + \frac{36-28}{20} \times 20) - (5 + \frac{12-8}{8} \times 10)$$

Interquartile range = upper quartile - lower quartile

Subtracting 28 from the 36th value works out how far into the last category it is. Putting this as a fraction of the 20 in the last category. Multiplying this fraction by the class width of the last category to estimate the upper quartile.

Answer 23 minutes

<https://youtu.be/d0hBAvlpPPQ>

7

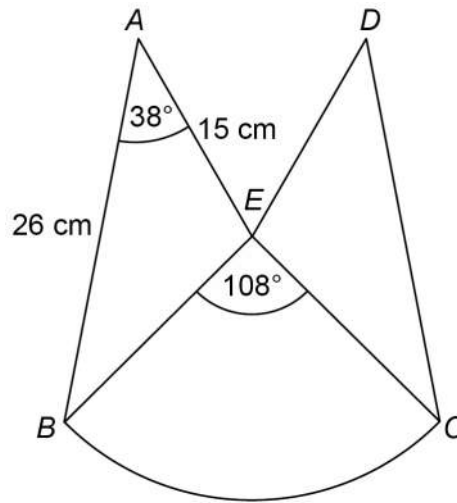
Turn over ►





25

The diagram shows a logo.

 $ABE$  and  $DCE$  are congruent triangles. $BCE$  is a sector of a circle, centre  $E$ .Not drawn  
accuratelyShow that the area of the logo is  $510 \text{ cm}^2$  to 2 significant figures.

[5 marks]

Area of logo = 2 x area of triangle + area of sector.  
 Area of triangle =  $(ab \sin C)/2$   
 Area of sector =  $(x^\circ/360)\pi r^2$   
 $r$  can be found with the cosine rule.  
 $a^2 = b^2 + c^2 - 2bc \cos A$

$$a = \sqrt{15^2 + 26^2 - 2 \times 15 \times 26 \times \cos 38} = r$$

Rearranged to make  $a$  the subject of the cosine rule. Substituted 15 for  $b$ , 26 for  $c$  and 38 for  $A$

$$2 \left( \frac{1}{2} \times 15 \times 26 \times \sin 38 \right) + \frac{108}{360} \times \pi \times r^2$$

Area of one of the triangles multiplied by 2

Area of the sector. Using the value of  $r$  calculated previously

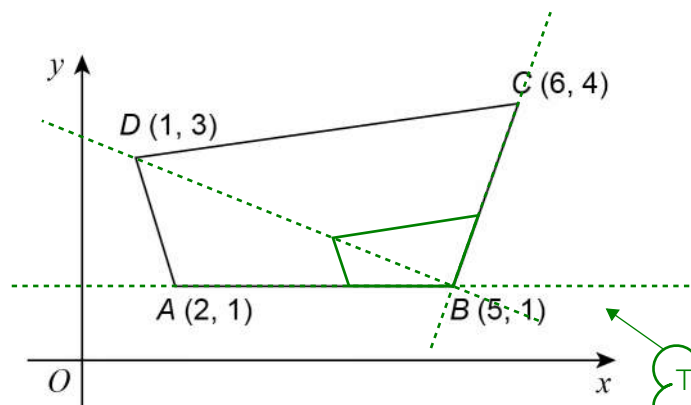
$$509.988... = 510$$

The answer rounds to 510 to 2 significant figures

<https://youtu.be/CKm4RcNTrzQ>



26 (a) A sketch of a quadrilateral  $ABCD$  is shown.



Not drawn  
accurately

The shape follows these  
lines of enlargement.

$ABCD$  is enlarged, centre  $B$ , scale factor  $\frac{1}{3}$

Circle the vertex that is invariant.

[1 mark]

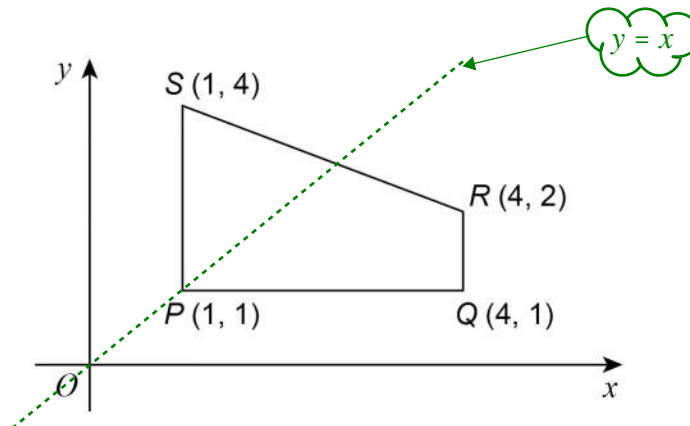
A

**B**

C

D

26 (b) A sketch of a quadrilateral  $PQRS$  is shown.



Not drawn  
accurately

$PQRS$  is reflected in the line  $y = x$

Circle the vertex that is invariant.

[1 mark]

**P**

Q

R

S

<https://youtu.be/fdvDWBIONaw>

7

Turn over ►



27 (a)  $h(x) = \sqrt[3]{x}$  for all values of  $x$

On the grid, draw the graph of the inverse function  $y = h^{-1}(x)$  for  $-2 \leq x \leq 2$

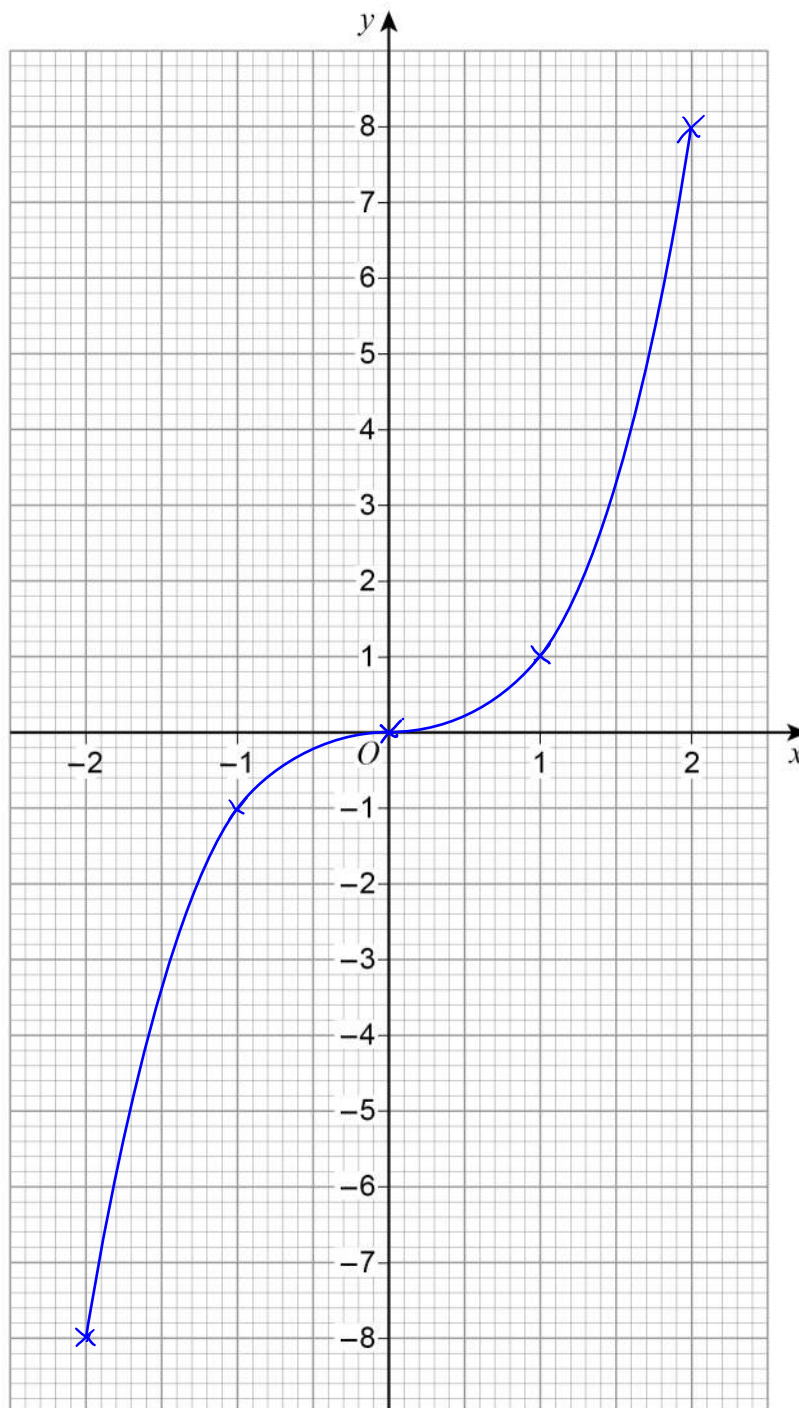
Inverse functions essentially do the opposite. Plot  $y$  values for  $x = -2, -1, 0, 1$  and  $2$  then join up with a line.

[2 marks]

$$h^{-1}(x) = x^3$$

The opposite of cube rooting  $x$  is cubing  $x$

Use table  
mode or  
 $(-2)^3 = -8$   
 $(-1)^3 = -1$   
 $0^3 = 0$   
 $1^3 = 1$   
 $2^3 = 8$



<https://youtu.be/GSL73723ltM>

**.CG Maths.**



27 (b) For all values of  $x$

$$f(x) = \sin x$$

$$g(x) = x + 90$$

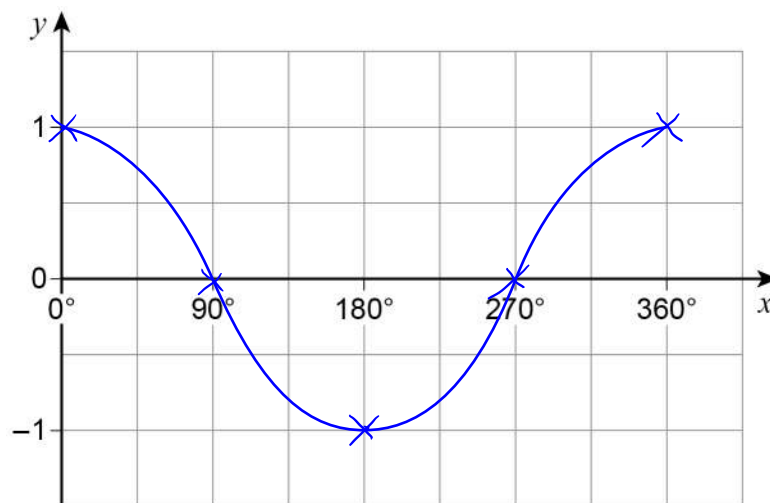
On the grid, draw the graph of the composite function  $y = fg(x)$  for  $0^\circ \leq x \leq 360^\circ$

$$fg(x) = f(g(x)) = f(x + 90)$$

[2 marks]

$$fg(x) = \sin(x + 90)$$

Use table mode or  
 $\sin(0 + 90) = 1$   
 $\sin(90 + 90) = 0$   
 $\sin(180 + 90) = -1$   
 $\sin(270 + 90) = 0$   
 $\sin(360 + 90) = 1$



<https://youtu.be/GSL73723ltM>

END OF QUESTIONS

