



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



Higher Tier

Paper 1 Non-Calculator

Tuesday 6 November 2018

Morning

Time allowed: 1 hour 30 minutes

### Materials

For this paper you must have:

- mathematical instruments



You must **not** use a calculator.

### Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- 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.

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	
<b>TOTAL</b>	

### Advice

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



N 0 V 1 8 8 3 0 0 1 H 0 1

Answer all questions in the spaces provided

Do not write  
outside the  
box

1 Simplify  $(5^4)^2 = 5^4 \times 5^4 = 5^{(4+4)}$

Circle your answer.

[1 mark]

$5^6$

$5^8$

$25^6$

$25^8$

2 Circle the volume, in  $\text{cm}^3$ , of a cylinder with radius 5 cm and height 8 cm

[1 mark]

$V_{\text{cyl}} = \pi r^2 h$

$40\pi$

$80\pi$

$200\pi$

$1600\pi$

3 Simplify  $16a^2 \div a + 3a \times 2$

Circle your answer.

[1 mark]

$22a$

$8a$

$38a$

$2a$

Must use BODMAS here

$16a^2 \div a + 3a \times 2$

$16a + 3a \times 2$

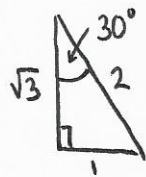
$16a + 6a$



Do not write outside the box

4 Circle the value of  $\cos 30^\circ$

[1 mark]



$\frac{1}{2}$

$\frac{\sqrt{3}}{2}$

$0$

$1$

5 Work out  $8\frac{1}{2} \div 2\frac{2}{3}$

Give your answer as a mixed number.

[4 marks]

$8\frac{1}{2} \div 2\frac{2}{3}$

$\frac{17}{2} \div \frac{8}{3}$

K S F

$\frac{17}{2} \times \frac{3}{8} = \frac{51}{16}$

$= 3\frac{3}{16}$

Answer \_\_\_\_\_

8
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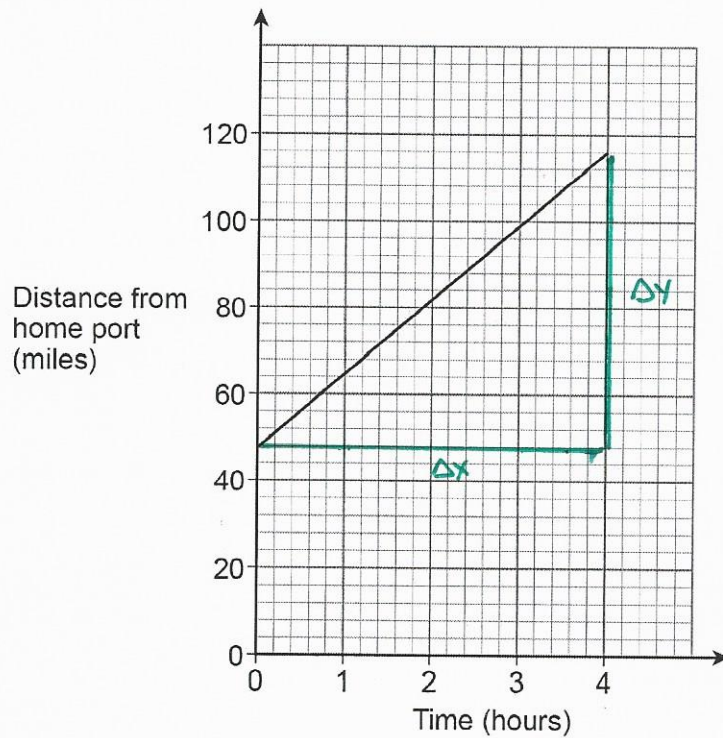
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6

A ship is sailing in a straight line from its home port.  
The distance-time graph shows 4 hours of the journey.



Work out the speed of the ship during these 4 hours.

[3 marks]

Speed is given by the gradient of the line

$$\frac{\Delta y}{\Delta x} = \frac{116 - 48}{4 - 0} = \frac{68}{4} = 17 \text{ miles per hour}$$

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



Do not write  
outside the  
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7

The sum of the angles in any quadrilateral is  $360^\circ$

For example, in a rectangle  $4 \times 90^\circ = 360^\circ$

Zak writes,

$5 \times 90^\circ = 450^\circ$  so the sum of the angles in any pentagon must be  $450^\circ$

Is he correct?

Tick a box.

Yes

No

Show working to support your answer.

[2 marks]

$$\begin{aligned} \text{Interior Angles} &= (\text{number of sides} - 2) \times 180 \\ &= (5 - 2) \times 180 \\ &= 3 \times 180 \\ &= 540^\circ \end{aligned}$$

Turn over for the next question

5

Turn over ►



0 5

8 Kim works at an airport in the UK.  
 She records the number of planes landing between 10 am and 2 pm each day.  
 The table shows the data for the first 10 days in January.

Day	1	2	3	4	5	6	7	8	9	10
Number of planes	148	151	147	155	153	147	155	102	151	154

8 (a) The airport was affected by fog on one of the days.

Which day do you think it was?  
 Give a reason for your answer.

[1 mark]

Day 8

Reason 102 is an outlier, all the others are in the range 147 → 155

8 (b) Kim uses the data to predict how many planes will land at the airport in a year.

In her method, she  
 uses an estimate of 150 planes in each 4-hour period throughout the day  
 assumes the same number of planes each day.

Work out her prediction.

[3 marks]

$24 \div 4 = 6$

$150 \times 6 = 900$

$900 \times 365 = 328500$

$$\begin{array}{r} 365 \\ \times 9 \\ \hline 3285 \end{array}$$

Answer \_\_\_\_\_



Do not write  
outside the  
box

8 (c) In fact,  
fewer planes land in winter than in summer  
fewer planes land at night than during the day.

What does this tell you about Kim's prediction?

Tick **one** box.

Her prediction is too low

Her prediction is too high

Her prediction could be too low or too high

Give a reason for your answer.

[2 marks]

There is not enough information to decide

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Turn over for the next question

6

Turn over ►



Do not write outside the box

9

$$\sqrt{6^2 + 8^2} = \sqrt[3]{125a^3}$$

Work out the value of  $a$ .

[4 marks]

$$\sqrt{6^2 + 8^2} = \sqrt[3]{125a^3}$$

$$\sqrt{36 + 64} = \sqrt[3]{125a^3}$$

$$\sqrt{100} = \sqrt[3]{125a^3}$$

$$10 = 5a$$

$$\div 5 \quad \div 5$$

$$2 = a$$

Answer \_\_\_\_\_

10

Work out the percentage increase from 80 to 280

[3 marks]

$$280 - 80 = 200$$

$$\frac{280}{80} \times 100 = 2.5 \times 100 = 250\%$$

Answer \_\_\_\_\_ %

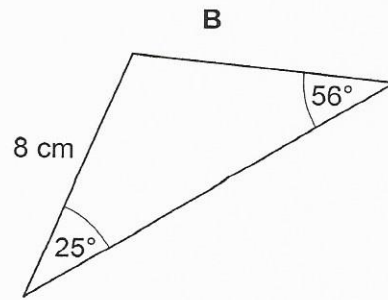
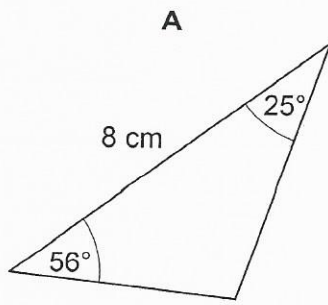




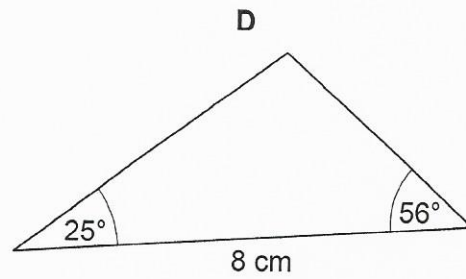
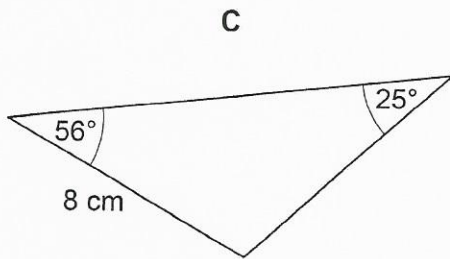
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11

Here are four triangles.



Not drawn  
accurately



Which **two** triangles are congruent?  
Circle **two** letters below.

[1 mark]

A

B

C

D

Turn over for the next question

8
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Turn over ►



Do not write outside the box

12

Solve  $x^2 - x - 12 = 0$

[3 marks]

$$(x - 4)(x + 3) = 0$$

$$x - 4 = 0$$

$$+4 \quad +4$$

$$x = 4$$

$$x + 3 = 0$$

$$-3 \quad -3$$

$$x = -3$$

Answer \_\_\_\_\_

13

$e:f = 2:3$  and  $f:g = 5:4$

Work out  $e:g$

Give your answer in its simplest form.

[3 marks]

$$e : f : g$$

$$2 : 3 \quad (\times 5)$$

$$5 : 4 \quad (\times 3)$$

$$10 : 15 : 12$$

$$e:f = \begin{matrix} 10:12 \\ \div 2 \quad \downarrow \quad \downarrow \quad \div 2 \\ 5:6 \end{matrix}$$

Answer \_\_\_\_\_ :

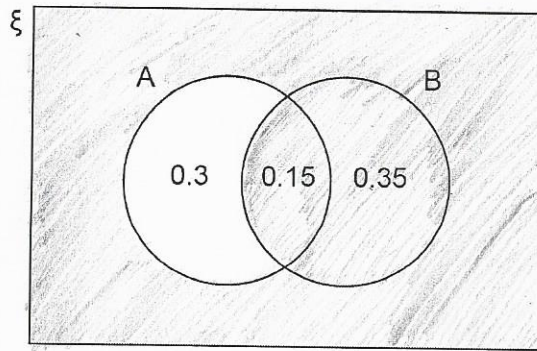


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14

A and B are two events.

Some probabilities are shown on the Venn diagram.



Work out  $P(A' \cup B)$

[2 marks]

•  $A' \cup B$  means 'not A' OR B (shaded)

• Whole is worth 1

$$\therefore P(A' \cup B) = 1 - 0.3 = 0.7$$

Answer \_\_\_\_\_

Turn over for the next question

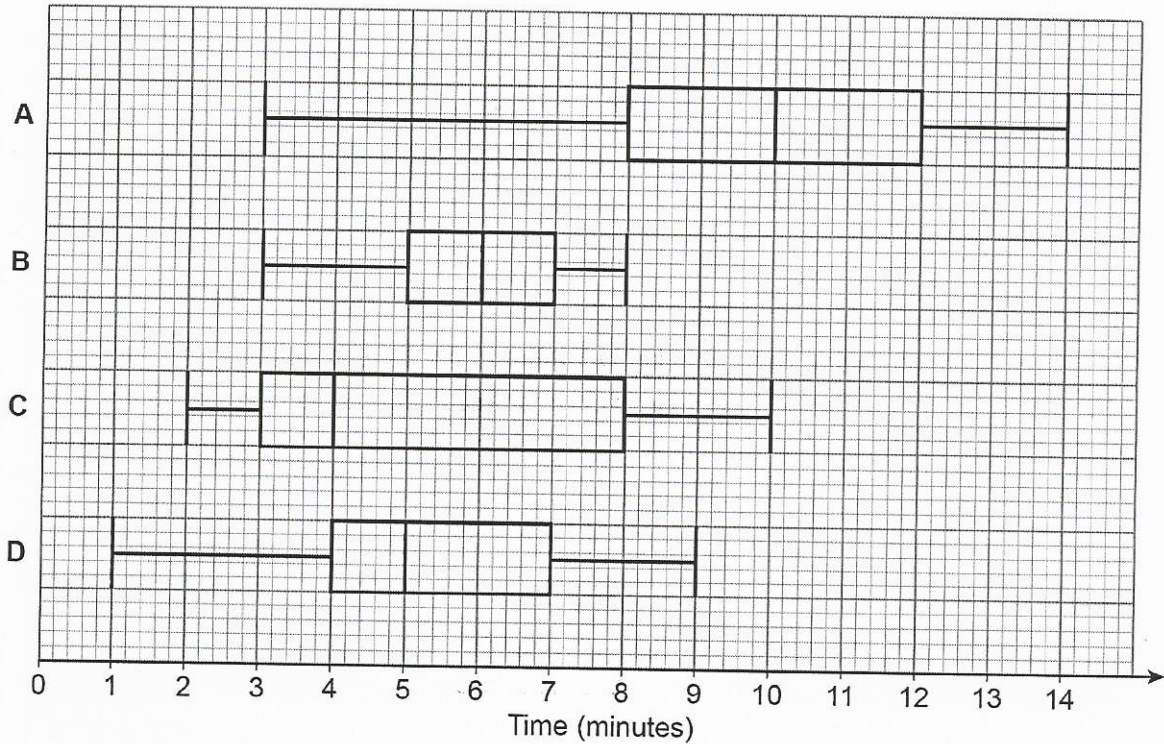
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15

In a survey, queuing times at supermarket checkouts were recorded. One morning, samples of 50 customers were taken at supermarkets A, B, C and D. The box plots represent the results.

Queuing times



15 (a) On average, which supermarket had the lowest queuing times?  
Give a reason for your answer.

[2 marks]

Supermarket C

Reason Lowest median of the four



Do not write outside the box

15 (b) At which supermarket were the queuing times most consistent?  
Give a reason for your answer.

[2 marks]

Supermarket B

Reason Interquartile range is the lowest

16 Circle the number that is closest to the value of  $29^3$

[1 mark]

27 000

90

2700

9000

HINT: Estimate the answer -

$$29^3 \approx 30^3$$

$$30 \times 30 \times 30 = 27000$$

17 Work out the exact value of  $\left(\frac{3}{4}\right)^{-3}$

[2 marks]

$$\left(\frac{3}{4}\right)^{-3} = \left(\frac{4}{3}\right)^3 = \frac{4^3}{3^3} = \frac{64}{27}$$

Answer \_\_\_\_\_

Turn over for the next question

7

Turn over ►



Do not write  
outside the  
box

18

Beth and Mia translate documents from Spanish into English.

A set of documents that would take Beth 8 days would take Mia 10 days.

Beth starts to translate the documents.

After 2 days Beth and Mia both work on translating the documents.

How many **more** days will it take to complete the work?

You **must** show your working.

[4 marks]

• After 2 days,  $\frac{1}{4}$  are done  $\therefore \frac{3}{4}$  are left

• Assume 80 papers (8x10)

$\therefore$  60 papers to do

Beth completes 10 per day, Mia completes 8

$\therefore$  18 per day

$\frac{60}{18} = 3\frac{1}{3}$  days  $\therefore$  4 days

Answer \_\_\_\_\_ days



Do not write  
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19 In a chess club, there are  $x$  boys and  $y$  girls.

19 (a) If 5 more boys and 8 more girls join, there would be half as many boys as girls.

Show that  $y = 2x + 2$

[2 marks]

$$2(x + 5) = y + 8$$

$$2x + 10 = y + 8$$

$$\begin{array}{r} -8 \\ -8 \end{array}$$

$$2x + 2 = y$$

19 (b) If instead,

10 more boys and 1 more girl join, there would be the same number of boys and girls.

Work out  $x$  and  $y$ .

[3 marks]

$$x + 10 = y + 1$$

$$\therefore x + 9 = y$$

Solve using sim eqns

$$2x + 2 = x + 9$$

$$\begin{array}{r} -x \\ -x \end{array}$$

$$x + 2 = 9$$

$$\begin{array}{r} -2 \\ -2 \end{array}$$

$$x = 7$$

$$x + 9 = y$$

$$(7) + 9 = y$$

$$y = 16$$

$x =$  \_\_\_\_\_

$y =$  \_\_\_\_\_

Turn over ►

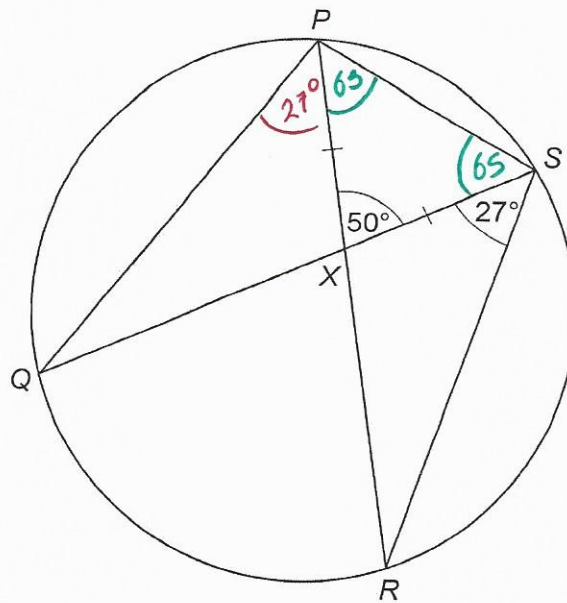


20

$P, Q, R$  and  $S$  are points on a circle.

$PXR$  and  $QXS$  are straight lines.

$PX = SX$



Not drawn accurately

Prove that  $QS$  is **not** a diameter of the circle.

[4 marks]

For  $QS$  to be a diameter,  $QPS$  must be  $90^\circ$

- $\triangle XPS$  is isosceles  $\angle RPS = (180 - 50) \div 2 = 65^\circ$
- $\angle QPR = \angle QSR = 27^\circ$  (Angles in the same segment)

$$65 + 27 = 92^\circ$$

$\therefore$  It cannot be a diameter.





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21

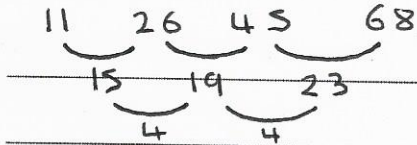
Here are the first four terms of a quadratic sequence.

11                  26                  45                  68

$$\underbrace{an^2}_{\text{Quad}} + \underbrace{bn+c}_{\text{Linear}}$$

Work out an expression for the  $n$ th term.

[3 marks]



$a$  is half of the 2<sup>nd</sup> difference  $\therefore a = 2$

$n$	1	2	3	4
$2n^2$	2	8	18	32
$bn+c$	9	18	27	36
$n^{\text{th}}$ term	11	26	45	68

9, 18, 27, 36 ... has an  $n^{\text{th}}$  term of  $9n$

Answer            $2n^2 + 9n$           

Turn over for the next question

Turn over ►



22

Solve  $\frac{x}{x+4} + \frac{7}{x-2} = 1$

You **must** show your working.

[4 marks]

$$\frac{x}{x+4} + \frac{7}{x-2} = 1$$

$$\frac{x(x-2) + 7(x+4)}{(x+4)(x-2)} = 1$$

$$x(x-2) + 7(x+4) = (x+4)(x-2)$$

$$x^2 - 2x + 7x + 28 = x^2 - 2x + 4x - 8$$

$$\begin{array}{r} x^2 + 5x + 28 = x^2 + 2x - 8 \\ -x^2 \qquad \qquad \qquad -x^2 \end{array}$$

$$\begin{array}{r} 5x + 28 = 2x - 8 \\ \qquad -28 \qquad \qquad -28 \end{array}$$

$$\begin{array}{r} 5x = 2x - 36 \\ -2x \qquad \qquad -2x \end{array}$$

$$3x = -36$$

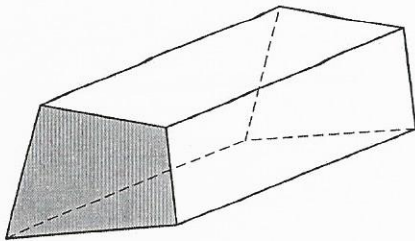
$$x = \underline{\qquad x = -12 \qquad}$$



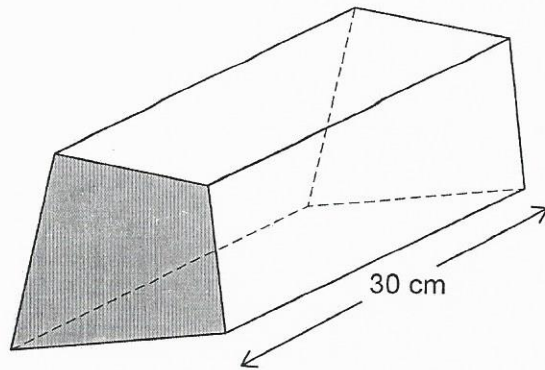
23

Prisms A and B are similar.  
The cross sections are shaded.

**Prism A**  
volume =  $480 \text{ cm}^3$



**Prism B**  
length = 30 cm



area of the cross section of A : area of the cross section of B = 4 : 9

Work out the area of the cross section of B.

[5 marks]

$$\text{Area}_A : \text{Area}_B = 4 : 9$$

$$\text{Length}_A : \text{Length}_B = \sqrt{4} : \sqrt{9} = 2 : 3$$

$$\therefore \text{Length}_A = (30 \div 3) \times 2 = 20 \text{ cm}$$

$$480 \div 20 = \text{Cross section A} = 24 \text{ cm}^2$$

$$(24 \div 4) \times 9 = 54 \text{ cm}^2$$

Answer \_\_\_\_\_  $\text{cm}^2$

9

Turn over ►



24

Show that  $\frac{2\sqrt{6}}{\sqrt{5}} - \frac{\sqrt{3}}{\sqrt{10}}$  can be written in the form  $\frac{c\sqrt{d}}{10}$

where  $c$  and  $d$  are integers.

[3 marks]

$$\frac{2\sqrt{6}}{\sqrt{5}} - \frac{\sqrt{3}}{\sqrt{10}}$$

$$\frac{2\sqrt{6}\sqrt{2}}{\sqrt{5}\sqrt{2}} - \frac{\sqrt{3}}{\sqrt{10}}$$

$$\frac{2\sqrt{12}}{\sqrt{10}} - \frac{\sqrt{3}}{\sqrt{10}} = \frac{4\sqrt{3} - \sqrt{3}}{\sqrt{10}} = \frac{3\sqrt{3}}{\sqrt{10}}$$

Rationalise the denominator

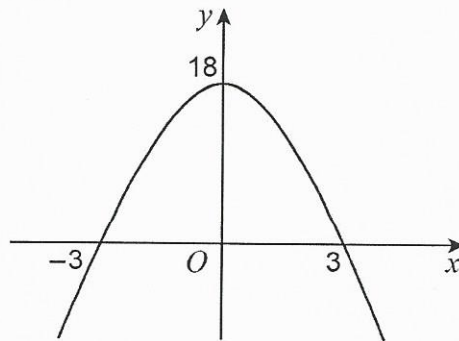
$$\frac{3\sqrt{3}}{\sqrt{10}} \times \frac{\sqrt{10}}{\sqrt{10}} = \frac{3\sqrt{30}}{10}$$



25

A quadratic curve intersects the axes at  $(-3, 0)$ ,  $(3, 0)$  and  $(0, 18)$

Must be of the form  $y = ax^2 + bx + c$



Not drawn accurately

Work out the equation of the curve.

[3 marks]

$c = 18$

Solutions at  $(3, 0)$  and  $(-3, 0)$ .

$(3, 0) = a(3)^2 + b(3) + 18 = 0 \Rightarrow 9a + 3b = -18$

$(-3, 0) = a(-3)^2 + b(-3) + 18 = 0 \Rightarrow 9a - 3b = -18$

$6b = 0 \therefore b = 0$

@  $(3, 0)$   $9a = -18 \therefore a = -2$

Answer  $y = -2x^2 + 18$

or

$y = 18 - 2x^2$

Turn over for the next question

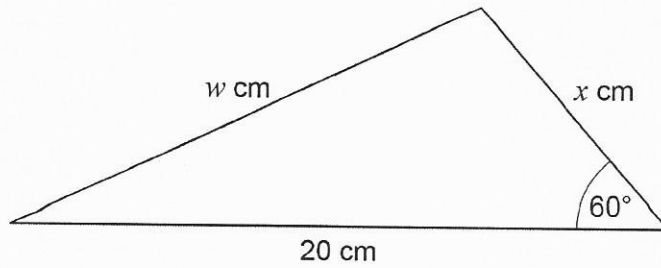
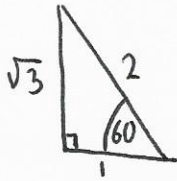


Do not write outside the box

26

The area of this triangle is  $25\sqrt{3} \text{ cm}^2$

Not drawn accurately



Work out the value of  $w$ .

Give your answer in the form  $a\sqrt{b}$  where  $a$  and  $b$  are integers greater than 1

[5 marks]

$$\text{Area} = \frac{1}{2} ab \sin C$$

$$25\sqrt{3} = \frac{1}{2} \times x \times 20 \times \frac{\sqrt{3}}{2}$$

$$\therefore 25 = 5x$$

$$x = 5$$

$$w^2 = (5^2 + 20^2) - (2 \times 5 \times 20 \times \cos 60)$$

$$= (25 + 400) - (2 \times 5 \times 20 \times \frac{1}{2})$$

$$= 425 - 100$$

$$= 325$$

$$w = \sqrt{325} = \sqrt{25 \times 13}$$

$$= 5\sqrt{13}$$

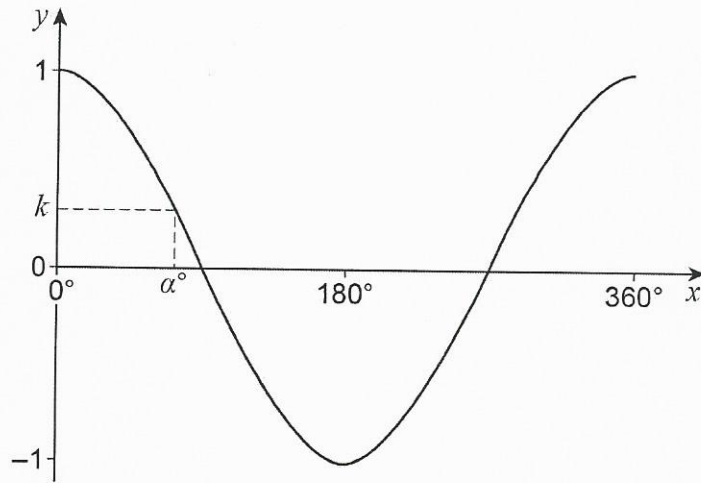
Answer \_\_\_\_\_



Do not write  
outside the  
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27

Here is a sketch of  $y = \cos x$  for values of  $x$  from  $0^\circ$  to  $360^\circ$



$\alpha^\circ$  is an acute angle.

$\cos \alpha^\circ = k$

27 (a) Circle the value of  $\cos (180^\circ - \alpha^\circ)$

[1 mark]

$1 - k$

$k$

$-k$

$-1 - k$

27 (b) Circle the value of  $\cos (360^\circ + \alpha^\circ)$

[1 mark]

$k - 1$

$k + 1$

$-k$

$k$

END OF QUESTIONS

7

