

Please write clearly in block capitals.

Centre number       Candidate number

Surname \_\_\_\_\_

Forename(s) \_\_\_\_\_

Candidate signature \_\_\_\_\_

**GCSE  
MATHEMATICS**

**H**

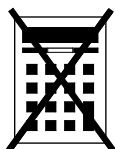
Higher Tier Paper 1 Non-Calculator

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.



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 Simplify  $(5^4)^2$   
Circle your answer.

[1 mark]

$5^6$

$5^8$

$25^6$

$25^8$

$$(a^x)^y = a^{xy}$$

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

[1 mark]

$40\pi$

$80\pi$

$200\pi$

$1600\pi$

A cylinder is similar to a prism, so volume = cross-sectional area x length  
The cross section is a circle and the length is the height  
Area of circle =  $\pi r^2$

- 3 Simplify  $16a^2 \div a + 3a \times 2$   
Circle your answer.

[1 mark]

$22a$

$8a$

$38a$

$2a$

Follow the order of operations (BIDMAS).  
Division is first, then multiplication, then addition



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

[1 mark]

$$\frac{1}{2}$$

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

0

1

The angles we need to remember are 0, 30, 45, 60 and 90. List these out then write 4, 3, 2, 1 and 0 under them. Square root them and put them over 2

5 Work out

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

Give your answer as a mixed number.

[4 marks]

1. Convert into improper fractions by multiplying the whole number by the denominator then adding the result to the numerator.

2. Divide by a fraction by using 'keep, change, flip'.

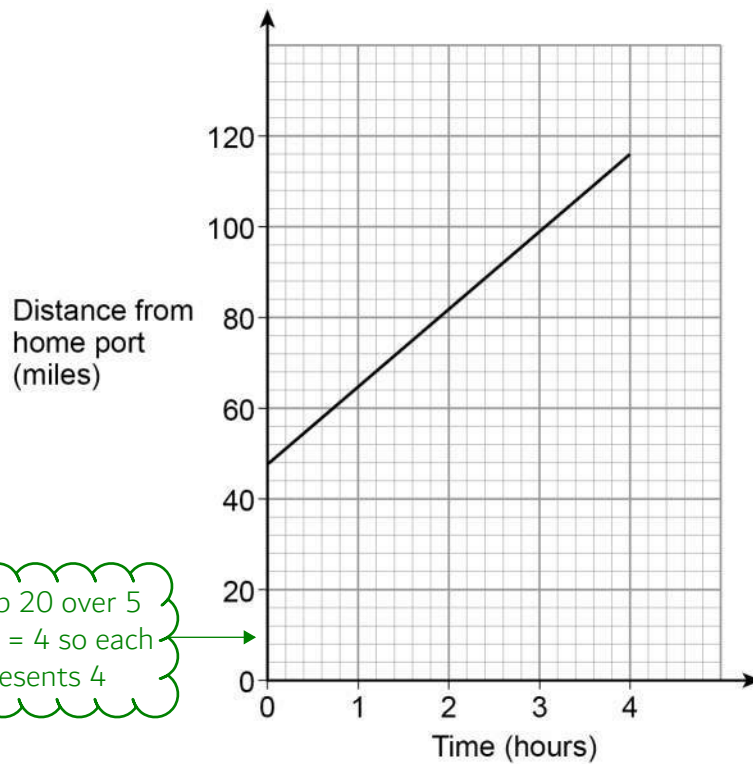
3. Multiply the fractions by multiplying the numerators and denominators together.

4. Divide the numerator by the denominator to work out the whole number and leave the remainder in the fraction

Answer \_\_\_\_\_



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



The scale goes up 20 over 5 small boxes.  $20/5 = 4$  so each small box represents 4

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

[3 marks]

Miles per hour so we need to divide the miles by the hours

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



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]

Sum of interior angles =  $(n - 2) \times 180$ , where  
n is the number of sides of the polygon

Turn over for the next question



- 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 \_\_\_\_\_

Reason \_\_\_\_\_

All of the other days are  
around 150 apart from one

- 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]

There are 24 hours in a day and 365 days in a year. First work out how many planes there would be in a day by multiplying 150 by the number of 4-hour periods in a day. Then multiply this by the number of days in a year

Answer \_\_\_\_\_



- 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]**

The prediction was based on the data collected from 10am to 2pm in January. This is in the day and in the Winter

**Turn over for the next question**





9

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

Work out the value of  $a$ .**[4 marks]**

On the left side, work out  $6^2$  and  $8^2$ , add them together then square root. On the right side, cube root 125 and cube root  $a^3$  and leave them multiplied together. This will make an equation which is much easier to solve with some simple rearranging

Answer \_\_\_\_\_

10

Work out the percentage increase from 80 to 280

**[3 marks]**

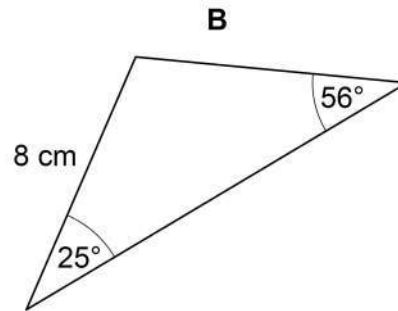
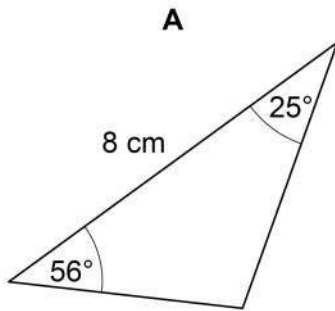
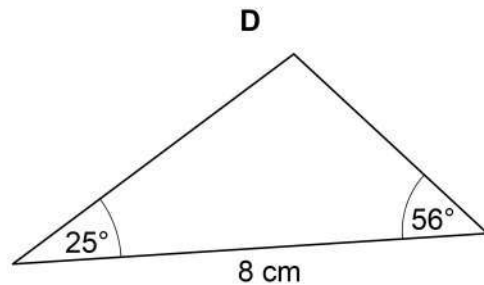
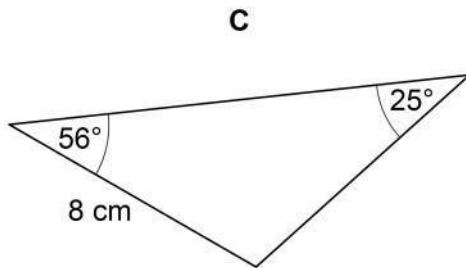
Express the increase as a fraction of the original, simplify the fraction (by dividing the numerator and denominator by the same amount) until the denominator can be multiplied to get 100. Percentage is out of 100 so is the numerator when the fraction is expressed out of 100

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



11

Here are four triangles.

Not drawn  
accurately

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

Identical except that they  
can be rotated or reflected

[1 mark]

A

B

C

D

All the triangles have the same angles and a side of 8cm. The 8cm  
needs to be opposite the same angle in both congruent triangles

Turn over for the next question

Turn over ►



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

[3 marks]

$$(x \quad)(x \quad) = 0$$

Factorise the left side. Look for two numbers which multiply to -12 and add to -1 and put these in the brackets with x. Then use the fact that one of the brackets must be equal to 0 in order to multiply to 0 to write two different equations which can be rearranged to find x

Answer \_\_\_\_\_

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

Work out  $e : g$

Give your answer in its simplest form.

[3 marks]

Combine the ratios together into the ratio  $e : f : g$ .  $f$  is in common to both ratios so they must have the same number of parts for  $f$  in order to be compatible. Find a common multiple of 3 and 5 and multiply both the 3 and 5 to get it. Multiplying both sides of the ratios by the same amount converts them.

Once there is the ratio  $e : f : g$ ,  $f$  can be ignored to get the ratio  $e : g$ . It can be simplified by dividing both sides by the same amount until they can't be divided any more while still being whole numbers

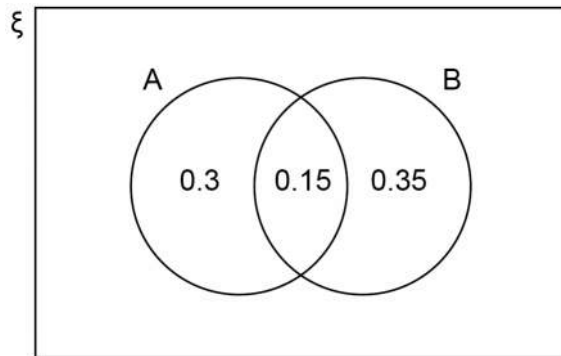
Answer \_\_\_\_\_ : \_\_\_\_\_



14

A and B are two events.

Some probabilities are shown on the Venn diagram.

Work out  $P(A' \cup B)$ **[2 marks]**

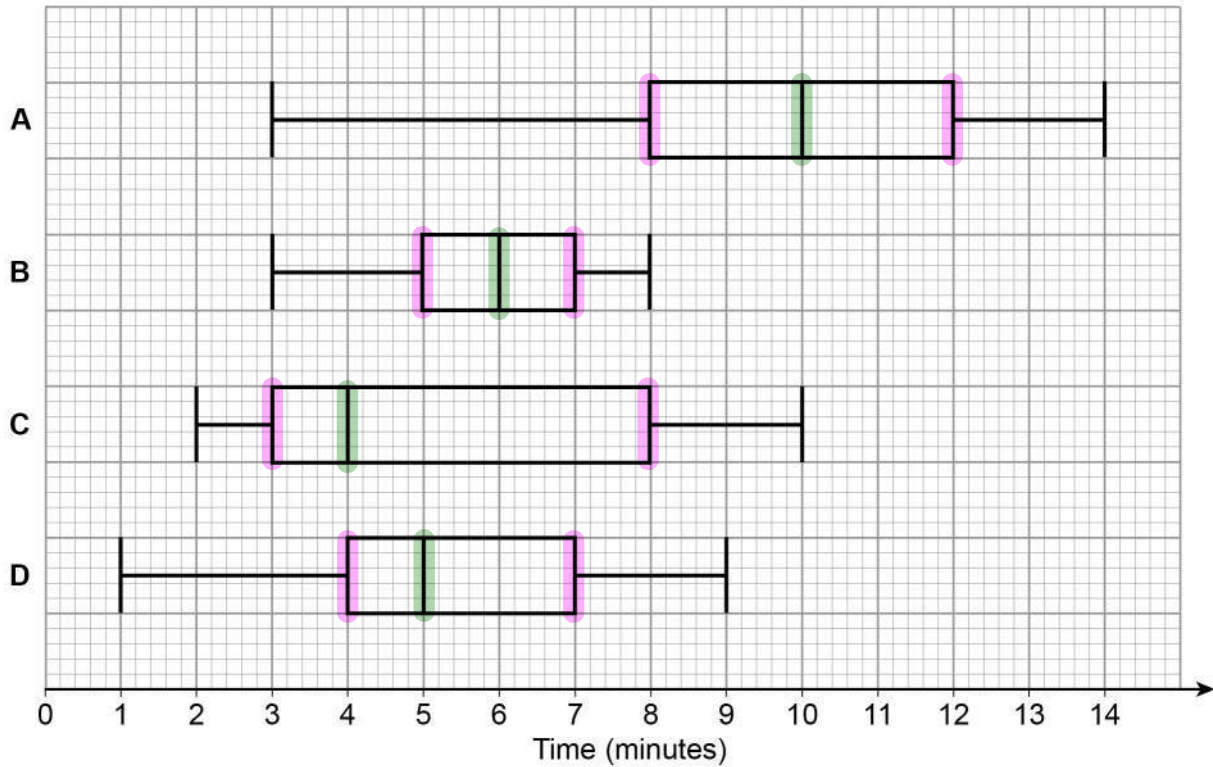
Probability it is the union of not A and B. To find the union, highlight everything which is not A and everything which is B in a different colour. Anything highlighted is in the union

Answer \_\_\_\_\_

**Turn over for the next question****Turn over ►**

- 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 \_\_\_\_\_

Reason \_\_\_\_\_

Compare the medians (highlighted in green)



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

**[2 marks]**

Supermarket \_\_\_\_\_

Reason \_\_\_\_\_

Compare the interquartile ranges (difference between the quartiles, highlighted in pink)

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

**[1 mark]**

27 000

90

2700

9000

An estimate is  $30^3$ . Do not work out  $29^3$

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

**[2 marks]**

First cube the 3 and 4, ignoring the negative part of the power for now. Then consider the negative part (which basically means to do the reciprocal)

Answer \_\_\_\_\_

**Turn over for the next question****Turn over ►**

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]

Time = distance/speed. Distance is basically how much of the documents still need to be translated. Speed is basically how much of the documents are completed each day.

As it would take Beth 8 days, she would complete  $\frac{1}{8}$  of the documents per day (this is Beth's speed). As it would take Mia 10 days, she would complete  $\frac{1}{10}$  of the documents per day (this is Mia's speed). Adding together the amounts of documents they complete each day gives the total amount of documents completed each day when both Beth and Mia are working on them (the speed of both working together).

To work out how much of the documents still need to be completed (the distance), subtract the fraction of the documents which Beth would complete in 2 days from 1 set of documents

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



**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]**

Express the number of boys and girls there would be at the club in terms of  $x$  and  $y$  and make an equation by halving the expression of the number of girls and setting them equal to the expression for the number of boys. Rearrange the equation to make  $y$  the subject

**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]**

Express the number of boys and girls there would be at the club in terms of  $x$  and  $y$  and set them equal to each other. Then solve this equation and the one in part (a) by using simultaneous equations.

Start by eliminating the  $y$  terms by substituting  $y$  for  $2x + 2$  (as  $y = 2x + 2$ ). The result can be rearranged to find  $x$ . Then substitute the value of  $x$  into the equation  $y = 2x + 2$  to find  $y$

$$x = \underline{\hspace{10cm}}$$

$$y = \underline{\hspace{10cm}}$$



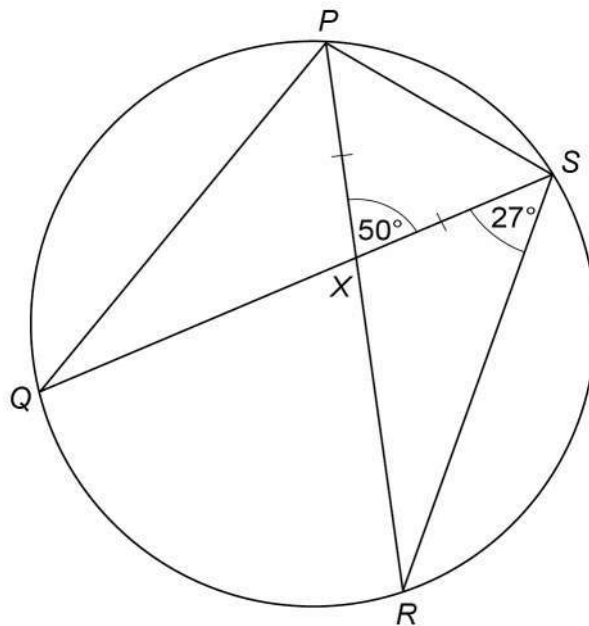


20

$P$ ,  $Q$ ,  $R$  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]

Adding angles  $QPR$  and  $XPS$  gives angle  $QPS$ . Angle  $QPS$  must be  $90$  degrees if it is in a semicircle.  $QS$  would be the diameter of the semicircle.

Angles in the same segment are equal, there are  $180$  degrees in a triangle and base angles of an isosceles triangle are equal. These facts can be used to find angles  $QPR$  and  $XPS$



21

Here are the first four terms of a quadratic sequence.

11

26

45

68

Work out an expression for the  $n$ th term.**[3 marks]**

The quadratic sequence will be in the form  $an^2 + bn + c$ .

Find the differences between the terms then work out the second difference (the difference of the differences).  $a$  is half of the second difference.

List the sequence of  $an^2$ . List the differences between that sequence and the original sequence. This forms a sequence which needs to be added to  $an^2$  to get the original.

The sequence which needs to be added will be a linear sequence  $bn + c$ .  $b$  is what the sequence goes up in and  $c$  is the 0th term

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Answer \_\_\_\_\_

**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]**

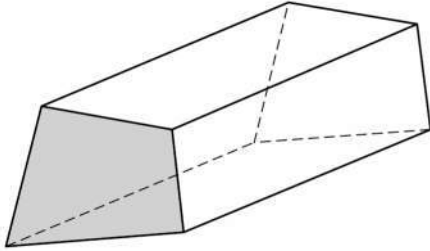
Multiply all terms by one of the denominators then by the other denominator to get rid of the denominators. Expand and simplify any brackets created. Rearrange and solve to find x

$x = \underline{\hspace{10em}}$

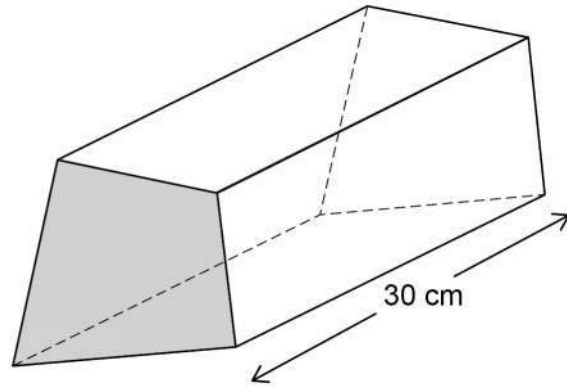


23

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]**

Volume of a prism = (cross sectional area) x length

Rearrange this formula to make the cross sectional area the subject then substitute in the values of the volume of Prism B and the length of Prism B. We already have the length of Prism B, we just need to find it's volume.

Convert the ratio of the areas into the ratio of the lengths (by square rooting both sides as area is a squared dimension) then the ratio of the volumes (by cubing both sides of the ratio of the lengths). Use the ratio of the volumes to find the volume of Prism B

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



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

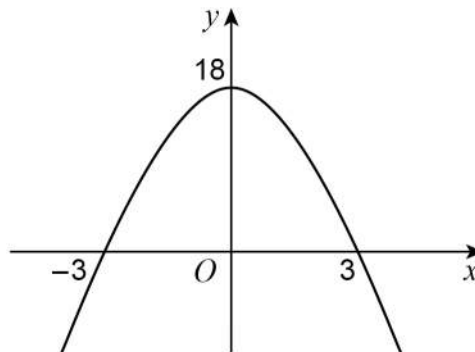
where  $c$  and  $d$  are integers.

[3 marks]

Rationalise both of the denominators by multiplying the numerators and denominators by something which eliminates the surds from the denominators (hint: to get rid of a root, it can be squared by being multiplied by itself). Then focus on combining the fractions by making the denominators the same. The numerators can be subtracted when the denominators are the same, with the denominator not changing



25

A quadratic curve intersects the axes at  $(-3, 0)$ ,  $(3, 0)$  and  $(0, 18)$ Not drawn  
accurately

Work out the equation of the curve.

**[3 marks]**

The equation is a quadratic so must be in the form  $y = ax^2 + bx + c$ .  
 Substitute in the coordinates of  $(0, 18)$  to find  $c$  ( $x = 0$  and  $y = 18$ ).  
 Substitute the other two coordinates to form a pair of equations  
 which can be solved simultaneously to find  $a$  and  $b$

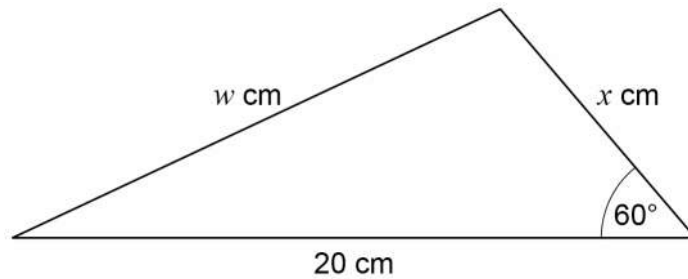
Answer \_\_\_\_\_

**Turn over for the next question**

Turn over ►



26

The area of this triangle is  $25\sqrt{3} \text{ cm}^2$ Not drawn  
accuratelyWork 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]**

The cosine rule can be used to find side  $w$  (the sine rule can't be used as there isn't opposite pairs of sides and angles). Rearrange to make  $a$  the subject and substitute in 20 for  $b$  and  $x$  for  $c$  and work out  $\cos A$ .

Area of triangle =  $\frac{1}{2} ab \sin C$ . Substitute 20 for  $a$ ,  $x$  for  $b$  and work out  $\sin C$ . Rearrange to make  $x$  the subject to find  $x$ .

To work out the values of  $\sin 60$  and  $\cos 60$ , list the angles we need to remember (0, 30, 45, 60, 90) then list 0, 1, 2, 3, 4 under for the sin values and 4, 3, 2, 1, 0 for the cos values. Square root then put them over 2.

The answer for  $w$  needs to be simplified into the form  $a\sqrt{b}$ . To do this, find a square number which goes into the unsimplified surd. Use  $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$  in reverse to split it into two separate surds, one of which can be square rooted to get a

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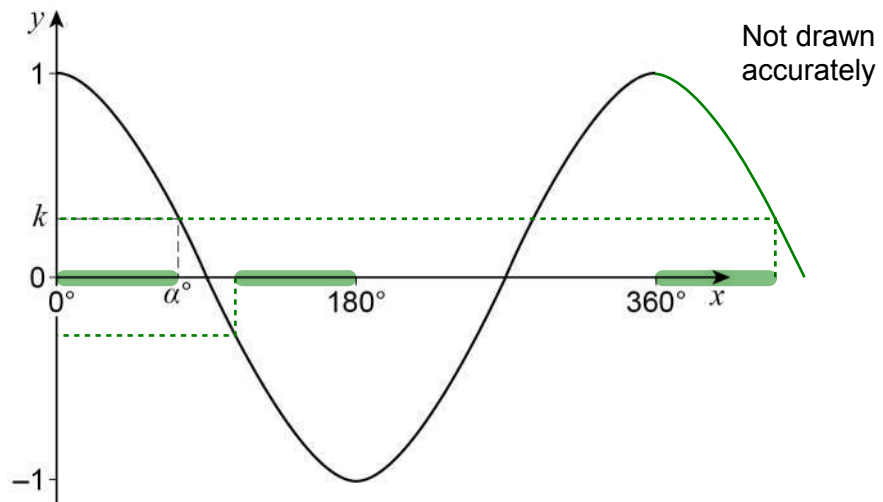
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Answer \_\_\_\_\_



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.  
 $\cos \alpha^\circ = k$

All the distances highlighted in green are the same. The graph is drawn accurately enough to work out which values are correct from drawing up or down to the curve then across to the y-axis

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

