AQA

Model Solutions

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE MATHEMATICS

H

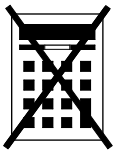
Higher Tier Paper 1 Non-Calculator

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.

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	
TOTAL	

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

IB/M/Nov18/E3

8300/1H

Answer **all** questions in the spaces provided

Do not write outside the box

1 Simplify $(5^4)^2 = 5^{4\times2} = 5^8$

Circle your answer.

[1 mark]

5^6 5^8 25^6 25^8

2 Circle the volume, in cm^3, of a cylinder with radius 5 cm and height 8 cm

[1 mark]

40π 80π 200π 1600π

Volume $= \pi r^2 \times h$

$\pi \times 5^2 \times 8 = (25 \times 8)\pi$

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

Circle your answer.

BIDMAS

[1 mark]

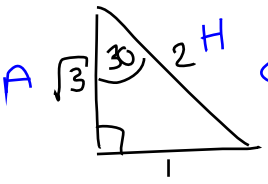
$22a$ $8a$ $38a$ $2a$

$= (16a^2 \div a) + (3a \times 2)$

$= 16a + 6a$

Do not write outside the box

4 Circle the value of cos 30° **[1 mark]**



$\frac{1}{2}$ $\quad$ $\frac{\sqrt{3}}{2}$ $\quad$ 0 $\quad$ 1

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

Give your answer as a mixed number.

[4 marks]

$8\frac{1}{2} = \frac{17}{2}$

$2\frac{2}{3} = \frac{8}{3}$

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

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

$51 - 48 = 3$

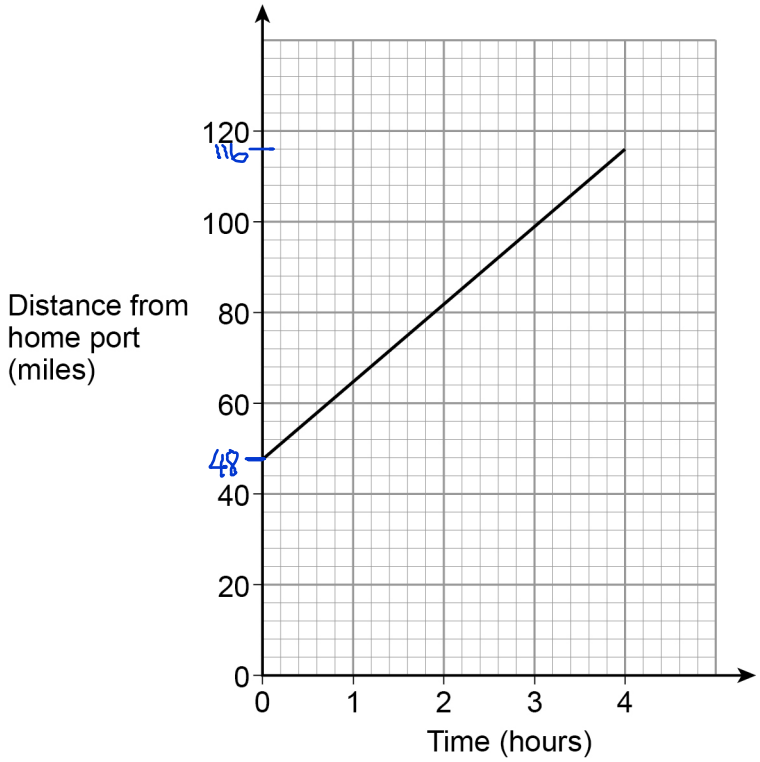
Answer $3\frac{3}{16}$

8

Do not write outside the box

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 = dist / time

116 − 48

Dist travelled = 116 − 48 = 68

Speed = 68 / 4

Answer 17 mph

Do not write outside the box

7 The sum of the angles in any quadrilateral is 360°

For example, in a rectangle 4 × 90° = 360°

Zak writes,

5 × 90° = 450° so the sum of the angles in any pentagon must be 450°

Is he correct?

Tick a box.

☐ Yes ☑ No

Show working to support your answer.

[2 marks]

Sum of angles = 180(n-2) n= number of sides

Pentagon: 180(5-2) = 180×3

180×3 = 540°

In a pentagon, the number of sides must add up to 540°. 450° is less than this

Turn over for the next question

5

Do not write outside the box

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 because 102 is an outlier (too low)

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]

In 1 day: $150 \times 6 = 900$ planes.

In 365 days (1 year): $900 \times 365 = 328,500$ planes

$$\begin{array}{r} {}^{5}{}^{4} \\ 365 \\ \times\ 9 \\ \hline 3285 \end{array}$$

Answer 328,500

Do not write outside the box

8 (c) In fact,

fewer planes land in winter (January) 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
- [x] Her prediction could be too low or too high

Give a reason for your answer.

[2 marks]

Fewer landings in winter would make the estimation too low, but fewer landing at night would make it too high

Turn over for the next question

6

Do not write outside the box

9 $\sqrt{6^2 + 8^2} = \sqrt[3]{125a^3}$

Work out the value of a.

[4 marks]

$\sqrt{6^2+8^2} = \sqrt{36+64}$

$= \sqrt{100} = 10$

$\sqrt[3]{125a^3} = 5a$

$10 = 5a$

$\div 5$

Answer $a = 2$

10 Work out the percentage increase from 80 to 280

[3 marks]

$\%$ increase $= \frac{\text{change}}{\text{original}} \times 100$

$= \frac{280-80}{80} \times 100$

$= \frac{200}{80} \times 100$

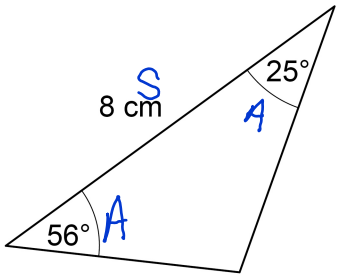
$= 2.5 \times 100$

Answer 250 %

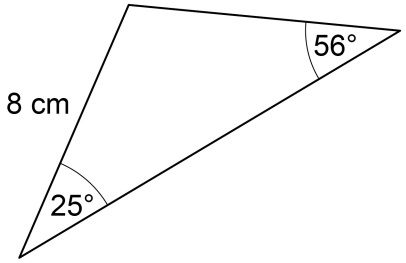
Do not write outside the box

11 Here are four triangles.

A



B



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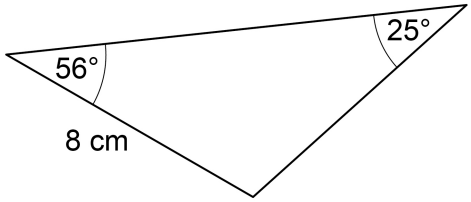
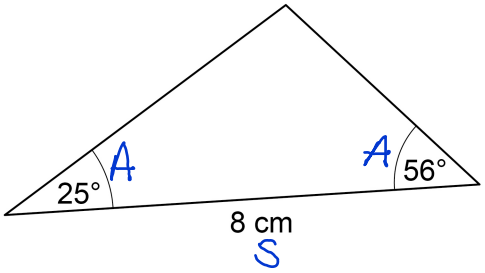
C



D



Which **two** triangles are congruent? - identical in size and shape

Circle **two** letters below.

[1 mark]

A B C D

Turn over for the next question

8

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

[3 marks]

Factorise: X to -12 and + to -1

-4, 3

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

$x - 4 = 0$ or $x + 3 = 0$

$x = 4$ $x = -3$

Answer $x = 4$ or $x = -3$

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 f : g

2 : 3 x5 5 : 4 x3

10 : 15 15 : 12

to make a common factor of 15.

e : f : g e : g

10 : 15 : 12 10 : 12

÷2

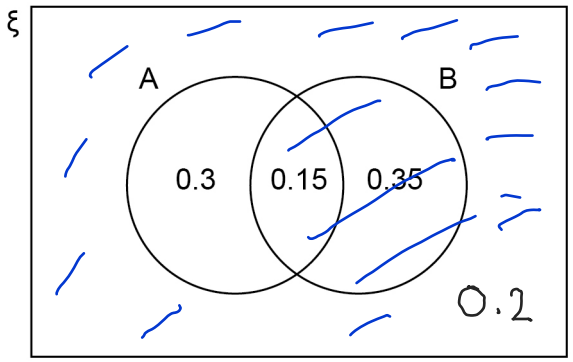
=

Answer 5 : 6

Do not write outside the box

14 A and B are two events.

Some probabilities are shown on the Venn diagram.



1 − 0.3 − 0.15 − 0.35
= 1 − 0.8
= 0.2

Work out $P(A' \cup B)$ → P(Not A or B)

[2 marks]

P = 0.15 + 0.35 + 0.2

= 0.7

Answer 0.7

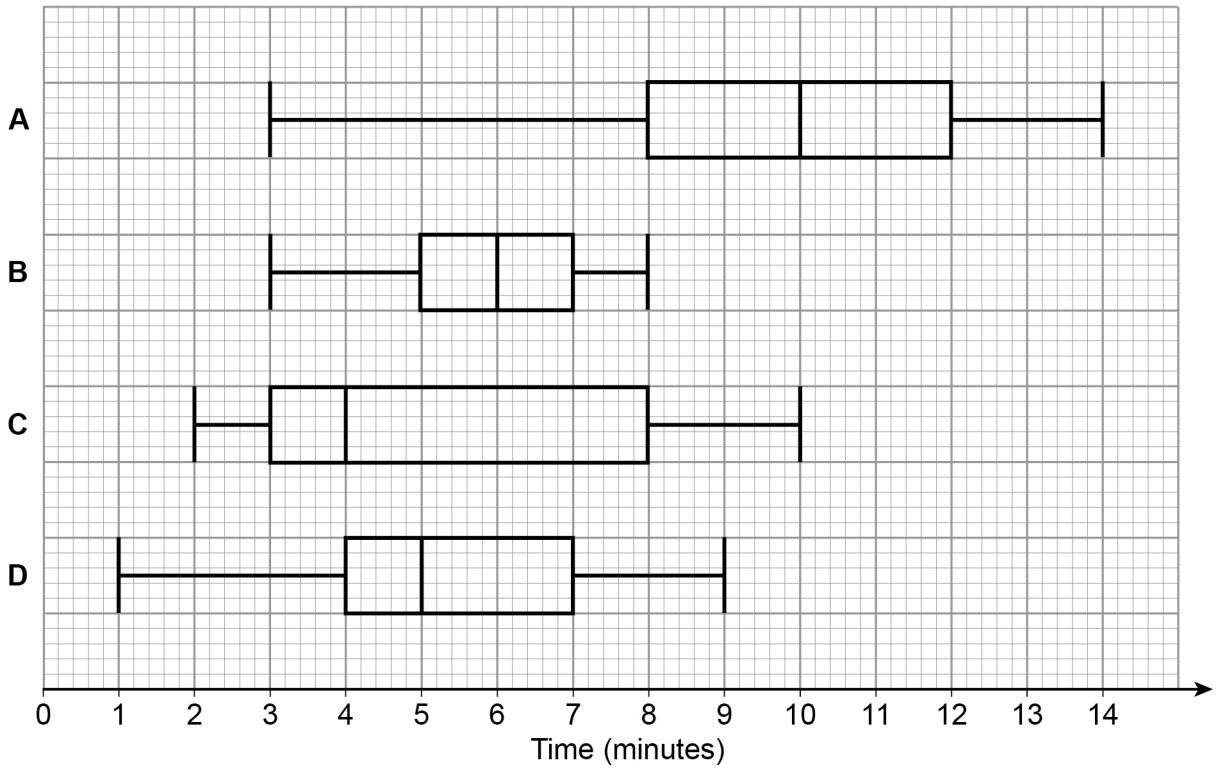
Turn over for the next question

8

Do not write outside the box

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 has the lowest median

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 has the lowest interquartile range

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

[1 mark]

(27 000) 90 2700 9000

$29 \approx 30$ $30^3 = 30 \times 30 \times 30 = 27000$

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

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

[2 marks]

Answer $\frac{64}{27}$ or $2\frac{10}{27}$

Turn over for the next question

7

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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]

Beth has worked $\frac{2}{8} = \frac{1}{4}$ Total

Work is $\frac{1}{4}$ finished

$\frac{3}{4}$ left.

$\frac{1}{8} + \frac{1}{10} = \frac{10+8}{80} = \frac{18}{40} = \frac{9}{40}$ ← Total work done a day

work left $\frac{3}{4} \div \frac{9}{40} = \frac{3}{4} \times \frac{40}{9} = \frac{120}{36}$ ÷12 days to complete

$=$

Answer $\frac{10}{3} = 3\frac{1}{3}$ days

Do not write outside the box

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]

① $x+5$

② $y+8$

③ $x+5 = \frac{1}{2}(y+8)$ ×2

$= 2(x+5) = y+8$ ×2

$2x+10 = y+8$

-8

$2x+2 = y$

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]

① $x+10$

② $y+1$

$x+10 = y+1$

$x+9 = y$

From (a) $y = 2x+2$

$x+9 = 2x+2$

$-x$

$9 = x+2$

-2

$7 = x$

$x =$ 7

$y = x+9$

$= 7+9$

$y =$ 16

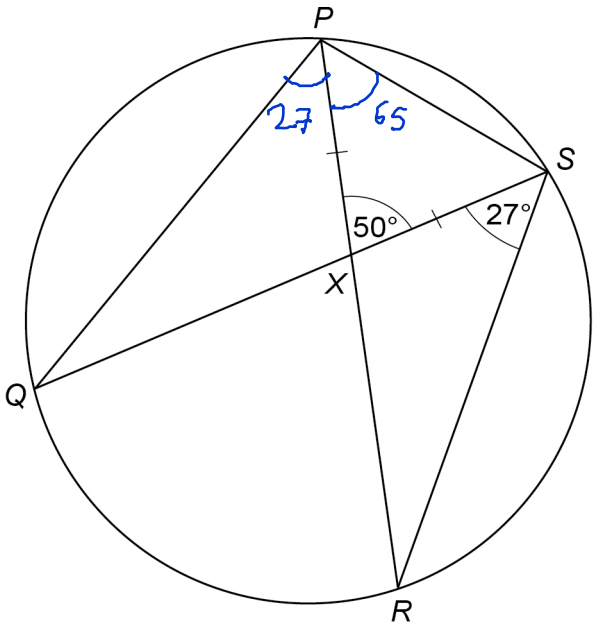
9

Do not write outside the box

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

PXR and *QXS* are straight lines.

PX = *SX*



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Prove that *QS* is **not** a diameter of the circle. Prove $\angle QPS \neq 90°$

[4 marks]

$\angle QPR = 27°$ angles in same chord

$\angle XPS = \frac{180-50}{2} = \frac{130}{2} = 65°$ Angle in isosceles triangle

$\angle QPS = 65 + 27 = 92°$

$\angle QPS \neq 90°$, therefore QS is not a diameter. (angle in a semicircle is 90°)

Do not write outside the box

21 Here are the first four terms of a quadratic sequence.

11 26 45 68

Work out an expression for the nth term.

[3 marks]

11, 26, 45, 68

+15 +19 +23

+4 +4

$2n^2$

Seq	11	26	45	68
$2n^2$	2	8	18	32

9, 18, 27, 36

$9n$ +9 +9

$2n^2 + 9n$

Answer $2n^2 + 9n$

Turn over for the next question

7

Do not write outside the box

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

You **must** show your working.

[4 marks]

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

$$\frac{x^2-2x+7x+28}{(x^2+2x-8)} = 1 \qquad \times(x^2+2x-8)$$

$$x^2+5x+28 = x^2+2x-8$$

$$3x+28 = -8 \qquad -2x$$

$$3x = -36 \qquad -28$$

$$x = -12 \qquad \div 3$$

$x =$ -12

Do not write outside the box

23 Prisms A and B are similar.

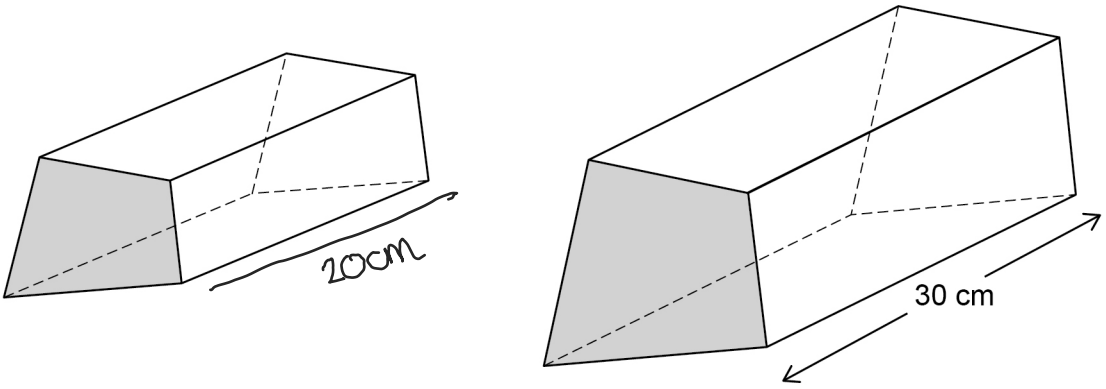
The cross sections are shaded.

Prism A

volume = 480 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]

linear scale factor : $\sqrt{4} : \sqrt{9}$

$= 2 : 3$

A to B = $\times \frac{3}{2}$

B to A = $\times \frac{2}{3}$

length of A = $30 \times \frac{2}{3} = 20$cm

cross area of A = $480 \div 20 = 24\ cm^2$

A : B

4 : 9

x6 → 24 : 54 ← x6

Answer 54 cm^2

9

Turn over ►

Do not write outside the box

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]

$\sqrt{10} = \sqrt{2} \times \sqrt{5}$

$= \frac{2\sqrt{6} \times \sqrt{2}}{\sqrt{5} \times \sqrt{2}} - \frac{\sqrt{3}}{\sqrt{2} \times \sqrt{5}}$

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

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

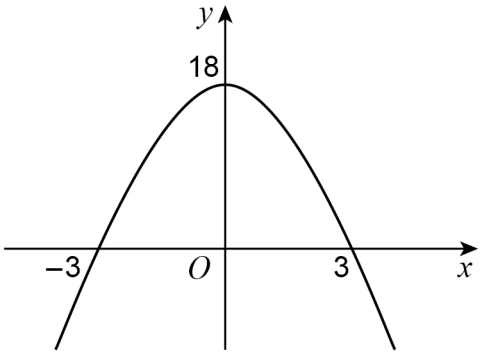
$c = 3$

$d = 30$

Do not write outside the box

25 A quadratic curve intersects the axes at (–3, 0), (3, 0) and (0, 18)

1 2 3



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Work out the equation of the curve.

$y = ax^2 + bx + c$

$c = 18$ (18 = y intercept (3))

[3 marks]

Sub 1 $0 = a(-3)^2 + -3b + 18 = 9a - 3b + 18$

Sub 2 $0 = a(3)^2 + 3b + 18 = 9a + 3b + 18$

$9a - 3b + 18 = 9a + 3b + 18$

$0 = 6b \quad \therefore b = 0$

$9a + 18 = 0$

$9a = -18$

$a = -2$

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

Turn over for the next question

6

Do not write outside the box

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

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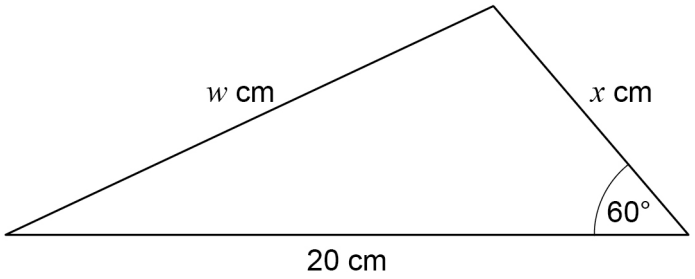


Work out the value of w.
Give your answer in the form $a\sqrt{b}$ where a and b are integers greater than 1

[5 marks]

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

$25\sqrt{3} = \frac{1}{2} \times 20 \times x \times \sin 60$ $-\frac{\sqrt{3}}{2}$

$25\sqrt{3} = 20x \times \frac{\sqrt{3}}{4}$ $\quad 25 = 5x$ $\quad 5 = x$

cosine: $a^2 = b^2 + c^2 - 2bc\cos A$

$W^2 = 20^2 + 5^2 - 2 \times 20 \times 5 \times \cos 60$

$W^2 = 400 + 25 - 100 = 325$

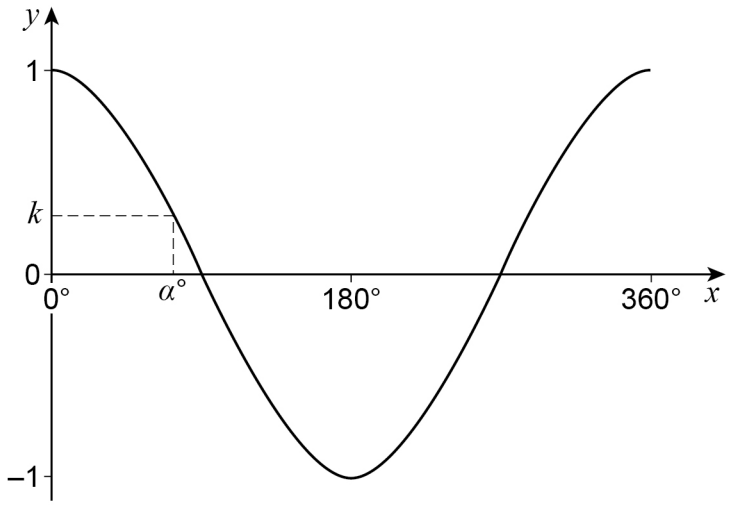
$W = \sqrt{325}$ $\quad 325 \div 25 = 13$

$= 5\sqrt{13}$

Answer $5\sqrt{13}$

Do not write outside the box

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



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$\alpha°$ is an acute angle.

$\cos \alpha° = k$

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

[1 mark]

$1 - k$ $\quad$ k $\quad$ $-k$ $\quad$ $-1 - k$

27 (b) Circle the value of $\cos (360° + \alpha°)$ – repeats every 360

[1 mark]

$k - 1$ $\quad$ $k + 1$ $\quad$ $-k$ $\quad$ k

END OF QUESTIONS

7

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