AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

GCSE MATHEMATICS

H

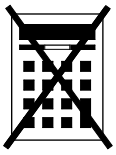
Higher Tier Paper 1 Non-Calculator

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	

Answer **all** questions in the spaces provided

Do not write outside the box

1 Simplify $\left(5^4\right)^2$

Laws of indices $(a^b)^c = a^{b \times c}$

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 of a cylinder $\rightarrow \pi r^2 L$

so $\pi \times 25 \times 8$

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

Circle your answer.

[1 mark]

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

BIDMAS

Separate $\frac{16a^2}{a} \rightarrow 16a$

$+$

$3a \times 2 \rightarrow 6a$

$22a$

Do not write outside the box

4 Circle the value of cos 30°

[1 mark]

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

*Memorise before the non-calculator

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

Give your answer as a mixed number.

[4 marks]

Change to improper $\frac{17}{2}$ and $\frac{8}{3}$

Division - change to multiply:

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

Convert back to a mixed number:

$\frac{51}{16} = 3\frac{3}{16}$

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]

$\frac{116-48}{4} = \frac{68}{4} = 17$

Look at the difference

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 $4 \times 90° = 360°$

Zak writes,

$5 \times 90° = 450°$ 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]

Pentagons do not have right angles.

One exterior angle is 72° (360÷5) which means each interior angle is 108° (180-72)

108° x 5 = 540°

Turn over for the next question

Two facts to consider:

→ Sum of interior angles in a polygon (n-2) x 180°

→ Exterior angles in any polygon add up to 360°

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 There are less planes that have landed due to poor weather conditions

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]

150 x 6 = 900 each day

900 x 365 = 328500

365
x 9
3285

Answer 328500

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]

This is the assumption that the same number of planes take off everyday - her data was taken in the day and in winter.

Turn over for the next question

6

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

split it up
keep it simple

Work out the value of a.

[4 marks]

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

$10 = 5a$

$2 = a$

Answer 2

10 Work out the percentage increase from 80 to 280

[3 marks]

original: 80 (100%) 100%

new: 280 (?) 350%

$\frac{280}{80} = 3.5$

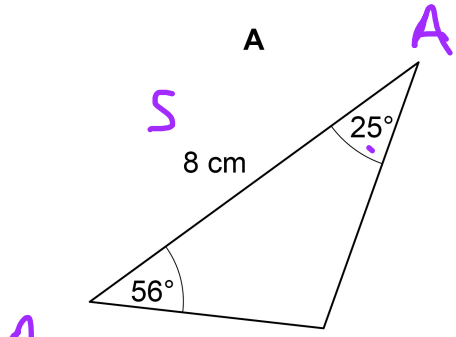
So the increase is...

Answer 250 %

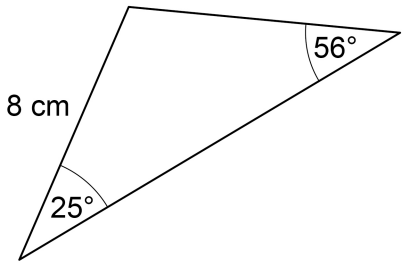
Do not write outside the box

11 Here are four triangles.

A



B



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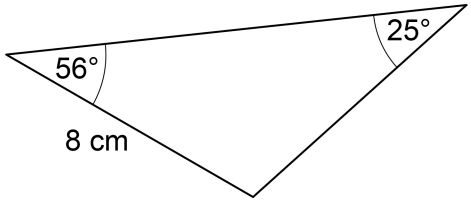
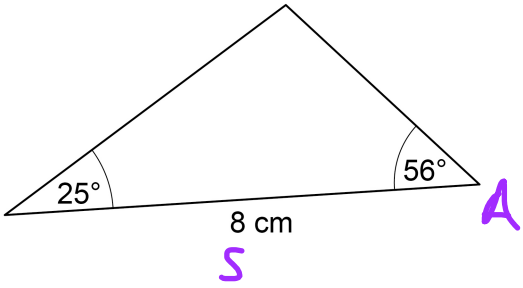
C



D



Which **two** triangles are congruent?

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]

Quadratic
Two solutions

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

Set each bracket to zero $x-4=0$ or $x+3=0$

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

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]

Combining ratios → find common multiples.

e : f : g

2 : 3

5 : 4

Common multiple = 15

×5 ×3

10 : 15 : 12

so e : g → 10 : 12

Don't forget to simplify

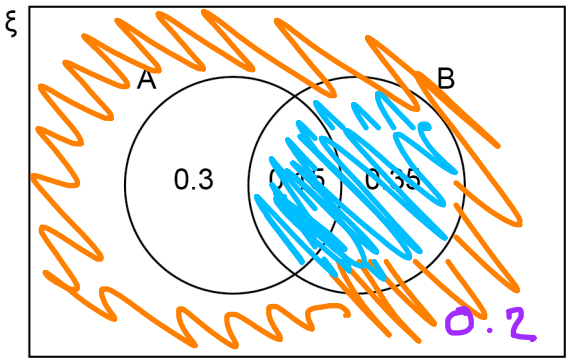
Answer 5 : 6

Do not write outside the box

14 A and B are two events.

Some probabilities are shown on the Venn diagram.

not A
B



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

[2 marks]

So what has been shaded?

0.2 + 0.15 + 0.35

Answer 0.7

Turn over for the next question

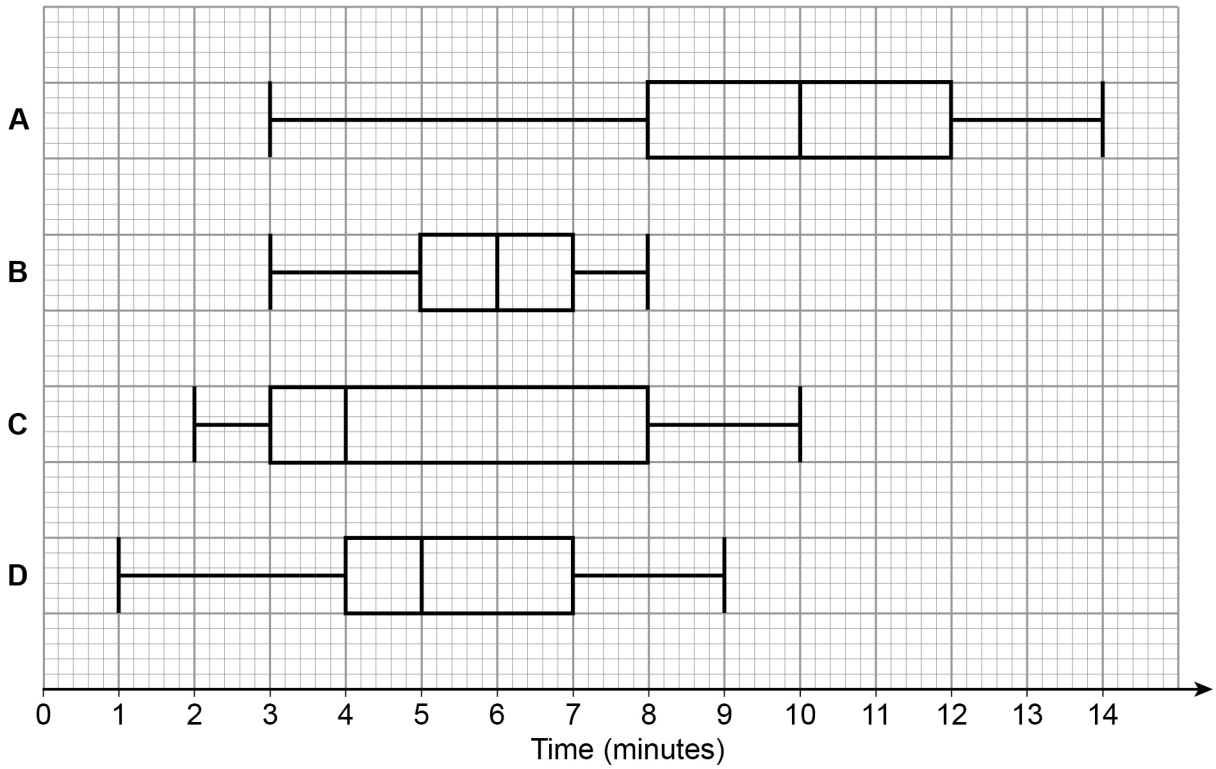
P(A' ∪ B) → not A or B
↳ look separately

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 Lowest median of 4 minutes.

Must refer to key maths terms → quartiles, median, range etc.

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 Supermarket B has the smallest range and interquartile range

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

[1 mark]

27 000 90 2700 9000

make it easier → 30^3

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

minus means reciprocal

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

$a^{-1} = \frac{1}{a}$

$a^{-2} = \frac{1}{a^2}$

$a^{-3} = \frac{1}{a^3}$

[2 marks]

Answer $\frac{64}{27}$

Cube the top

Cube the bottom

Turn over for the next question

7

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]

First two days $\frac{1}{8} + \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$

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

Beth and Mia → $\frac{1}{8} + \frac{1}{10} = \frac{10}{80} + \frac{8}{80} = \frac{9}{40}$

$\frac{3}{4} \div \frac{9}{40} = \frac{3}{4} \times \frac{40}{9} = \frac{120}{36} = \frac{10}{3}$ days

$3\frac{1}{3}$

Answer _____ days

Do not write outside the box

19 In a chess club, there are x boys and y girls.

so double the boys

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]

then make them equal

$x+5$ boys $y+8$ girls

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

$2x+10 = y+8$

$2x+2 = y$

got to where they have asked

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]

$x+10$ boys $y+1$ girls

So $x+10 = y+1$

$x+9 = y$

*Now use part a) as they both equal y

$2x+2 = x+9$ (-2)

$2x = x+7$

$x = 7$

$x =$ 7

$y =$ 16

use this to find y

If $x=7$

$7+9 = y$ $y=16$

9

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

PXR and *QXS* are straight lines.

PX = *SX*

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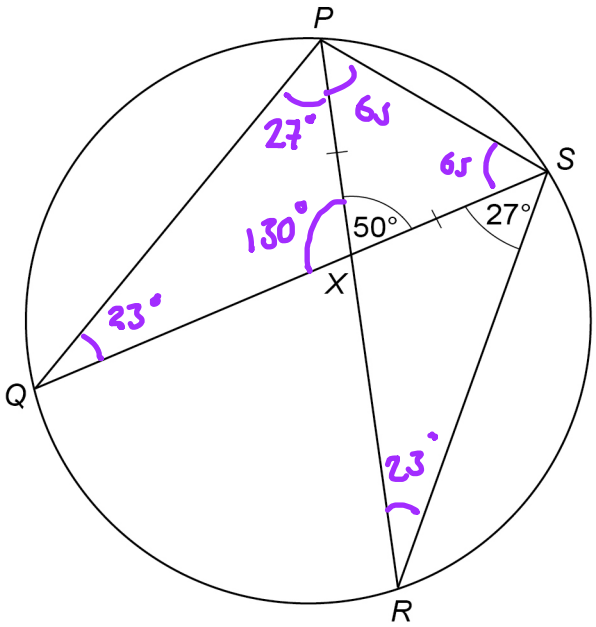


Need clear statements for this.

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

[4 marks]

Angles in the same segment:

$Q\hat{S}R = Q\hat{P}R$

Angles on a straight line

$180 - 50 = 130°$

Angles in a triangle

$180 - (130+27) = 180 - 57 = 23$

Angles in same segment:

$P\hat{Q}S = P\hat{R}S$

this point is key

PXS is isosceles so $x\hat{P}S = x\hat{S}P = 65°$

* If QS is the diameter $Q\hat{P}S$ would be $90°$ - this is not the case as it is $65 + 27 = 92°$

Do not write outside the box

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

so we are looking for n^2.....

11 26 45 68

Work out an expression for the nth term.

[3 marks]

11 26 45 68

15 19 23

4 4 ← as its the 2nd difference – ÷ by 2

Compare against $2n^2$

	11	26	45	68
n^2	1 (9)	4 (18)	9 (27)	16 (36)
$2n^2$	2	8	18	32

d	9	18	27	36 ← this is a pattern itself.
	9	9	9	
$9n$	9	18	27	36

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]

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

$\times (x+4)$

Get rid of fractions.

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

$\times (x-2)$

Expand

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

Solve

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

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

$3x = -36$

$x = -12$

$x =$ -12

Do not write outside the box

23 Prisms A and B are similar.

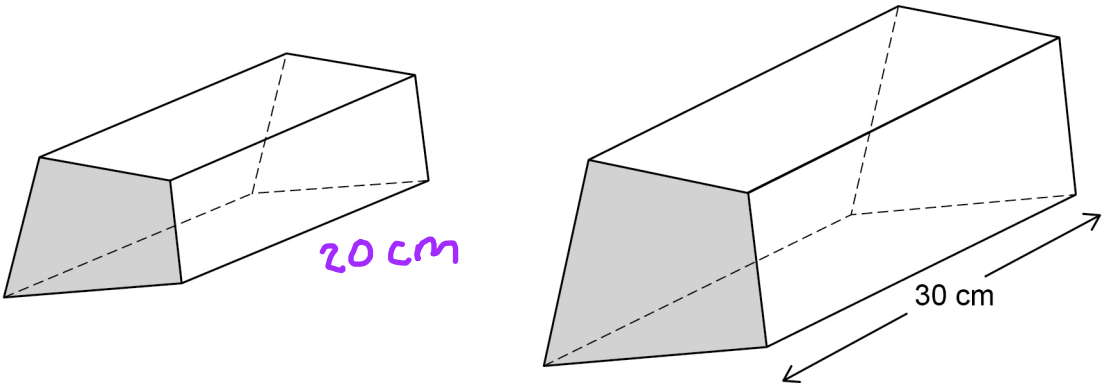
The cross sections are shaded.

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]

What is the scale factor?

A → B

4 → 9

×9/4

Area scale factor : 9/4

Linear scale factor : 3/2

Square root the area scale factor

Prism A length = 30 ÷ 3/2 = 20

Prism A cross section area = 480 ÷ 20 = 24

24 × 9/4 = 54

Answer 54 cm^2

9

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]

Subtracting so we need a common denominator

denominator needs to be rationalised

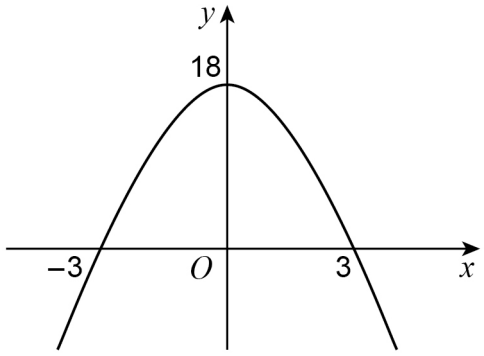
$\frac{2\sqrt{6}}{\sqrt{5}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{2\sqrt{12}}{\sqrt{10}}$ $\quad \sqrt{12} = \sqrt{4}\sqrt{3} = 2\sqrt{3}$

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

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

Do not write outside the box

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



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Work out the equation of the curve.

[3 marks]

two solutions -3 and 3
so similar to $(x+3)(x-3)=0$

y-intercept is 18 (double 9) so
$2(x+3)(x-3)$
its upside down so one x is negative

Answer $2(3-x)(x+3)$

or the expanded version
$y = 18 - 2x^2$

6

Turn over for the next question

Do not write outside the box

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

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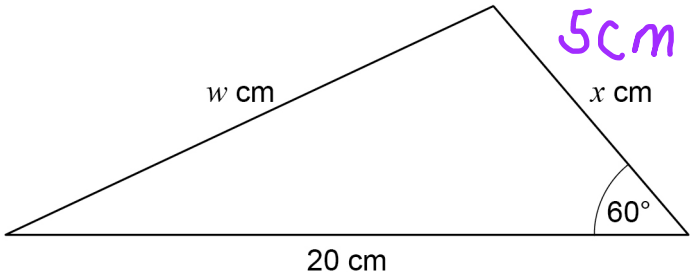


Work out the value of w.

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

[5 marks]

Triangle → not a right angle so trig may come in handy

Area of a triangle → $\frac{1}{2}ab\sin C$

$25\sqrt{3} = \frac{1}{2}(20)(x)\sin 60$

$25\sqrt{3} = 10x\frac{\sqrt{3}}{2}$

$50\sqrt{3} = 10x$

$5 = x$

sin 60 you need to remember for the non-calc $= \frac{\sqrt{3}}{2}$

To find w - cosine rule

$a^2 = 25 + 400 - 2\times 5\times 20\cos 60$

$a^2 = 425 - 2\times 5\times 20\times \frac{1}{2}$

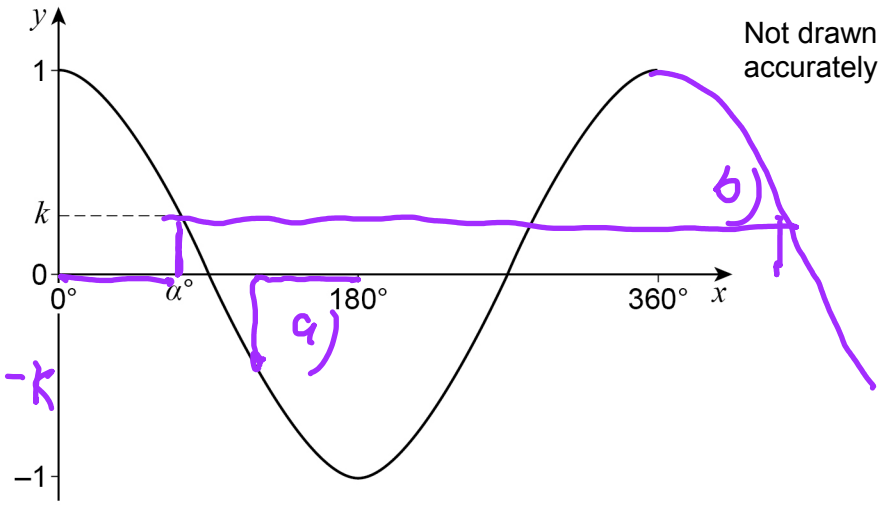
$a^2 = 325$

Answer $5\sqrt{13}$

$a = \sqrt{325} = \sqrt{25}\sqrt{13} = 5\sqrt{13}$

Do not write outside the box

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



$\alpha°$ 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 $\cos (360° + \alpha°)$

[1 mark]

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

END OF QUESTIONS

7

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