

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname *StemUp Model Solution*

Forename(s)

Candidate signature

GCSE MATHEMATICS

H

Higher Tier

Paper 1 Non-Calculator

Tuesday 6 November 2018

Morning

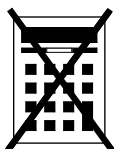
Time allowed: 1 hour 30 minutes

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

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

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

[1 mark]

40π

80π

200π

1600π

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

[1 mark]

$22a$

$8a$

$38a$

$2a$



- 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]

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

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

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

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

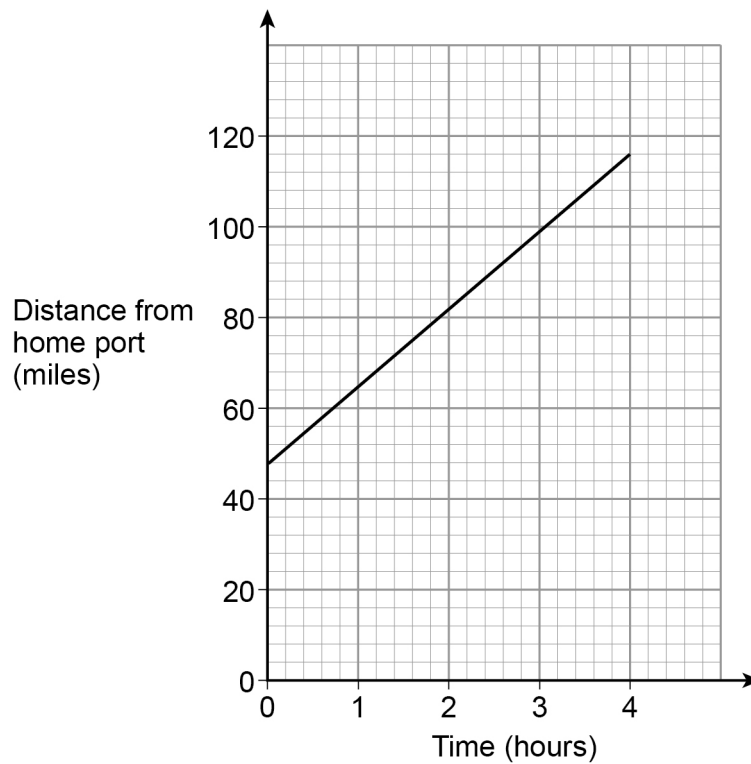
Answer $3\frac{3}{16}$

Turn over ►



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]

At 0 hours the distance is 48 miles

At 4 hours the distance is 116 miles

Distance travelled = $116 - 48 = 68$ miles

Speed = $68 \div 4 = 17$

Answer 17 mph



7

The sum of the angles in any quadrilateral is 360°

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°

Is he correct?

Tick a box.

☐

Yes

☒

No

Show working to support your answer.

[2 marks]

A pentagon splits into 3 triangles from one vertex

Sum of angles = $3 \times 180^\circ = 540^\circ$

$540^\circ \neq 450^\circ$, so Zak is not correct

(a pentagon cannot have five right angles)

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 8

Reason Only 102 planes landed, all the other days were over 140

- 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]

$$24 \div 4 = 6 \text{ periods, } 150 \times 6 = 900 \text{ planes per day}$$

$$900 \times 365 = 900 \times 300 + 900 \times 65$$

$$= 270\,000 + 58\,500$$

$$= 328\,500$$

Answer 328 500



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]*Data is from January (winter), so the summer total is higher: too low**But 150 at night is too many: too high**So the effects work in opposite directions***Turn over for the next question****Turn over ►**

9

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

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

$$\sqrt{6^2 + 8^2} = \sqrt{36 + 64} = \sqrt{100} = 10$$

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

$$5a = 10$$

$$a = 10 \div 5 = 2$$

Answer 2

10

Work out the percentage increase from 80 to 280

[3 marks]

$$\text{Increase} = 280 - 80 = 200$$

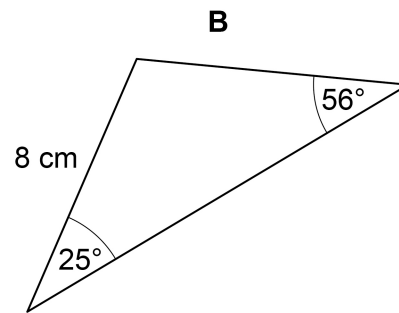
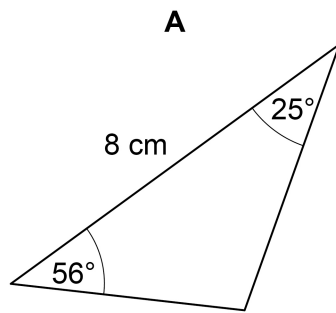
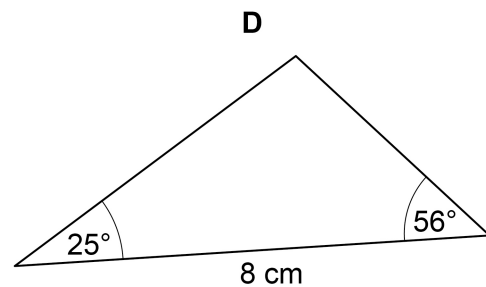
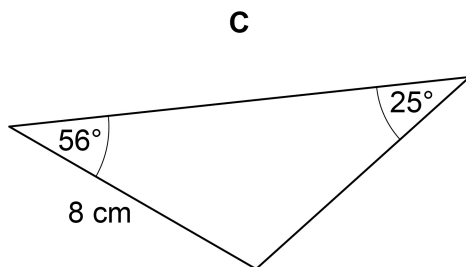
$$200 \div 80 = 2.5$$

$$2.5 \times 100 = 250$$

Answer 250 %

11

Here are four triangles.

Not drawn
accuratelyWhich **two** triangles are congruent?Circle **two** letters below.

[1 mark]

A

B

C

D

Turn over for the next question

Turn over ►



- 12** Solve $x^2 - x - 12 = 0$ **[3 marks]**

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

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

$$x - 4 = 0 \quad \text{or} \quad x + 3 = 0$$

$$x = 4 \quad \text{or} \quad x = -3$$

Answer $x = 4 \quad \text{or} \quad x = -3$

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

Work out $e : g$

Give your answer in its simplest form.

[3 marks]

$$e : f = 2 : 3 = 10 : 15$$

$$f : g = 5 : 4 = 15 : 12$$

$$e : f : g = 10 : 15 : 12$$

$$e : g = 10 : 12 = 5 : 6$$

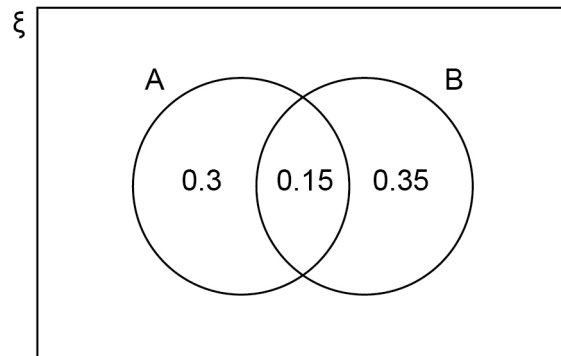
Answer $5 : 6$



14

A and B are two events.

Some probabilities are shown on the Venn diagram.

Work out $P(A' \cup B)$ **[2 marks]** *$A' \cup B$ is everything except the 0.3 (A only)*

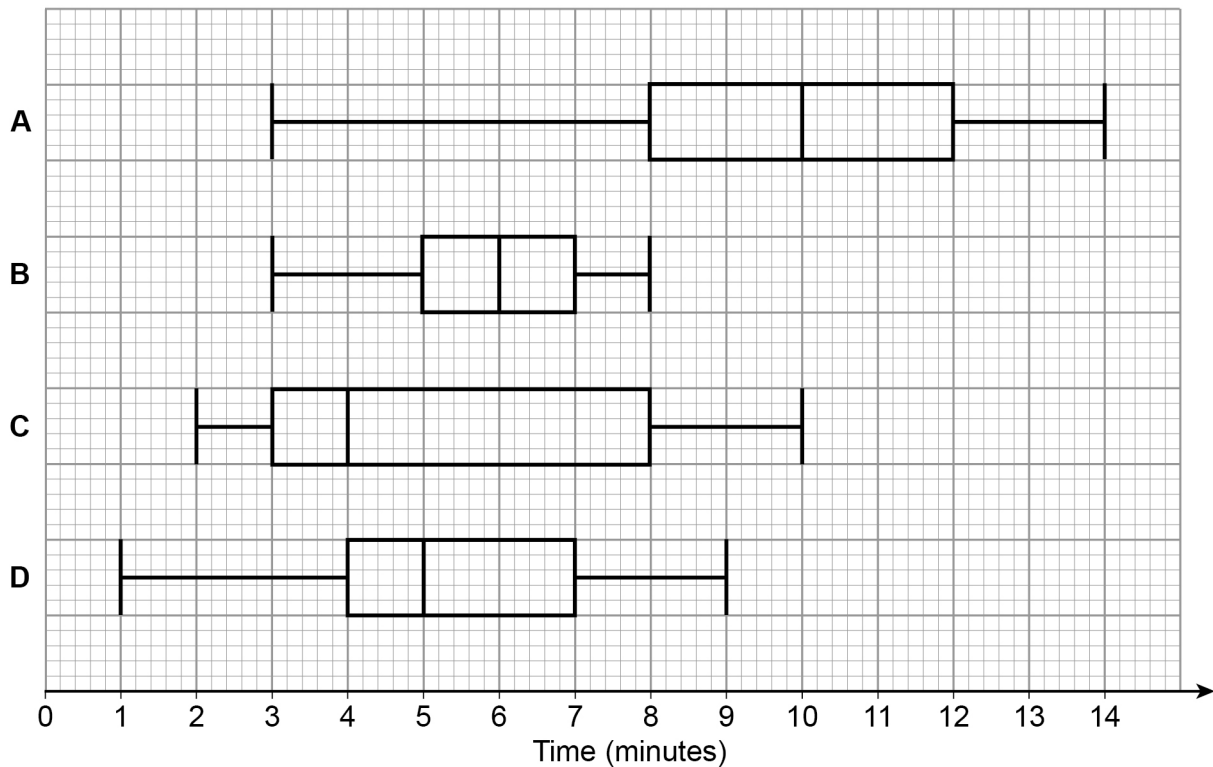
$$P(A' \cup B) = 1 - 0.3 = 0.7$$

Answer 0.7**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 C

Reason C has the lowest median (4 minutes)



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

[2 marks]Supermarket BReason B has the smallest interquartile range (2 minutes)

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

[1 mark]

27 000

90

2700

9000

- 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 $\frac{64}{27}$ **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]

Beth does $\frac{1}{8}$ per day, Mia does $\frac{1}{10}$ per day

In 2 days Beth does $\frac{2}{8} = \frac{1}{4}$ so $\frac{3}{4}$ is left

Together: $\frac{1}{8} + \frac{1}{10} = \frac{5}{40} + \frac{4}{40} = \frac{9}{40}$ per day

$\frac{3}{4} \div \frac{9}{40} = \frac{3}{4} \times \frac{40}{9} = \frac{120}{36} = 3 \frac{1}{3}$

Answer $3 \frac{1}{3}$ 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]

$$\text{Boys} = x + 5, \text{ girls} = y + 8$$

$$\text{Girls} = 2 \times \text{boys}$$

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

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

$$y = 2x + 2$$

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]

$$x + 10 = y + 1$$

$$x + 10 = (2x + 2) + 1$$

$$x + 10 = 2x + 3$$

$$x = 7$$

$$y = 2 \times 7 + 2 = 16$$

$$x = 7$$

$$y = 16$$

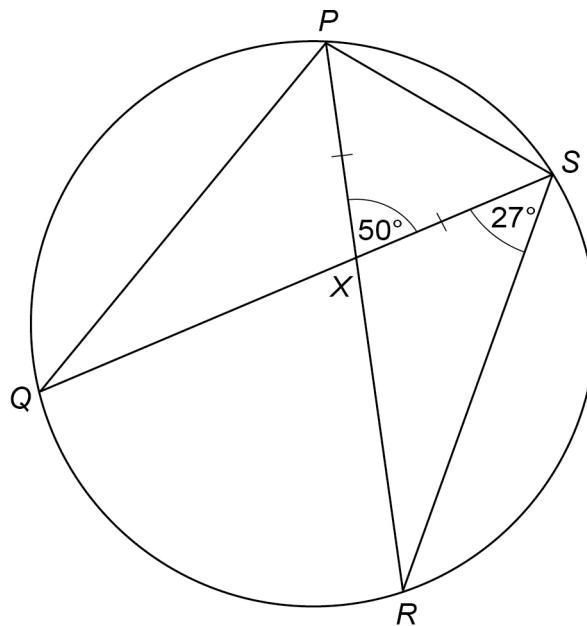


20

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]

$\text{Angle } QPR = 27^\circ$ (angles in the same segment are equal)

$PX = SX$ so triangle PXS is isosceles

$\text{Angle } XPS = (180^\circ - 50^\circ) \div 2 = 65^\circ$

(angles in a triangle add up to 180° , base angles of an isosceles triangle are equal)

$\text{Angle } QPS = 27^\circ + 65^\circ = 92^\circ$

The angle in a semicircle is 90° , so if QS were a diameter

$\text{angle } QPS = 90^\circ$. But $92^\circ \neq 90^\circ$, so QS is not a diameter



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]**

Terms:	11	26	45	68
1st differences:	15	19	23	
2nd differences:	4	4	so $2n^2$	
$2n^2$:	2	8	18	32
term - $2n^2$:	9	18	27	36 = $9n$
n th term = $2n^2 + 9n$				

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]

Multiply every term by $(x+4)(x-2)$:

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

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

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

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

$$3x = -36$$

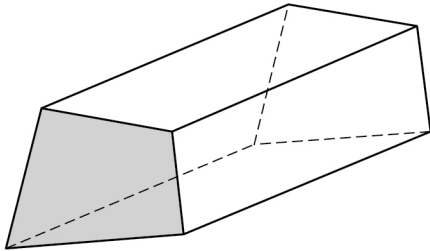
$$x = -12$$

$$x = \underline{\hspace{10em} -12 \hspace{10em}}$$

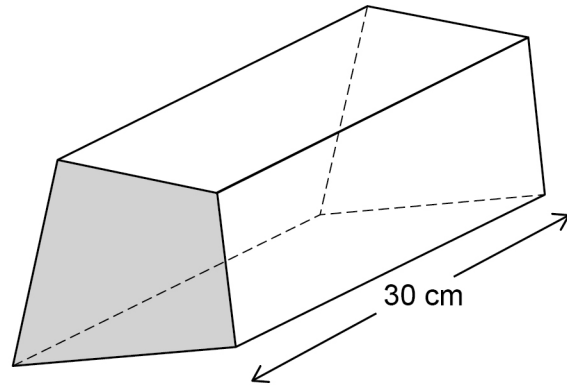


23

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

Prism Avolume = 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]

Area ratio 4 : 9, so length ratio $\sqrt{4} : \sqrt{9} = 2 : 3$

Length of A = $30 \div 3 \times 2 = 20 \text{ cm}$

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

Cross section of B = $24 \div 4 \times 9 = 54 \text{ cm}^2$

Answer 54 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]

$$\frac{2\sqrt{6}}{\sqrt{5}} = \frac{2\sqrt{6} \times \sqrt{5}}{\sqrt{5} \times \sqrt{5}} = \frac{2\sqrt{30}}{5} = \frac{4\sqrt{30}}{10}$$

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

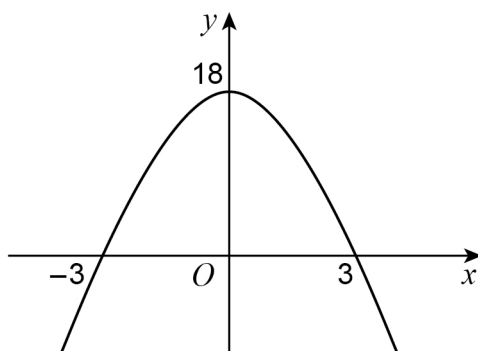
$$\frac{2\sqrt{6}}{\sqrt{5}} - \frac{\sqrt{3}}{\sqrt{10}} = \frac{4\sqrt{30}}{10} - \frac{\sqrt{30}}{10} = \frac{3\sqrt{30}}{10}$$

$$\text{which is } \frac{c\sqrt{d}}{10} \text{ with } c = 3 \text{ and } d = 30$$



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]

$$\text{Roots } -3 \text{ and } 3 \text{ so } y = a(x + 3)(x - 3)$$

$$\text{At } (0, 18): 18 = a(3)(-3) = -9a$$

$$a = -2$$

$$y = -2(x + 3)(x - 3) = -2(x^2 - 9)$$

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

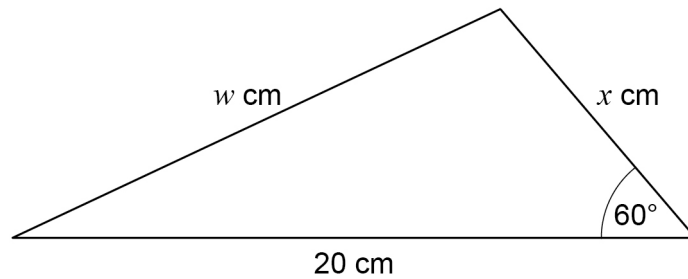
Answer $y = 18 - 2x^2$

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]**

$$\text{Area} = \frac{1}{2} \times 20 \times x \times \sin 60^\circ$$

$$= 10x \times \sqrt{3} \div 2 = 5\sqrt{3} x$$

$$5\sqrt{3} x = 25\sqrt{3} \quad \text{so} \quad x = 5$$

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

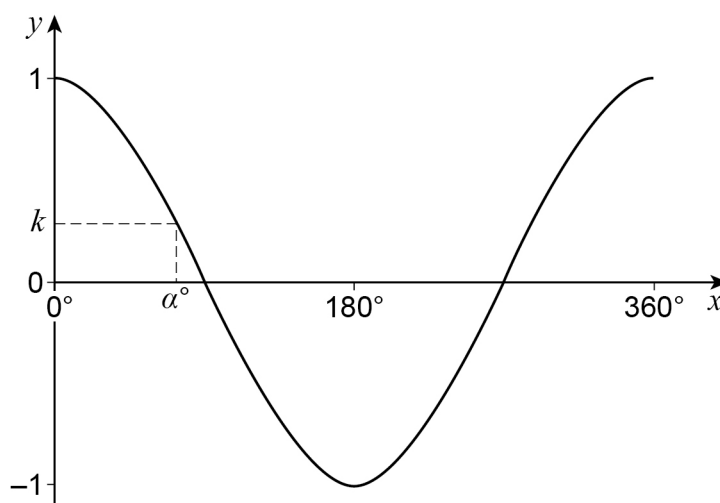
$$w^2 = 25 + 400 - 200 \times \frac{1}{2}$$

$$w^2 = 425 - 100 = 325$$

$$w = \sqrt{325} = \sqrt{(25 \times 13)} = 5\sqrt{13}$$

Answer 5√13

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



α° 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



There are no questions printed on this page

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