AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

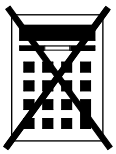
H

Higher Tier Paper 1 Non-Calculator

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.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- 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	
24–25	
26	
TOTAL	

Answer **all** questions in the spaces provided.

Do not write outside the box

1 Simplify $\left(a^5\right)^3$

Circle your answer.

[1 mark]

$8a$ $15a$ a^8 a^{15}

2 $x \neq 0.4$

Circle the possible value of x.

[1 mark]

$\frac{4}{10}$ $\frac{20}{50}$ $\frac{26}{70}$ $\frac{120}{300}$

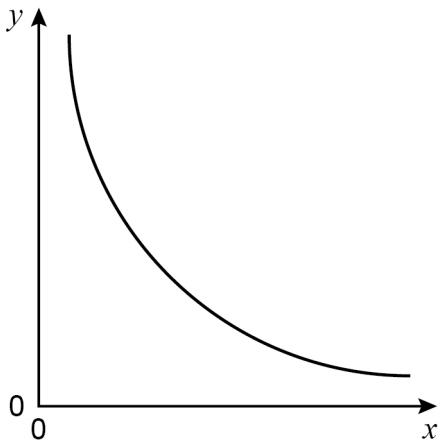
3 Circle the solid that has 7 vertices.

[1 mark]

hexagonal prism | hexagon-based pyramid | pentagonal prism | pentagon-based pyramid

Do not write outside the box

4 Here is a sketch of a graph.



Circle the equation of the graph.

k is a constant.

[1 mark]

$y = kx$ $y = k + x$ $y = k - x$ $y = \frac{k}{x}$ (1)

5 Write 200 as a product of prime factors.

Give your answer in index form.

[3 marks]

200
2 100
2 50 (1)
2 25
5 5

(1)

$2 \times 2 \times 2 \times 5 \times 5 = 200$

$2^3 \times 5^2$

Answer $2^3 \times 5^2$ (1)

7

Turn over ►

Do not write outside the box

6 Lily's age is 2 years and 4 months.

Hugo's age is 1 year and 8 months.

Write Lily's age in months as a fraction of Hugo's age in months.

Give your fraction in its simplest form.

[2 marks]

Lily : $(2 \times 12) + 4 = 28$ months

Hugo : $(1 \times 12) + 8 = 20$ months

Fraction : $\frac{28 \div 4}{20 \div 4} = \frac{7}{5}$

Answer $\frac{7}{5}$ (2)

7 Use approximations to estimate the answer to $\dfrac{\sqrt{97} + 2.014^3}{0.49}$

[3 marks]

$\sqrt{97} = \sqrt{100} = 10$

$2.014^3 = 2^3 = 8$ (1)

$0.49 = 0.5 = \frac{1}{2}$ (1)

$\frac{10 + 8}{\frac{1}{2}} = 18(2) = 36$ (1)

Answer 36

Do not write outside the box

8 (a) Solve $5x + 6 > 3x + 15$

[3 marks]

$5x - 3x > 15 - 6$ (1)

$2x > 9$ (1)

$x > \frac{9}{2}$ (1)

Answer $x > \frac{9}{2}$

8 (b) Write down the inequality represented by the number line.

[2 marks]

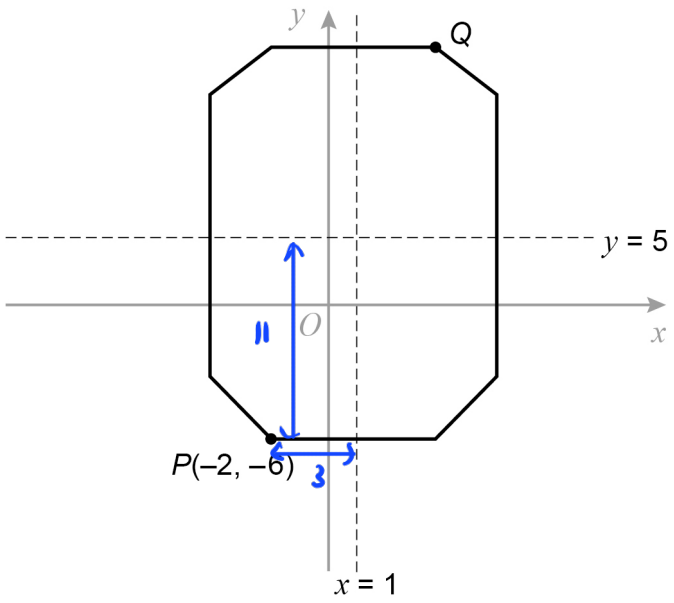
Answer $2 \leqslant x < 5$ (2)

10

Turn over ►

Do not write outside the box

9 The diagram shows an octagon.



Not drawn accurately

$x = 1$ and $y = 5$ are lines of symmetry.

Work out the coordinates of point Q.

[2 marks]

$x = 1 + 3 = 4$

$y = 5 + 11 = 16$

Answer (4 , 16) (2)

Do not write outside the box

10 (a) Work out $2000 \times 70\,000$

Give your answer in standard form.

[2 marks]

$2 \times 10^3 \times 7 \times 10^4$ (1)

$= 2 \times 7 \times 10^{3+4}$

$= 14 \times 10^7$

$= 1.4 \times 10^8$ (1)

Answer 1.4×10^8

10 (b) Work out $\dfrac{1.8 \times 10^2}{3 \times 10^{-1}}$

Give your answer as an ordinary number.

[2 marks]

$\dfrac{1.8}{3} \times 10^{2-(-1)}$

(1)

$= 0.6 \times 10^3$

$= 6 \times 10^2$

$= 600$ (1)

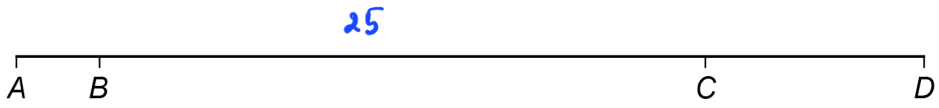
Answer 600

6

Do not write outside the box

11 *A*, *B*, *C* and *D* are junctions on a motorway.

Not drawn accurately



distance *CD* = 3 × distance *AB*

distance *BC* = 25 miles

Salma drives from *A* to *C*.

She drives for 30 minutes at an average speed of 62 miles per hour.

Work out the distance *AD*.

[4 marks]

$62 = \frac{25 + AB}{30 \div 60}$

(0.5) $62 = 25 + AB$ (1)

(1)

$31 = 25 + AB$

$AB = 6$ miles

$CD = 3 \times 6$ (1)

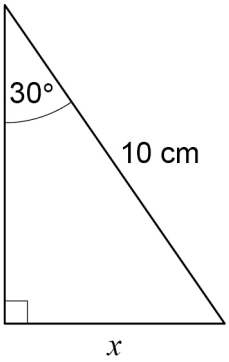
$= 18$

$AD = 6 + 25 + 18 = 49$ (1)

Answer 49 miles

Do not write outside the box

12 Here is a right-angled triangle.



Not drawn accurately

Use trigonometry to work out the value of x.

[3 marks]

$\sin 30^\circ = \frac{x}{10}$ (1)

$x = 10 \sin 30^\circ$

$= 10\,(0.5)$ (1)

$= 5$ (1)

Answer 5 cm

Turn over for the next question

7

Do not write outside the box

13 Convert $\frac{5}{6}$ to a recurring decimal.

[2 marks]

$0.8333\ldots$

$6\overline{)5}$ (1)

-0

50

-48

20

-18

20

-18

20

Answer $0.8\dot{3}$ (1)

14 Simplify $\frac{3}{x} + \frac{4}{x}$

Circle your answer.

[1 mark]

$\frac{7}{x}$ (1) $\quad \frac{7}{2x}$ $\quad \frac{12}{x}$ $\quad \frac{12}{x^2}$

Do not write outside the box

15 $(x + a)(x + 3a) \equiv x^2 + bx + 75$

Work out the **two** possible values of b.

[3 marks]

$(x+a)(x+3a) = x^2 + 3ax + ax + 3a^2$

$= x^2 + 4ax + 3a^2$ (1)

$3a^2 = 75$

$a^2 = 25$

$a = \pm 5$ (1)

$4a = b$

$4(5) = b$ or $4(-5) = b$

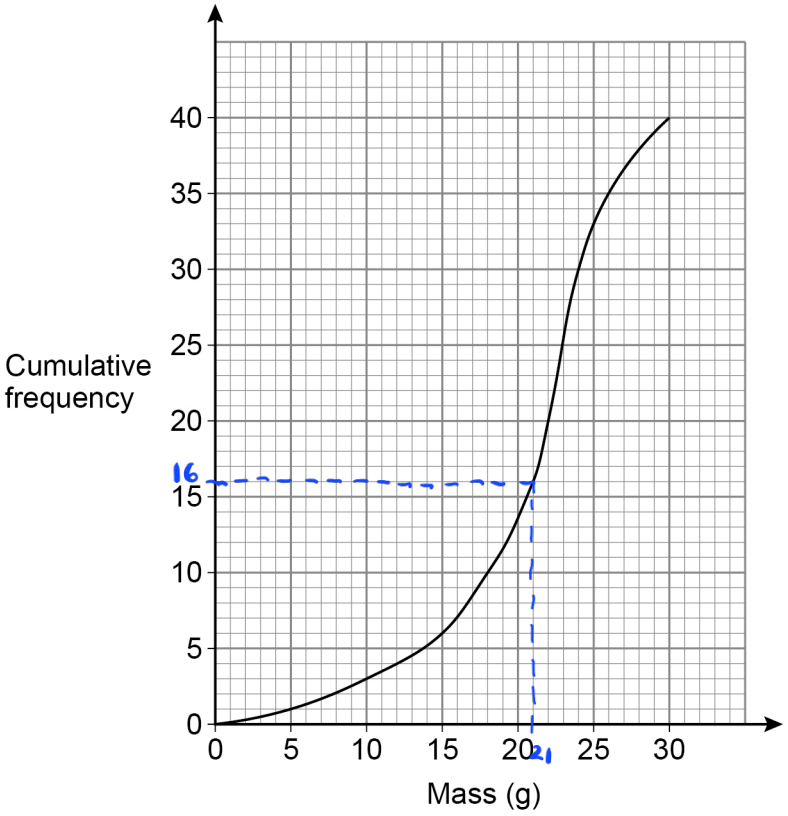
$b = 20$ or $b = -20$

Answer 20 and -20 (1)

6

Do not write outside the box

16 The cumulative frequency graph represents the masses of 40 necklaces.



16 (a) A jeweller buys every necklace with mass **greater than** 21 grams.

Use the graph to estimate how many she buys.

[2 marks]

40 − 16 = 24

(1)

Answer 24 (1)

Do not write outside the box

16 (b) The lowest mass was 3 grams.

The highest mass was 28 grams.

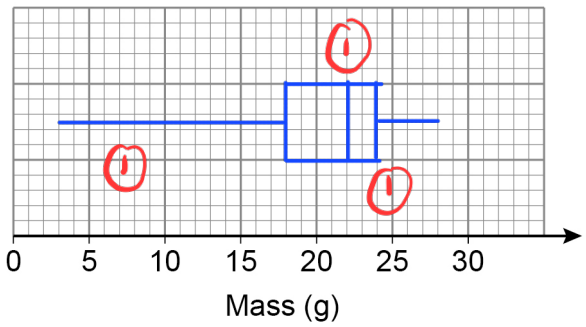
Draw a box plot to represent the data.

median = 22

LQ = 18

UQ = 24

[3 marks]



17 Circle the vector that translates the point (–2, 7) to the point (3, –1)

[1 mark]

$\begin{bmatrix} 3-(-2) \\ -1-7 \end{bmatrix} = \begin{bmatrix} 5 \\ -8 \end{bmatrix}$

$\begin{pmatrix} 5 \\ -6 \end{pmatrix}$ $\begin{pmatrix} 5 \\ -8 \end{pmatrix}$ $\begin{pmatrix} -5 \\ 8 \end{pmatrix}$ $\begin{pmatrix} -5 \\ 6 \end{pmatrix}$

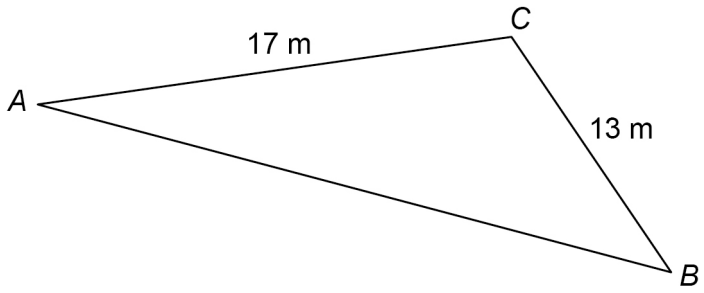
Turn over for the next question

6

Do not write outside the box

18 (a) Here is a triangle.

Not drawn accurately



Give a reason why the length of side *AB* **cannot** be 35 m

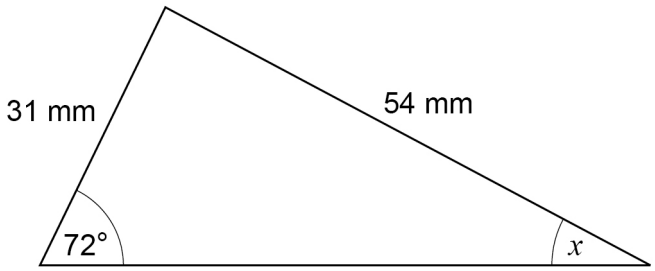
[1 mark]

AB cannot be more than AC + BC. (1)

Do not write outside the box

18 (b) Here is a different triangle.

Not drawn accurately



Leah tries to use the sine rule to work out the size of angle x.

Here are the first two lines of her working.

$$\frac{x}{\sin 31} = \frac{54}{\sin 72}$$

$$x = \frac{54 \sin 31}{\sin 72}$$

What error has she made in this working?

[1 mark]

it should be $\frac{31}{\sin x}$ instead. (1)

2

Turn over ►

Do not write outside the box

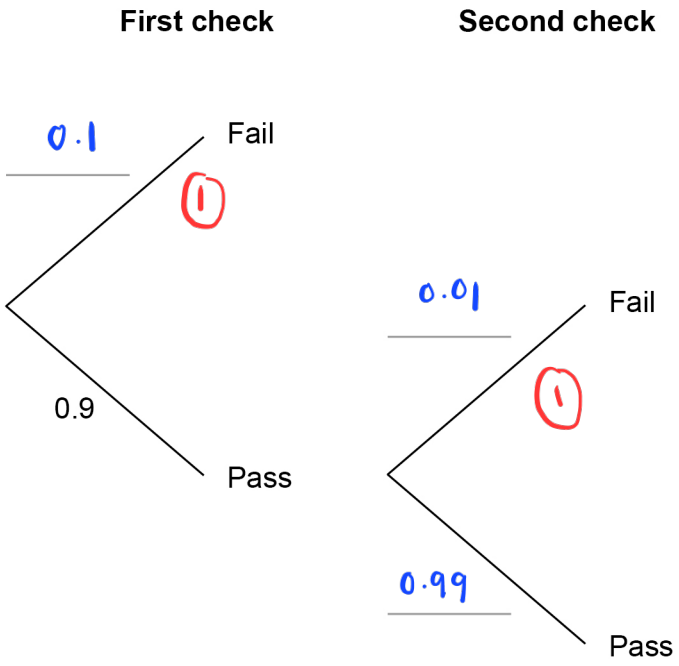
19 Items made at a factory have to pass two checks.

90% pass the first check.
The items that fail are scrapped.

99% of the items that pass the first check pass the second check.
The items that fail are scrapped.

19 (a) Complete the tree diagram.

[2 marks]



Do not write outside the box

19 (b) An item is chosen at random before the checks.

Work out the probability that the item is scrapped.

[3 marks]

0.1 + (0.9 × 0.01) (1)

0.1 + 0.009 = 0.109 (1)

(1)

Answer 0.109

20 Which **one** of these is a unit of density?

Circle your answer.

[1 mark]

cm^2/g cm^3/g g/cm^2 g/cm^3 (1)

density = mass / volume

Turn over for the next question

6

Do not write outside the box

21 The first two terms of a quadratic sequence are 10 and 17

Here is some information about the sequence.

	1st term	2nd term	3rd term	4th term
Sequence	10	17	30	49
First difference		+7	+13	19
Second difference			+6	+6

Work out an expression for the nth term of the sequence.

[4 marks]

n^{th} term : $an^2 + bn + c$

$a = \frac{6}{2} = 3$ (1)

$an^2 = 3n^2 = 3(1)^2, 3(2)^2, 3(3)^2, 3(4)^2$

$= 3, 12, 27, 48$

sequence = 10, 17, 30, 49

difference = 7, 5, 3, 1

$b = -2$ (1)

$-2(x1) + c = 7$

$c = 9$ (1)

$a = 3, b = -2, c = 9$, $3n^2 - 2n + 9$

Answer $3n^2 - 2n + 9$ (1)

Do not write outside the box

22 Work out the value of $\left(\frac{5}{7}\right)^{-2}$

Give your answer as a mixed number.

[3 marks]

$\left[\frac{5}{7}\right]^{-2} = \left[\frac{7}{5}\right]^{2}$

$= \frac{49}{25} = 1\frac{24}{25}$ (3)

Answer $1\frac{24}{25}$

23 Rearrange $y = \frac{1}{\sqrt{x+1}}$ to make x the subject.

[3 marks]

$y(\sqrt{x+1}) = 1$ (1)

$\sqrt{x+1} = \frac{1}{y}$

$x+1 = \left(\frac{1}{y}\right)^2$ (1)

$x+1 = \frac{1}{y^2}$

$x = \frac{1}{y^2} - 1$ (1)

Answer $x = \frac{1}{y^2} - 1$

10

Do not write outside the box

24 (a) $f(x) = cx + d$

$f(4) = 7$

$f(10) = 22$

Work out the values of c and d.

[3 marks]

$f(4) = 7 = 4c + d \quad -(1)$ (1)

$f(10) = 22 = 10c + d \quad -(2)$

(2) − (1) :

$22 - 7 = 10c - 4c + d - d$ (1)

$15 = 6c$

$c = \frac{15}{6} = 2.5$

$7 = 4(2.5) + d$

$d = 7 - 10$

$= -3$

(1)

$c =$ 2.5 $\quad d =$ −3

Do not write outside the box

24 (b) $g(x) = 2x$ and $h(x) = \dfrac{x-1}{2}$

$hg(x) = \dfrac{2x-1}{2}$

Circle the expression for $hg(x)$

[1 mark]

$\dfrac{2x^2 - x}{2}$ $\quad$ $\dfrac{2x-1}{2}$ (1) $\quad$ $x^2 - x$ $\quad$ $x - 1$

25 Show that $\dfrac{\sqrt{150} - \sqrt{6}}{\sqrt{2} \times \sqrt{3}}$ simplifies to an integer.

[3 marks]

$\sqrt{150} = \sqrt{25}\sqrt{6} = 5\sqrt{6}$

$\sqrt{2} \times \sqrt{3} = \sqrt{6}$ (1)

$= \dfrac{5\sqrt{6} - \sqrt{6}}{\sqrt{6}}$ (1) $= \dfrac{\sqrt{6}}{\sqrt{6}}\left(\dfrac{5-1}{1}\right)$

$= 4$ (1)

Turn over for the next question

7

Do not write outside the box

26 $d = 2f$

$$\frac{e-f}{d-e} = \frac{1}{4}$$

Work out the ratio $e : f$

[3 marks]

$\frac{e-f}{2f-e} = \frac{1}{4}$

$4e - 4f = 2f - e$ (1)

$5e = 6f$ (1)

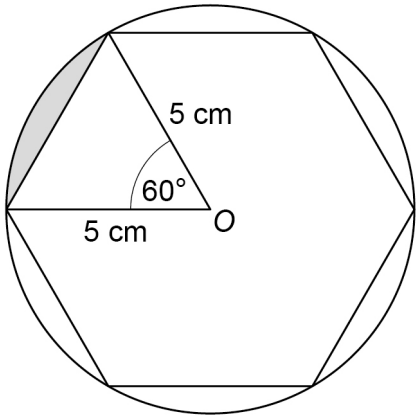
$\frac{e}{f} = \frac{6}{5}$

Answer 6 : 5 (1)

Do not write outside the box

27 The vertices of a regular hexagon lie on a circle with centre O and radius 5 cm

Not drawn accurately



Work out the shaded area.

Give your answer in the form $\dfrac{a\pi - b\sqrt{c}}{12}$ where a, b and c are integers.

[4 marks]

Area of triangle $= \frac{1}{2} \times 5^2 \times \sin 60^\circ = \frac{25}{2} \times \frac{\sqrt{3}}{2}$

$= \frac{25\sqrt{3}}{4}$ (1)

Area of sector $= \pi \times 5^2 \times \frac{60}{360} = \frac{25\pi}{6}$ (1)

Area of shaded region $= \frac{(25\pi)\times 2}{6\times 2} - \frac{(25\sqrt{3})\times 3}{(4)\times 3}$ (1)

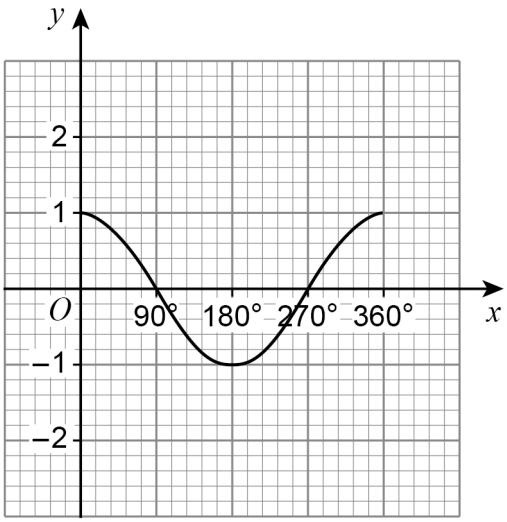
$= \frac{50\pi - 75\sqrt{3}}{12}$ (1)

Answer $\dfrac{50\pi - 75\sqrt{3}}{12}$ cm^2

7

Do not write outside the box

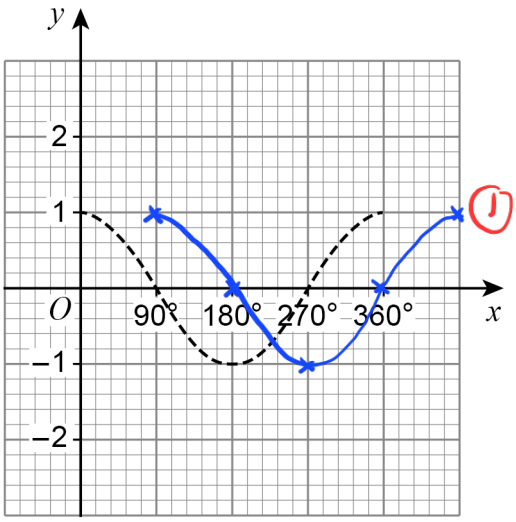
28 Here is the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$



In parts (a) and (b) the graph of $y = \cos x$ is shown as a dashed line.

28 (a) On the grid below, draw the graph of $y = \cos (x - 90°)$ for $0° \leqslant x \leqslant 360°$

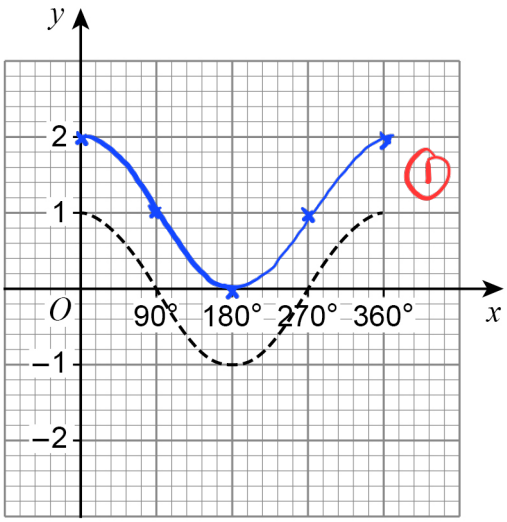
[1 mark]



Do not write outside the box

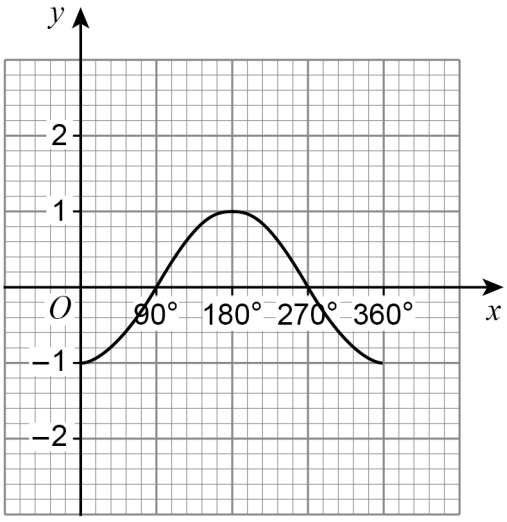
28 (b) On the grid below, draw the graph of $y = 1 + \cos x$ for $0° \leqslant x \leqslant 360°$

[1 mark]



28 (c) Rita tries to draw the graph of $y = \cos(-x)$ for $0° \leqslant x \leqslant 360°$

Here is her graph.



Give a reason why Rita's graph is incorrect.

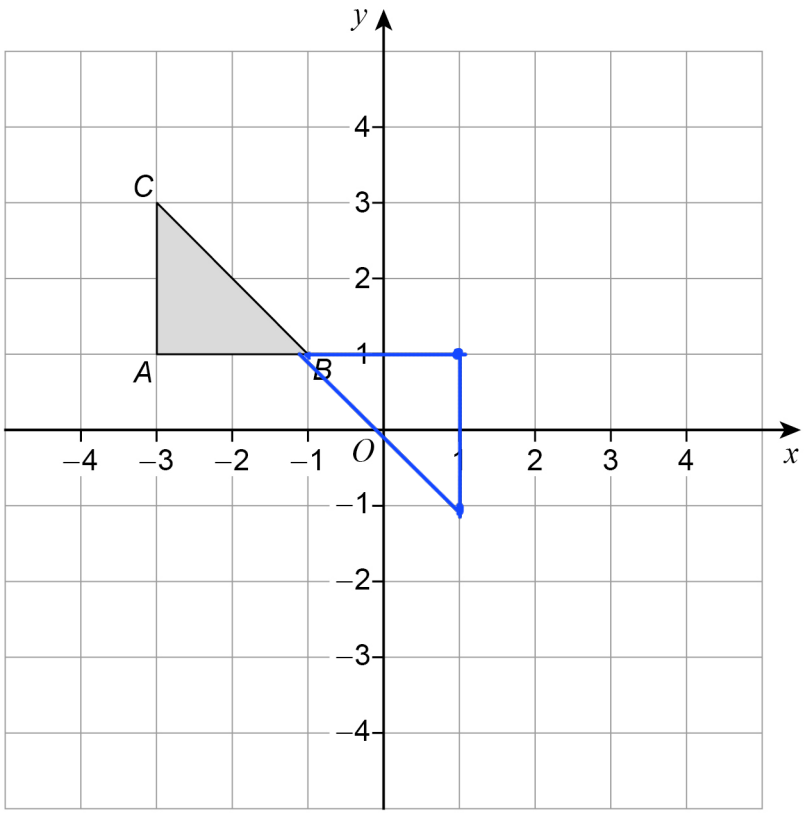
[1 mark]

This is the graph of $y = -\cos x$ (1)

3

Do not write outside the box

29 Here is triangle *ABC* on a grid.



Describe a **single** transformation of the triangle so that

point *B* is invariant

point *A* moves to (1, 1)

point *C* moves to (1, –1)

[3 marks]

Rotation of 180° about (-1, 1)

(1) (1) (1)

END OF QUESTIONS

3

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED