

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

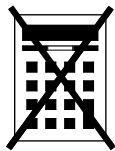
Higher Tier Paper 1 Non-Calculator

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.

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	

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

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

1 Simplify $(a^5)^3$

Circle your answer.

[1 mark]

$8a$

$15a$

a^8

a^{15}

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

2 $x \neq 0.4$

x is not equal to 0.4

Circle the possible value of x .

[1 mark]

$\frac{4}{10}$

$\frac{20}{50}$

$\frac{26}{70}$

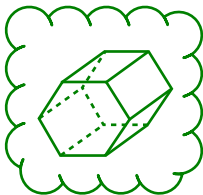
$\frac{120}{300}$

$4/10 = 0.4$ and this simplifies to $2/5$. Simplify all of the other fractions by dividing the numerators and denominators by the same amount to get smaller whole numbers. They will all simplify to $2/5$ apart from one of them

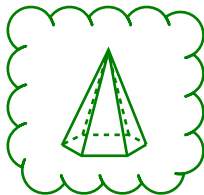
3 Circle the solid that has 7 vertices.

[1 mark]

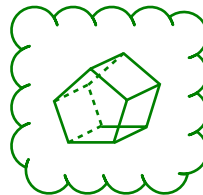
hexagonal
prism



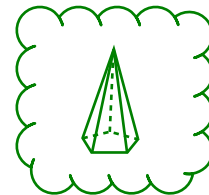
hexagon-based
pyramid



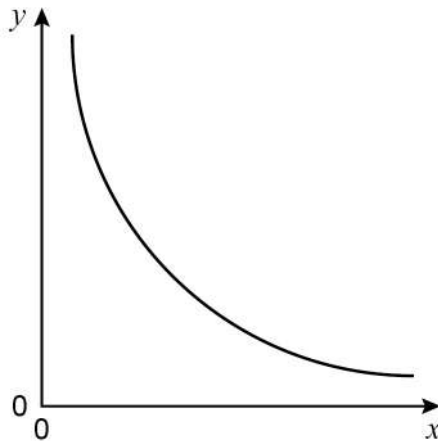
pentagonal
prism



pentagon-based
pyramid



- 4 Here is a sketch of a graph.



Circle the equation of the graph.

k is a constant.

[1 mark]

$$y = kx$$

$$y = k + x$$

$$y = k - x$$

$$y = \frac{k}{x}$$

y increases as x increases for both of these so it can't be these two

- 5 Write 200 as a product of prime factors.
Give your answer in index form.

[3 marks]

200

Do a factor tree for 200 and circle the primes. Then write all the circled primes multiplied together in the form $a^x \times b^y$ where a and b are prime numbers and x and y are positive whole numbers

Answer _____



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]

Convert both Lily's and Hugo's age into months. There are 12 months in a year. Write Lily's ages in months over Hugo's age in months. To simplify the fraction, divide both the numerator and denominator by the same amount to get smaller whole numbers

Answer _____

7

Use approximations to estimate the answer to

$$\frac{\sqrt{97} + 2.014^3}{0.49}$$

[3 marks]

Round each number to 1 significant figure. Eliminate the decimal from the denominator by multiplying both the numerator and denominator by 10 a number of times. Then divide the numerator by the denominator

Answer _____



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

[3 marks]

Get all the x terms on the same side, the one with the most x, then get the x terms on their own then get x on its own. The inequality solves in a similar way to an equation. Do the opposite operation to both sides to eliminate

Answer $x >$

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



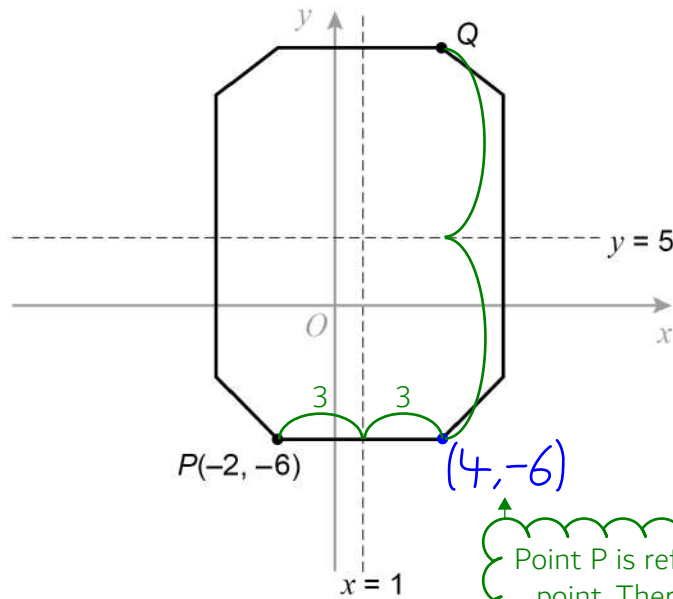
[2 marks]

Answer $2 \leq x < 5$



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]

(4, -6) is reflected on the line $y = 5$ to get point Q

Answer (_____ , _____)



- 10 (a)** Work out $2000 \times 70\,000$
Give your answer in standard form.

[2 marks]

$2 \times 7 = 14$. 2000 is 2 multiplied by 10 3 times and 70000 is 7 multiplied by 10 4 times so adjust the answer of 14 by multiplying by 10 an appropriate number of times. Standard form is in the form $a \times 10^n$ where $1 \leq a < 10$ and n is a whole number

Answer _____

- 10 (b)** Work out $\frac{1.8 \times 10^2}{3 \times 10^{-1}}$
Give your answer as an ordinary number.

[2 marks]

$(1.8/3) \times (10^2/10^{-1})$. $a^x/a^y = a^{x-y}$

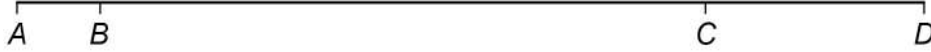
Answer _____

Turn over ►



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

Not drawn
accurately



$$\text{distance } CD = 3 \times \text{distance } AB$$

$$\text{distance } BC = 25 \text{ miles}$$

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]

s^d_t ←

This is a speed, distance, time problem
so writing out the formula triangle

First work out AC . The time
needs to be in hours to do this.

$$AC - BC = AB$$

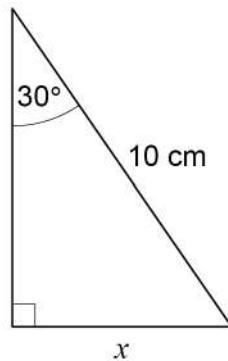
$$AB \times 3 = CD$$

$$AC + CD = AD$$

Answer _____ miles



12 Here is a right-angled triangle.



Not drawn
accurately

Use trigonometry to work out the value of x .

[3 marks]

SOHCAHTOA

Right angled trigonometry can be used so writing SOH CAH TOA as formula triangles

Tick what we have and what we are trying to find. If there are two ticks on a formula triangle that one can be used. To use the formula triangle cover over what we are trying to find and the rest will tell us what to do. S: sin of the angle. C: cos of the angle. T: tan of the angle. O: opposite. H: hypotenuse. A: adjacent

Answer _____ cm

List the angles we need to remember which are 0, 30, 45, 60, 90. For the sin values list 0, 1, 2, 3, 4 under these, square root them then put them over 2. For the cos values list 4, 3, 2, 1, 0 under these, square root them then put them over 2. For the tan values, divide the sin value by the cos value

Turn over for the next question



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

[2 marks]

6 | 5

← Divide 5 by 6

Answer _____

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

Circle your answer.

[1 mark]

$$\frac{7}{x}$$

$$\frac{7}{2x}$$

$$\frac{12}{x}$$

$$\frac{12}{x^2}$$

The denominators are the same so the numerators
can be added. The denominator stays the same



15

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

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

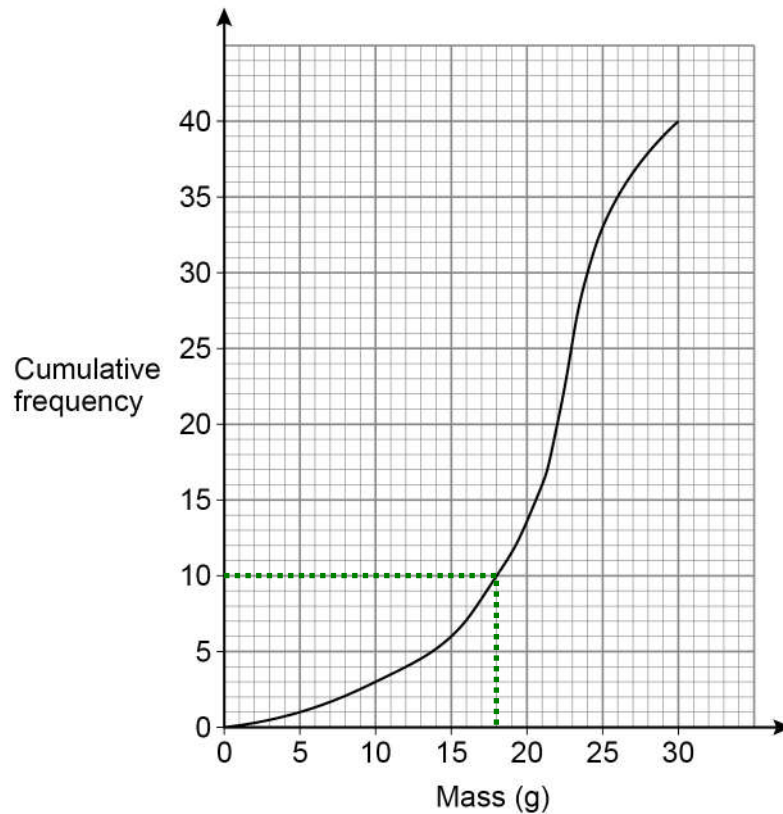
[3 marks]

Expand the brackets on the left side then equate the coefficients. To find a we can equate the constant terms, the ones not involving x , on the left and right. This will give an equation in terms of a which can be solved. Once a is found equate the x terms to find b

Answer _____ and _____



- 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]

Drawing a line up from 21 to the line then across estimates how many necklaces have a mass of 21 or less. Subtracting this many from the total number of necklaces gives the number which were greater than 21 grams

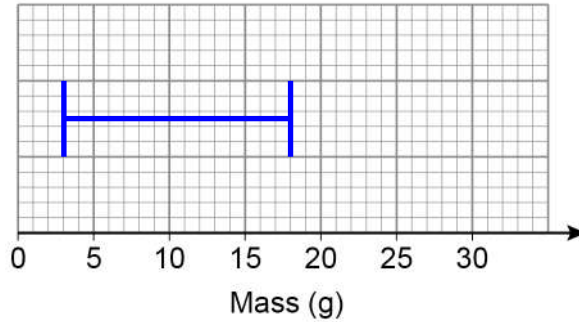
Answer _____

Line drawn across from 10 to the line then down to estimate the lower quartile, which is roughly $\frac{1}{4}$ of the way through the 40. The median is roughly $\frac{1}{2}$ of the way through the 40. The upper quartile is roughly $\frac{3}{4}$ of the way through the 40



- 16 (b)** The lowest mass was 3 grams.
The highest mass was 28 grams.
Draw a box plot to represent the data.

[3 marks]



Draw vertical lines for the lowest, lower quartile, median, upper quartile and highest. Join up the lowest and lower quartile with a horizontal line. Join up the upper quartile and the highest with a horizontal line. Draw a box around the quartiles and median

- 17** Circle the vector that translates the point $(-2, 7)$ to the point $(3, -1)$

[1 mark]

x coordinate
y coordinate

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

Column vectors are in the form $\begin{pmatrix} x \\ y \end{pmatrix}$, where x is how far in the x direction and y is how far in the y direction

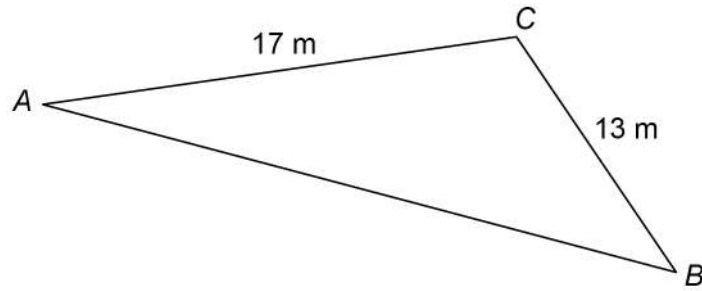
Turn over for the next question

Turn over ►



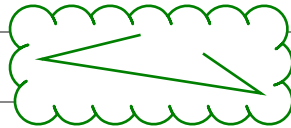
18 (a) Here is a triangle.

Not drawn
accurately

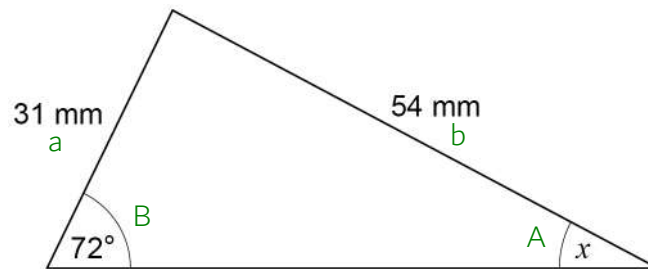


Give a reason why the length of side AB **cannot** be 35 m

[1 mark]



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]

The sine rule: $a/\sin A = b/\sin B$



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

90% pass the first check.

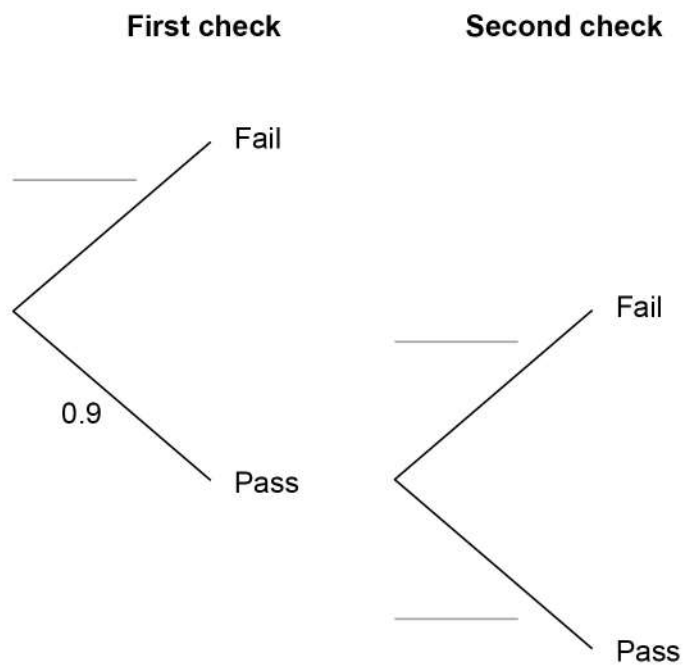
The items that fail are scrapped.

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]



It is certain to either pass or fail so each branch has to add up to 1



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

Work out the probability that the item is scrapped.

[3 marks]

Fail OR pass AND fail. OR means
to add, AND means to multiply

Answer _____

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

Density = mass/volume

Turn over for the next question



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

Give your answer as a mixed number.

[3 marks]

The power of 2 means to square the fraction. This squares the numerator and denominator. The negative power means to do the reciprocal, which flips the result. To convert into a mixed number, the number of times the denominator goes into the numerator is the whole number and the remainder is left in a fraction over the denominator

Answer _____

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

[3 marks]

Doing the reciprocal of both sides eliminates x as the denominator. Then do the opposite of square rooting to both sides to eliminate the square root. Then do the opposite of adding 1 to both sides to eliminate the +1. x should now be on its own as the subject

Answer _____



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

$f(4) = 7$

$f(10) = 22$

Work out the values of c and d .

[3 marks]

Substitute x for 4 in $f(x)$ and set it equal to 7. Substitute x for 10 in $f(x)$ and set it equal to 22. This will form two equations in terms of c and d which can be solved simultaneously. Multiply or divide one or both equations to make the number of c or d the same magnitude, amount ignoring any negative signs, then add or subtract the equations to eliminate either the c or d terms. This will leave an equation in terms of c or d which can be rearranged and solved. Then substitute the result into one of the original equations to find the other unknown

$$c = \underline{\hspace{2cm}} \quad d = \underline{\hspace{2cm}}$$



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

Circle the expression for $hg(x)$

[1 mark]

$$\frac{2x^2 - x}{2}$$

$$\frac{2x - 1}{2}$$

$$x^2 - x$$

$$x - 1$$

$g(x)$ is substituted for x in $h(x)$

25

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

[3 marks]

$$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$$

$$\sqrt{a}/\sqrt{b} = \sqrt{a/b}$$

First simplify $\sqrt{2} \times \sqrt{3}$ then divide both terms on the numerator by this. This should give the square root of a square number and an integer. Square rooting the square number then subtracting the integer will leave an integer

Turn over for the next question

Turn over ►



26

$$d = 2f$$

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

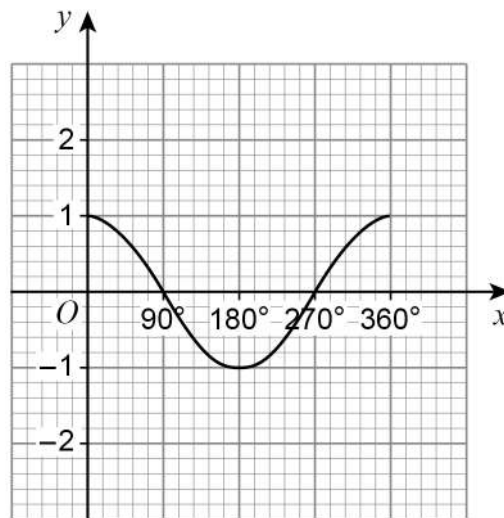
Work out the ratio $e : f$ **[3 marks]**

Substitute d for $2f$ in the second equation so there is an equation in terms of only e and f . Multiply both sides by the denominators to eliminate them. Collect all the e terms on one side and the f terms on the other. Think of a value of e and f which would work in the resulting equation then write these as a ratio

Answer _____ : _____



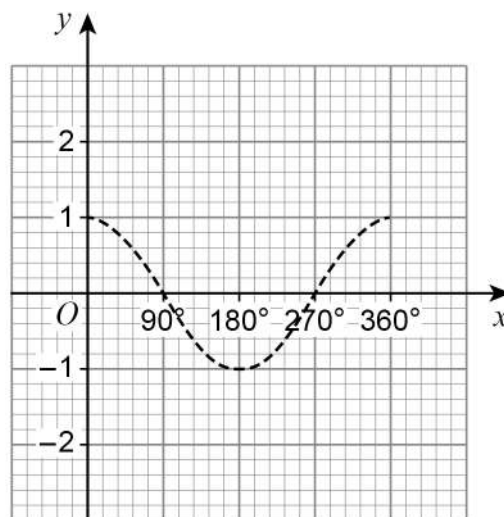
28 Here is the graph of $y = \cos x$ for $0^\circ \leq x \leq 360^\circ$



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 $y = \cos(x - 90^\circ)$ for $0^\circ \leq x \leq 360^\circ$

[1 mark]

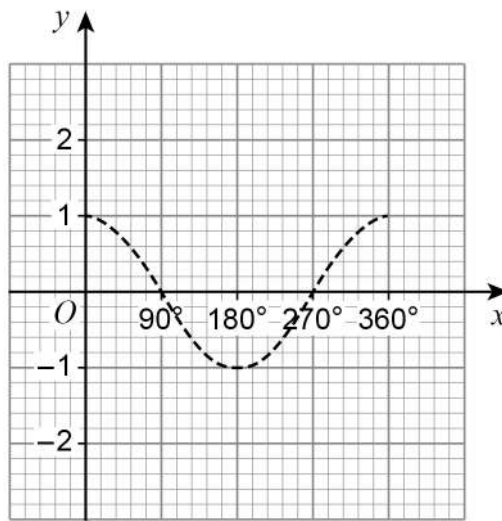


The graph is translated 90 to the right



- 28 (b) On the grid below, draw the graph of $y = 1 + \cos x$ for $0^\circ \leq x \leq 360^\circ$

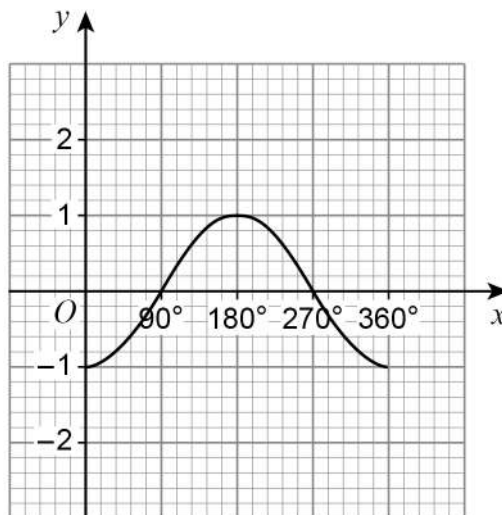
[1 mark]



The graph is translated 1 up

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

Here is her graph.



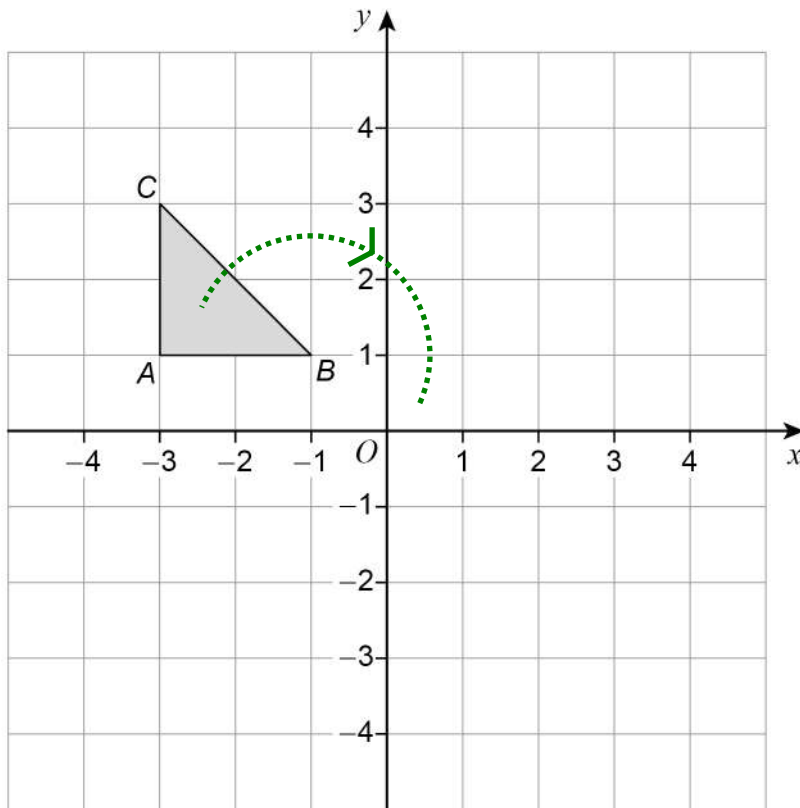
Give a reason why Rita's graph is incorrect.

[1 mark]

It has been reflected in the x axis



29

Here is triangle ABC on a grid.Describe a **single** transformation of the triangle so thatpoint B is invariantpoint A moves to $(1, 1)$ point C moves to $(1, -1)$

B stays the same. Plot all the points
onto the graph to see where the
triangle is after the transformation

[3 marks]

Rotation...

Describe by how many degrees, the direction
(if necessary) and about which point

END OF QUESTIONS