

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

Higher Tier

Paper 1 Non-Calculator

Shadow paper based on November 2021 question paper

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.

1 Simplify $(x^3)^7$

Circle your answer.

[1 mark]

$10x$

$21x$

x^{10}

x^{21}

2 $p \neq 0.6$

Circle the possible value of p .

[1 mark]

$\frac{6}{10}$

$\frac{30}{50}$

$\frac{45}{70}$

$\frac{180}{300}$

3 Circle the solid that has 9 vertices.

[1 mark]

octagonal
prism

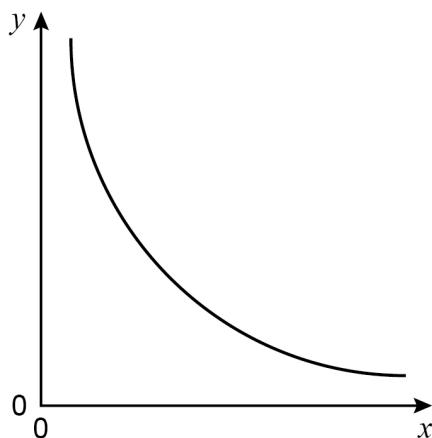
octagon-based
pyramid

hexagonal
prism

hexagon-based
pyramid

4

Here is a sketch of a graph.



Do not write
outside the
box

Circle the equation of the graph.

[1 mark]

$$y = x$$

$$y = 1 + x$$

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

$$y = 1 - x$$

5

Write 360 as a product of prime factors.

Give your answer in index form.

[3 marks]

Answer _____

—
7

Turn over ►

6

Adam's age is 3 years and 6 months.

Zara's age is 2 years and 11 months.

Write Adam's age in months as a fraction of Zara's age in months.

Give your fraction in its simplest form.

[2 marks]

Answer _____

7

Use approximations to estimate the answer to

$$\frac{\sqrt{145} + 3.017^2}{2.95}$$

[3 marks]

Answer _____

Do not write outside the box

8 (a) Solve $7x + 3 > 5x + 10$

[3 marks]

Answer _____

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



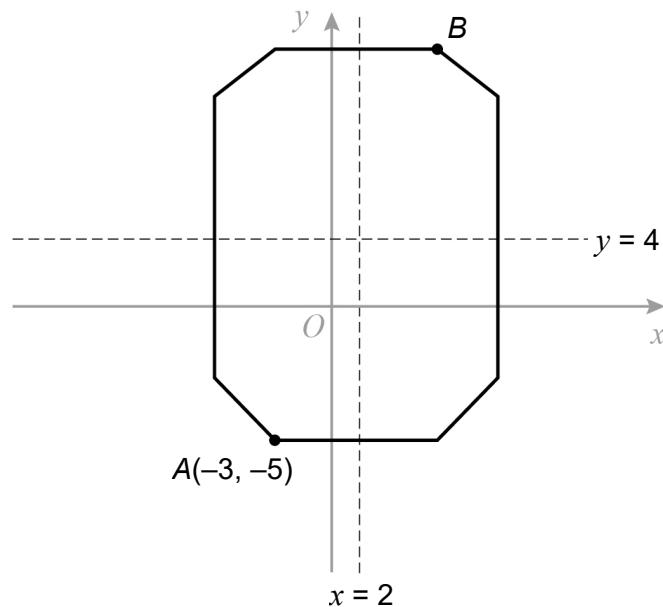
[2 marks]

Answer

9

The diagram shows an octagon.

Do not write
outside the
box



Not drawn
accurately

$x = 2$ and $y = 4$ are lines of symmetry.

Work out the coordinates of point B.

[2 marks]

Answer (_____, _____)

10 (a) Work out $3000 \times 60\,000$
Give your answer in standard form.

[2 marks]

Answer

10 (b) Work out
$$\frac{2.1 \times 10^3}{3 \times 10^{-2}}$$

[2 marks]

Give your answer as an ordinary number.

Answer

11

A, B, C and D are markers on a park run route.

Not drawn accurately



distance $CD = 2 \times$ distance AB

distance $BC = 4$ km

Sheena runs from A to C.

She runs for 30 minutes at an average speed of 14 km per hour.

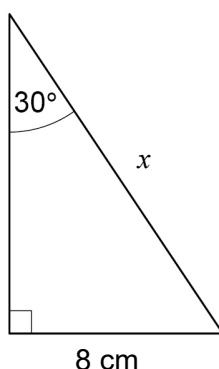
Work out the distance AD .

[4 marks]

Answer km

12

Here is a right-angled triangle.



Not drawn
accurately

Use trigonometry to work out the value of x .

[3 marks]

Answer _____ cm

Turn over for the next question

13 Convert $\frac{5}{9}$ to a recurring decimal.

[2 marks]

Answer

14 Simplify $\frac{4}{x+1} + \frac{5}{x+1}$

Circle your answer.

[1 mark]

$$\frac{9}{x+1}$$

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

$$\frac{20}{x+1}$$

$$\frac{20}{(x+1)^2}$$

15

$$(x + a)(x + 2a) \equiv x^2 + bx + 128$$

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

[3 marks]

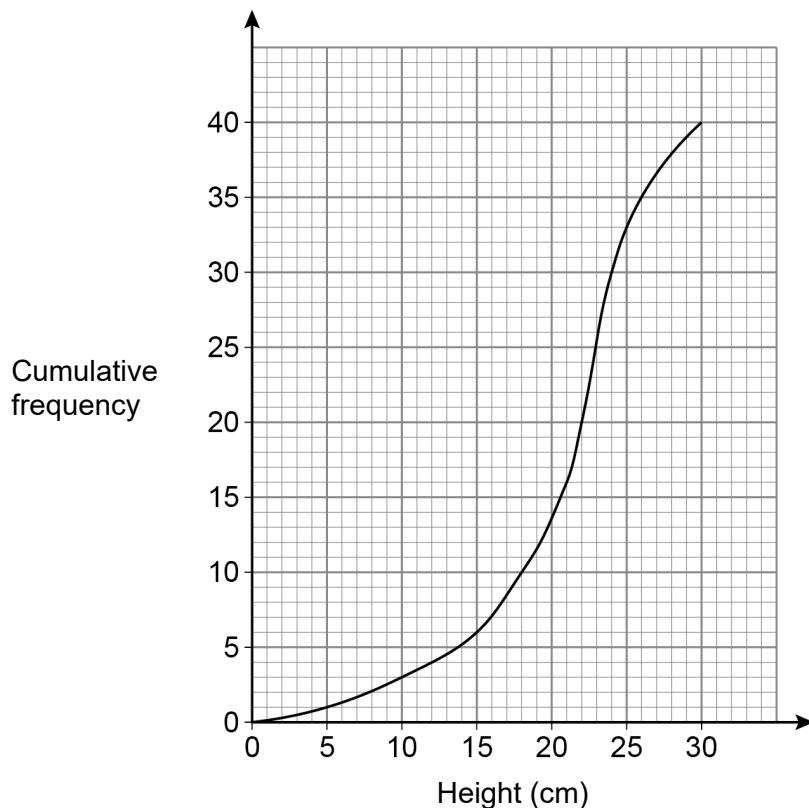
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Answer and

16

The cumulative frequency graph represents the heights of 40 vases.

Do not write
outside the
box



16 (a) A dealer buys every vase with height **greater than** 26 cm.

Use the graph to estimate how many she buys.

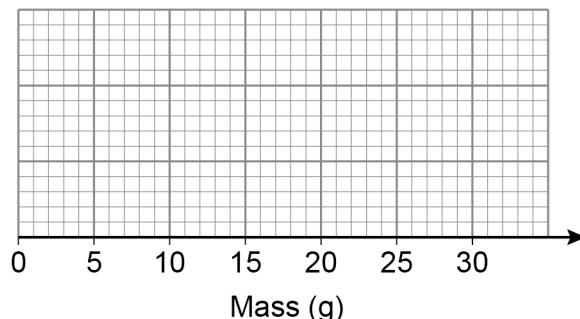
[2 marks]

Answer _____

16 (b) The lowest height was 8 cm.
The greatest height was 28 cm.

Draw a box plot to represent the data.

[3 marks]



17 Circle the vector that translates the point $(4, -5)$ to the point $(-3, 1)$

[1 mark]

$$\begin{pmatrix} -7 \\ 4 \end{pmatrix}$$

$$\begin{pmatrix} -7 \\ 6 \end{pmatrix}$$

$$\begin{pmatrix} 7 \\ -4 \end{pmatrix}$$

$$\begin{pmatrix} 7 \\ -6 \end{pmatrix}$$

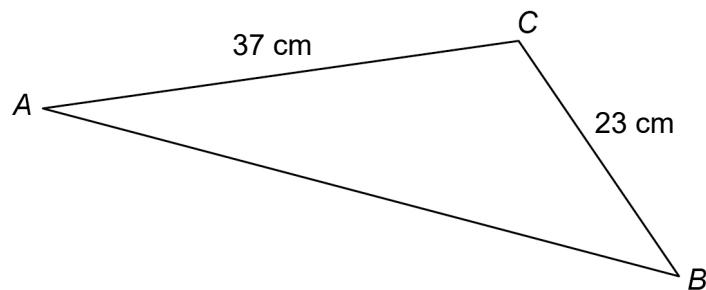
Turn over for the next question

6

Turn over ►

18 (a) Here is a triangle.

Do not write
outside the
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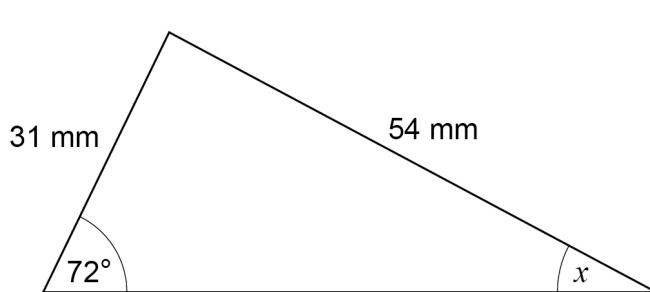


Give a reason why the length of side AB cannot be 60 cm

[1 mark]

18 (b) Here is a different triangle.

Do not write outside the box



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

Here are the first two lines of her working.

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

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

What error has she made in this working?

[1 mark]

2

Turn over ►

19 Apples intended for a supermarket have to pass two checks.

20% of apples fail the first check.

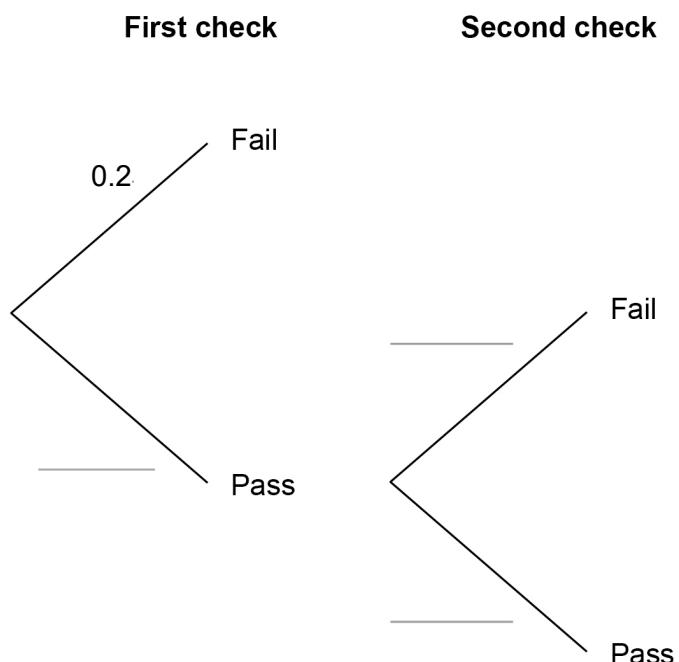
The apples that fail are thrown away.

95% of the apples that pass the first check pass the second check.

The apples that fail are thrown away.

19 (a) Complete the tree diagram.

[2 marks]



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

Work out the probability that the apple is thrown away.

[3 marks]

Answer

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

Circle your answer.

[1 mark]

m^2/s

m/s²

s/m²

s^2/m

Turn over for the next question

21

The first two terms of a quadratic sequence are 3 and 12

Here is some information about the sequence.

Sequence: 3, 12, ...,

First difference: +9, +17, ...,

Second difference: +8, +8, ...

Work out an expression for the n th term of the sequence.

[4 marks]

Answer

22

Work out the value of $\left(\frac{2}{3}\right)^{-3}$

Give your answer as a mixed number.

[3 marks]

Answer

23

Rearrange $y = \frac{1}{x^2 + 2}$ to make x the subject.

[3 marks]

Answer _____

10

Turn over ►

24 (a) $f(x) = ax + 2b$

$$f(6) = 17$$

$$f(10) = 31$$

Work out the values of a and b

[3 marks]

$$a = \quad \quad \quad b =$$

24 (b) $g(x) = 3x$ and $h(x) = \frac{x+2}{3}$

Circle the expression for $hg(x)$

[1 mark]

$$\frac{3x^2 + x}{3}$$

$$x^2 + 2x$$

$$\frac{3x+2}{3}$$

$$x + 2$$

25 Show that $\frac{\sqrt{135} + \sqrt{15}}{\sqrt{3} \times \sqrt{5}}$ simplifies to an integer.

[3 marks]

Turn over for the next question

26

$$a = 3c$$

$$\frac{b-c}{a+b} = \frac{1}{6}$$

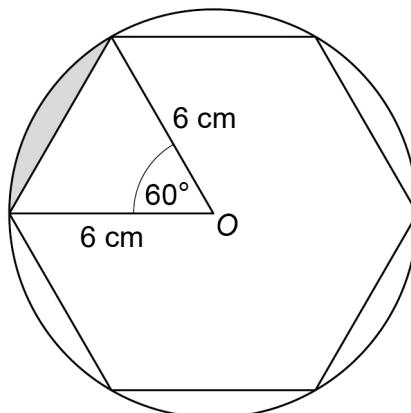
Work out the ratio $b : c$

[3 marks]

Answer :

27

The vertices of a regular hexagon lie on a circle with centre O and radius 6 cm



Not drawn accurately

Work out the shaded area.

Give your answer in the form $a\pi - b\sqrt{3}$ where a and b are integers.

[4 marks]

Answer cm^2

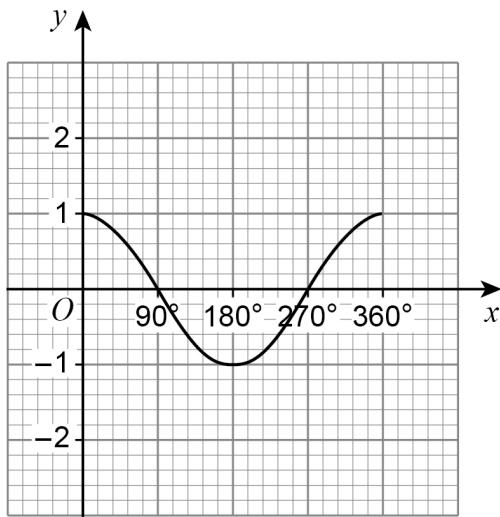
7

Turn over ►

28

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

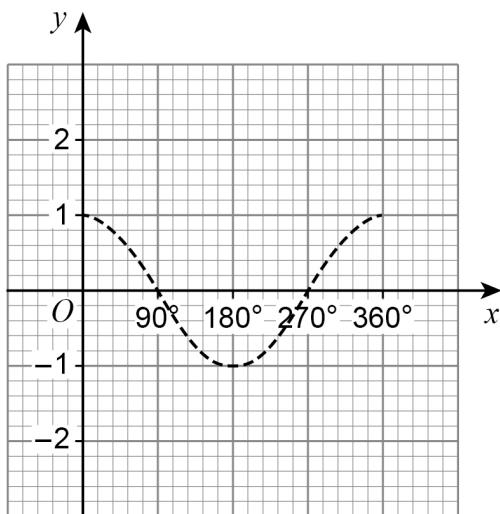
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In parts (a) and (b) the graph of $y = \cos x$ is shown as a dashed line.

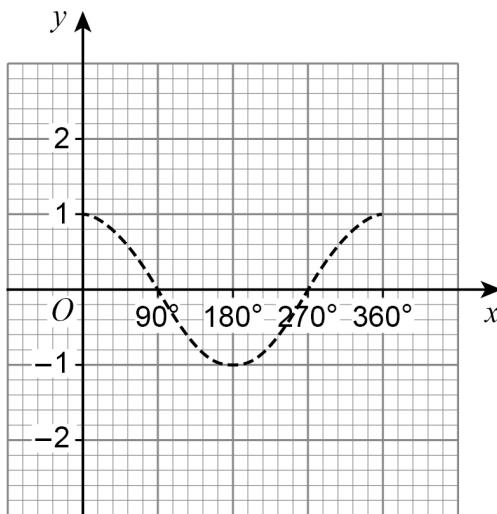
28 (a) On the grid below, draw the graph of $y = \cos(x + 90^\circ)$ for $0^\circ \leq x \leq 360^\circ$

[1 mark]



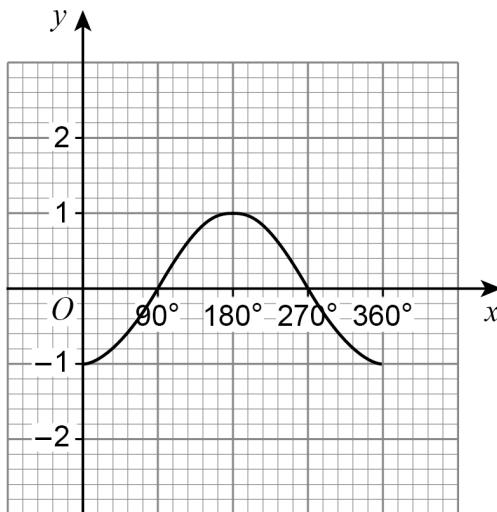
28 (b) On the grid below, draw the graph of $y = \cos x - 1$ for $0^\circ \leq x \leq 360^\circ$

[1 mark]



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

Here is her graph.



Give a reason why Rita's graph is incorrect.

[1 mark]

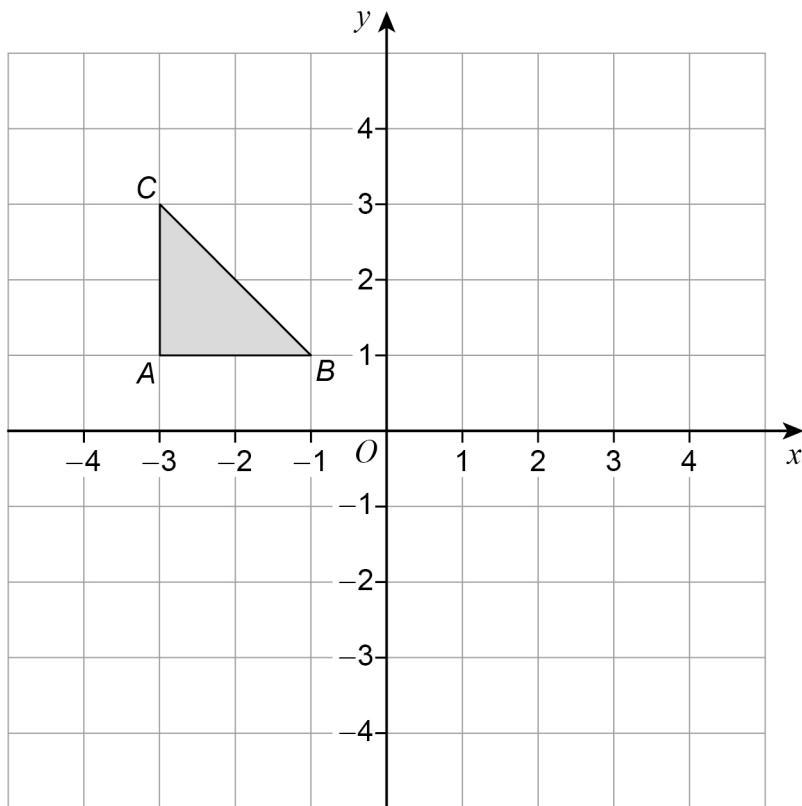
3

Turn over ►

29

Here is triangle ABC on a grid.

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

- point B is invariant
- point A moves to $(-1, -1)$
- point C moves to $(-3, -1)$

[3 marks]

END OF QUESTIONS

3

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ANSWER IN THE SPACES PROVIDED**

Question number	<p style="text-align: center;">Additional page, if required. Write the question numbers in the left-hand margin.</p>

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