

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

H

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]**

$\frac{6}{10}$

$\frac{30}{50}$

$\frac{45}{70}$

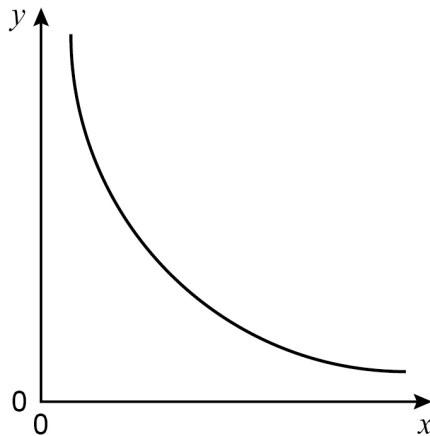
$\frac{180}{300}$

3

Circle the solid that has 9 vertices.

[1 mark]octagonal
prismoctagon-based
pyramidhexagonal
prismhexagon-based
pyramid

- 4 Here is a sketch of a graph.



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 _____

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]

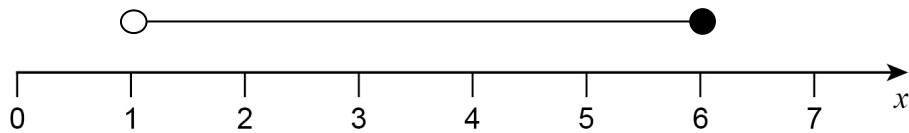
Answer _____

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

[3 marks]

Answer _____

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

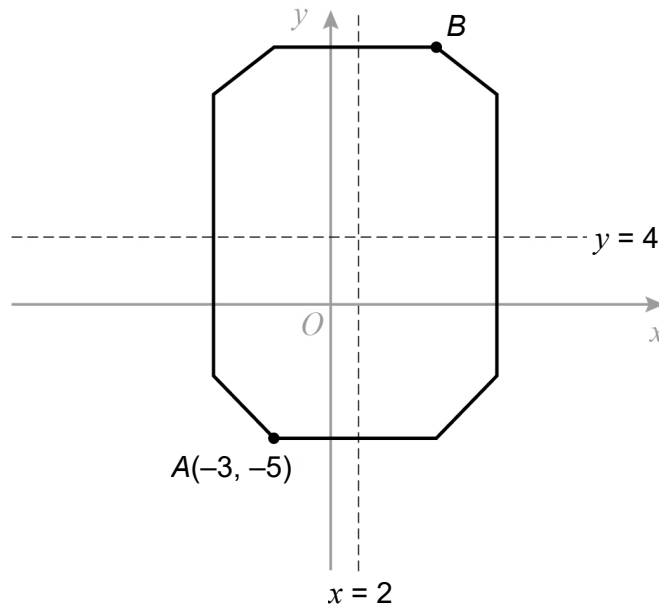


[2 marks]

Answer _____

9

The diagram shows an octagon.

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 $\frac{2.1 \times 10^3}{3 \times 10^{-2}}$
Give your answer as an ordinary number.

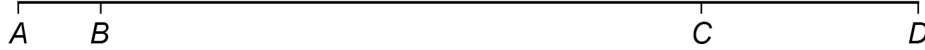
[2 marks]

Answer _____

Turn over ►

- 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.

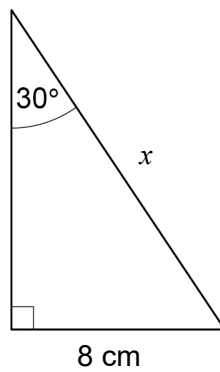
Work out the distance AD .

[4 marks]

Answer _____ km

12

Here is a right-angled triangle.

Not drawn
accuratelyUse 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]

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

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

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

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

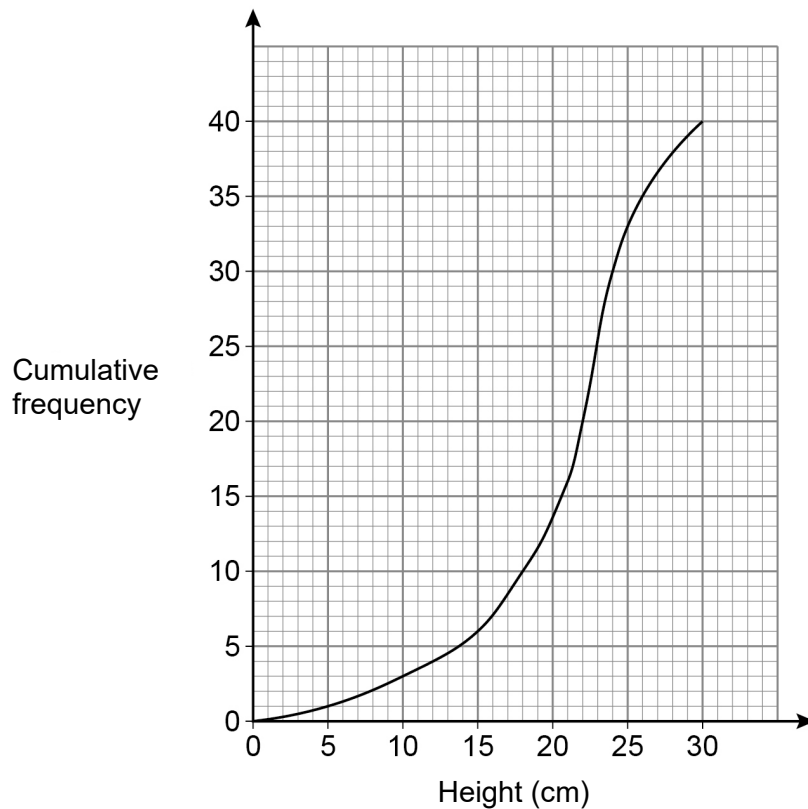
$$(x + a)(x + 2a) \equiv x^2 + bx + 128$$

[3 marks]

[illegible]

Answer _____ and _____

- 16** The cumulative frequency graph represents the heights of 40 vases.



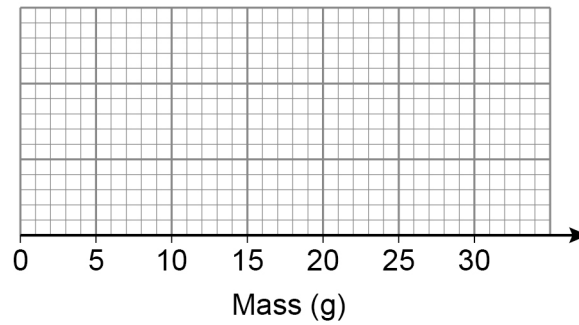
- 16 (a)** A dealer buys every vase with height **greater than** 26 cm.

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]

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

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

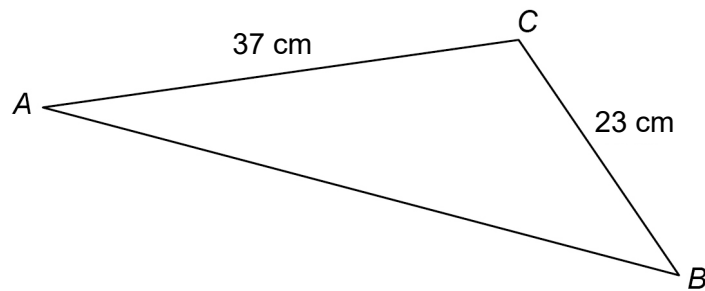
$$\begin{pmatrix} 7 \\ -4 \end{pmatrix}$$

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

Turn over for the next question**Turn over ►**

18 (a) Here is a triangle.

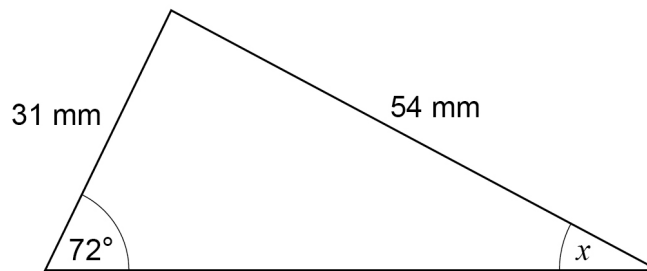
Not drawn
accurately



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

[1 mark]

18 (b) Here is a different triangle.



Not drawn
accurately

Penny tries to use the sine rule to work out the size of angle x .
Here are the first two lines of her working.

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

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

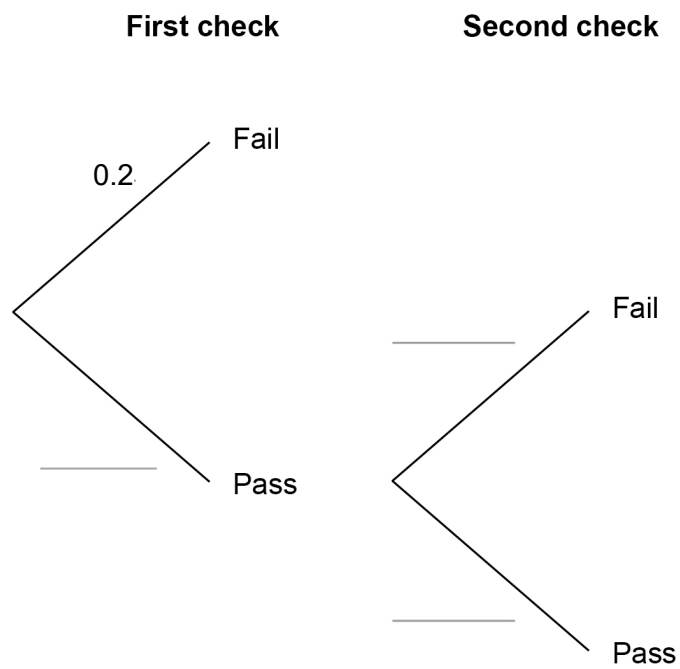
What error has she made in this working?

[1 mark]

- 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/s^2

s/m^2

s^2/m

Turn over for the next question

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

The diagram shows three rows of values and differences, aligned with four terms of a sequence:

	1st term	2nd term	3rd term	4th term
Sequence	3	12
First difference		+9	+17	...
Second difference		+8	+8	

Arrows indicate the progression from one term to the next in each row. The first difference row shows the change from the 1st to 2nd term (+9) and from the 2nd to 3rd term (+17). The second difference row shows the change from the 1st to 2nd term (+8) and from the 2nd to 3rd term (+8).

[4 marks]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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 _____

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

$$f(6) = 17$$

$$f(10) = 31$$

Work out the values of a and b .

[3 marks]

$$a = \underline{\hspace{2cm}} \quad b = \underline{\hspace{2cm}}$$

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 _____ :

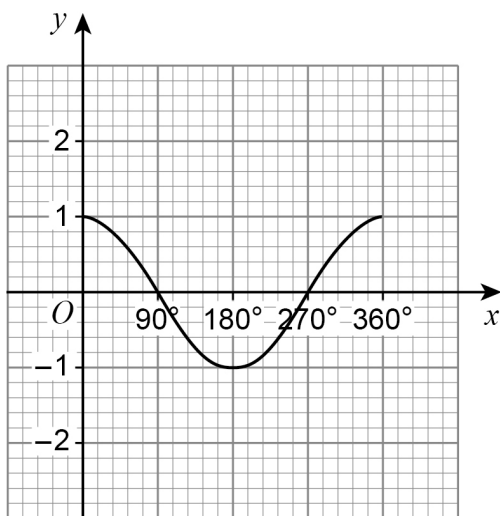
The vertices of a regular hexagon lie on a circle with centre O and radius 6 cm

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

[illegible]

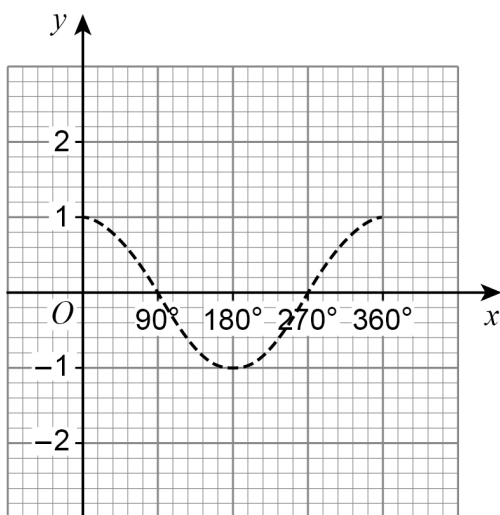
Answer _____ cm^2

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



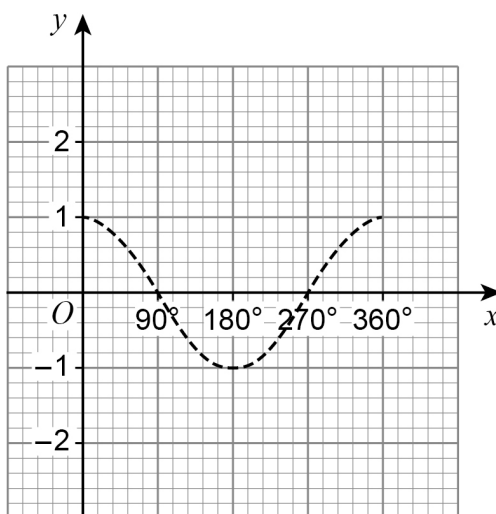
In parts **(a)** and **(b)** the graph of $y = \cos x$ is shown as a dashed line.

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]



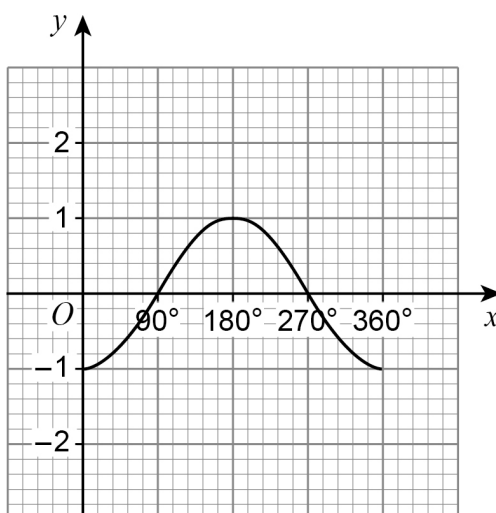
- 28 (b) On the grid below, draw the graph of $y = \cos x - 1$ for $0^\circ \leq x \leq 360^\circ$

[1 mark]



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

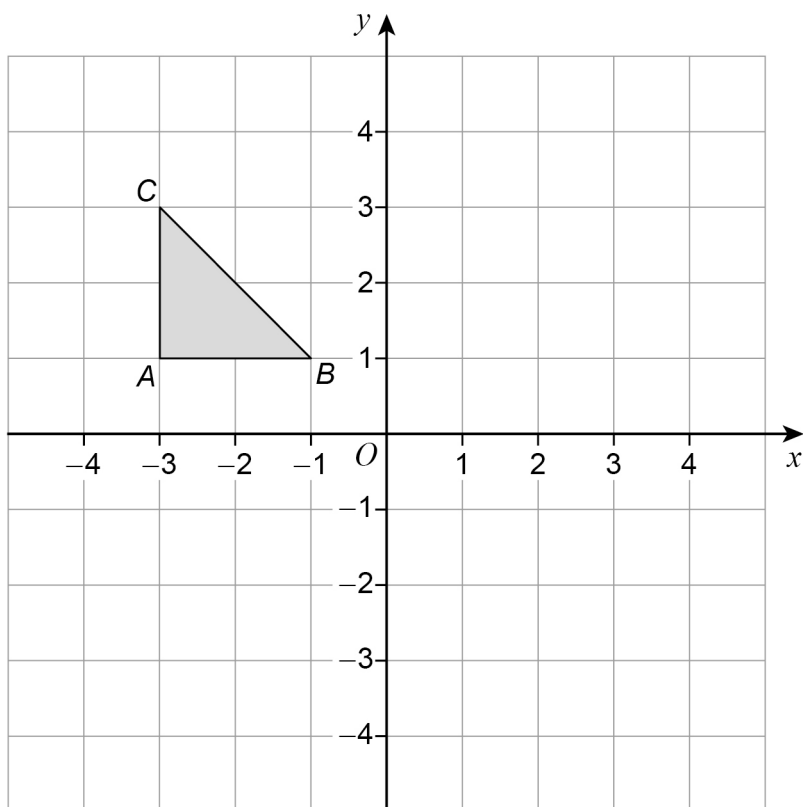
Here is her graph.



Give a reason why Rita's graph is incorrect.

[1 mark]

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 $(-3, -1)$ **[3 marks]**

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED**

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[illegible]

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ANSWER IN THE SPACES PROVIDED**

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