Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

C300UA0-1

S23-C300UA0-1

FRIDAY, 19 MAY 2023 – MORNING

MATHEMATICS – Component 1
Non-Calculator Mathematics
HIGHER TIER

2 hours 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**3**	
2.	**2**	
3.	**5**	
4.	**4**	
5.	**5**	
6.	**5**	
7.	**6**	
8.	**3**	
9.	**2**	
10.	**5**	
11.	**5**	
12.	**4**	
13.	**5**	
14.	**5**	
15.	**5**	
16.	**5**	
17.	**9**	
18.	**6**	
19.	**6**	
20.	**3**	
21.	**5**	
22.	**4**	
23.	**4**	
24.	**9**	
25.	**5**	
Total	**120**	

ADDITIONAL MATERIALS

An additional formulae sheet.

The use of a calculator is not permitted in this examination.

A ruler, protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

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

If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the need for good English and orderly, clear presentation in your answers.

JUN23C300UA0101

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Examiner only

1. The lengths of the three sides of a triangle are in the ratio 3 : 5 : 7.

(a) What fraction of the perimeter is the longest side of this triangle? [1]

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(b) The perimeter of this triangle is 60 cm.

Find the length of each of the three sides of this triangle. [2]

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..... cm, ... cm, ... cm

2. The bearing of *Q* from *P* is 140°.

Find the bearing of *P* from *Q*. [2]

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Examiner only

3. The nth term of a sequence is given by $2n+9$.

(a) Work out the difference between consecutive terms. [2]

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(b) (i) Solve $2n+9<99$. [2]

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(ii) Write down the number of terms of this sequence that are less than 99. [1]

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Number of terms = ...

Examiner only

4. James has been on holiday to the USA and is flying home to the UK.
The price of a gift in a shop at the airport is $65.
The price of the same gift online is €60 including delivery.

On the day of his flight, the exchange rates were as follows.

£0.80 = $1
£1 = €1.20

Is it cheaper to buy the gift at the airport or online?

Airport ☐ Online ☐

Show how you decide. [4]

Examiner only

5.

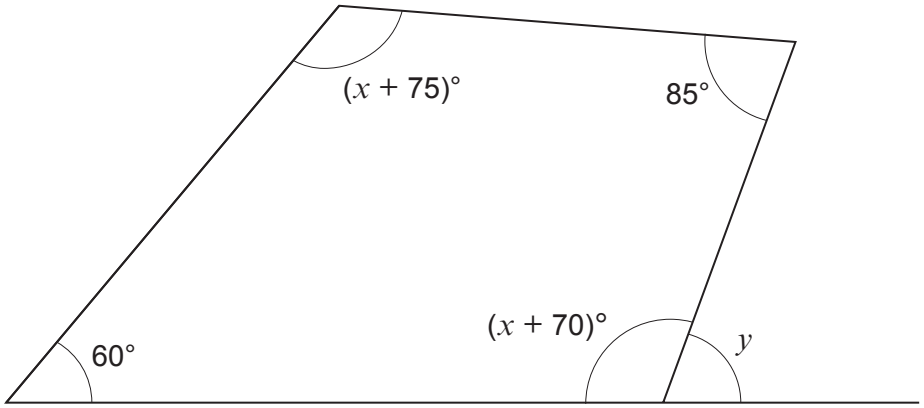

Diagram not drawn to scale

The diagram shows a quadrilateral.

Use algebra to find the size of the exterior angle y. [5]

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y = ... °

Examiner only

6. (a) Sam cycled south for 16 km.
He then turned and cycled **east**.
When he stopped for a rest, the shortest distance back to his starting point was 20 km.

Calculate how many kilometres Sam cycled while travelling east. [3]

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(b) Sam cycled the 20 km back to his starting point at a constant speed of 25 km/h.

How many minutes did this take? [2]

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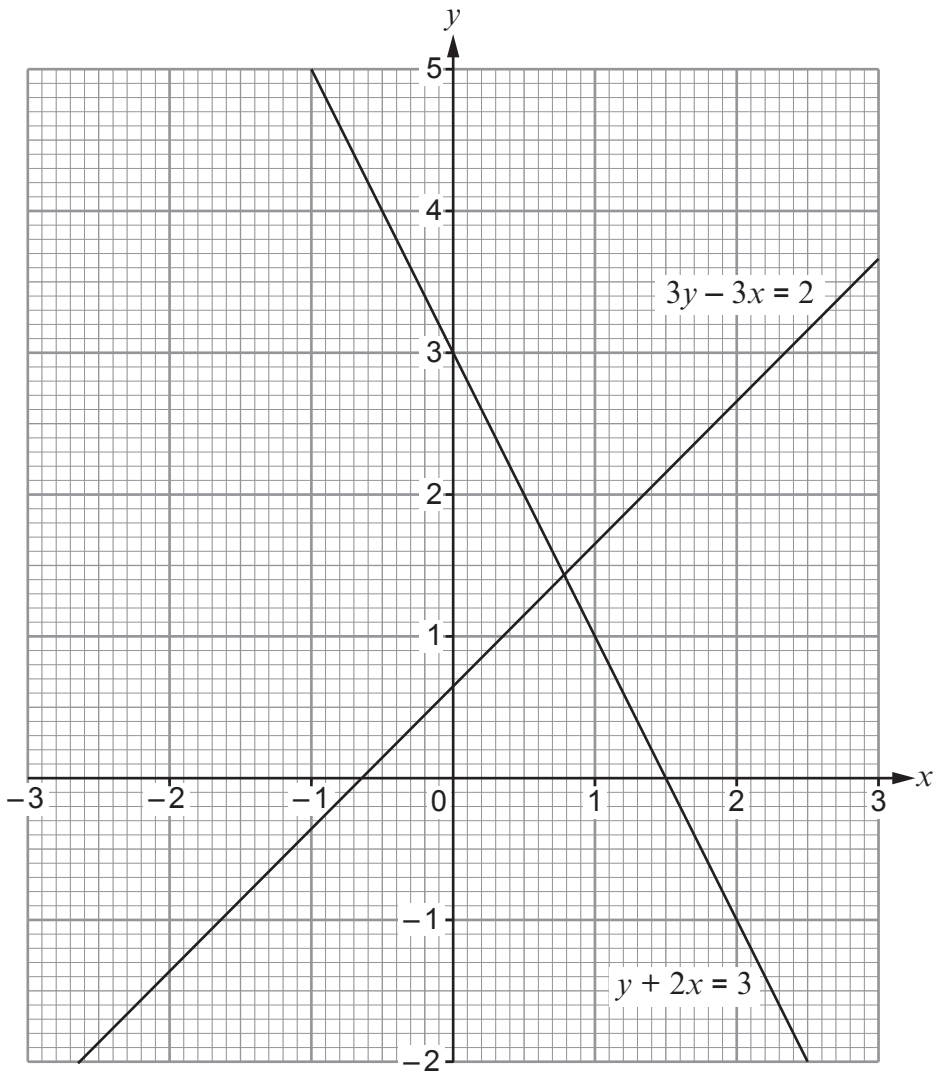
7. (a)



Use the diagram to solve the following simultaneous equations.

$$3y - 3x = 2$$
$$y + 2x = 3$$

Give your answers correct to 1 decimal place. [2]

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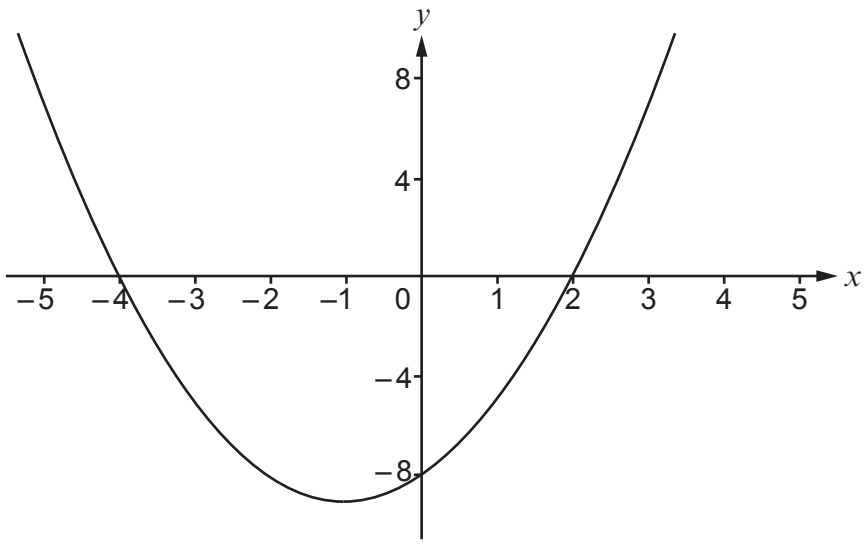
x = ... y = ...

Examiner only

(b) The diagram shows the curve $y = x^2 + 2x - 8$.



(i) Write down the y-intercept of the curve. [1]

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(ii) Find the coordinates of the turning point of the curve. [2]

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(iii) Use the diagram to solve $x^2 + 2x - 8 = 0$. [1]

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x = ... or x = ...

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8. The surface area of the Earth is $5{\cdot}101 \times 10^8$ km^2.
The Earth's oceans are 70·9% of this surface area.

Estimate the surface area of the Earth's oceans.
Give your answer in standard form. [3]

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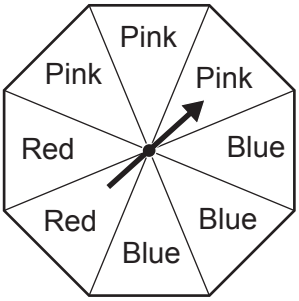
9.



The diagram shows a fair spinner.
Eve spins it twice.

What is the probability that the spinner lands on red both times? [2]

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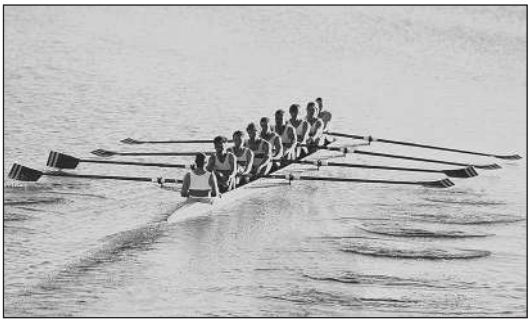
Examiner only

10. (a) In an athletics club:

- 20 of the female athletes have a mean height of 170 cm
- 30 of the male athletes have a mean height of 180 cm.

What is the mean height of these 50 athletes? [4]

(b) A boat crew has 8 rowers and a cox who steers.



The heights, in cm, of the 9 people in the crew are as follows.

150 183 193 201 203 198 201 188 193

The mean of these heights is 190 cm.
Explain why the mean is not the best average to use for this data set. [1]

Examiner only

11. The table shows some information about the cost per person to take a boat across a river.

Adults (£)	*a*
Children (£)	*c*

The Jones family of 4 adults and 1 child pay £9.50 to take the boat.
The Patel family of 5 adults and 2 children pay £13 to take the boat.

The Lee family has 3 adults and 2 children.

How much does the Lee family pay to take the boat?
You must use an algebraic method and show all your working. [5]

The Lee family pays .....

Examiner only

12. (a) Circle the equation of a line parallel to the line $y = 4x + 5$. [1]

$y = -\frac{1}{4}x + 5$ $\quad$ $y = 4x - 5$ $\quad$ $y = -4x + 5$ $\quad$ $y = \frac{1}{4}x - 5$ $\quad$ $4y = x + 5$

(b) The gradient of the line which passes through the points $(a, 3)$ and $(2a, 9)$ is $\frac{3}{4}$.

Find the value of a. [3]

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13. (a) (i) Find the next term of the following Fibonacci-type sequence. [1]

0 $\quad$ 2 $\quad$ 2 $\quad$ 4 $\quad$ 6 $\quad$ .....

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(ii) Here are the first 4 terms of a sequence.

$\sqrt{3}$ $\quad$ 1 $\quad$ $\frac{1}{\sqrt{3}}$ $\quad$ $\frac{1}{3}$ $\quad$ ..... $\quad$ .....

Find the 6th term of this sequence.
Simplify your answer. [2]

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(b) Find the nth term of the following sequence. [2]

–3 $\quad$ 0 $\quad$ 5 $\quad$ 12 $\quad$ 21

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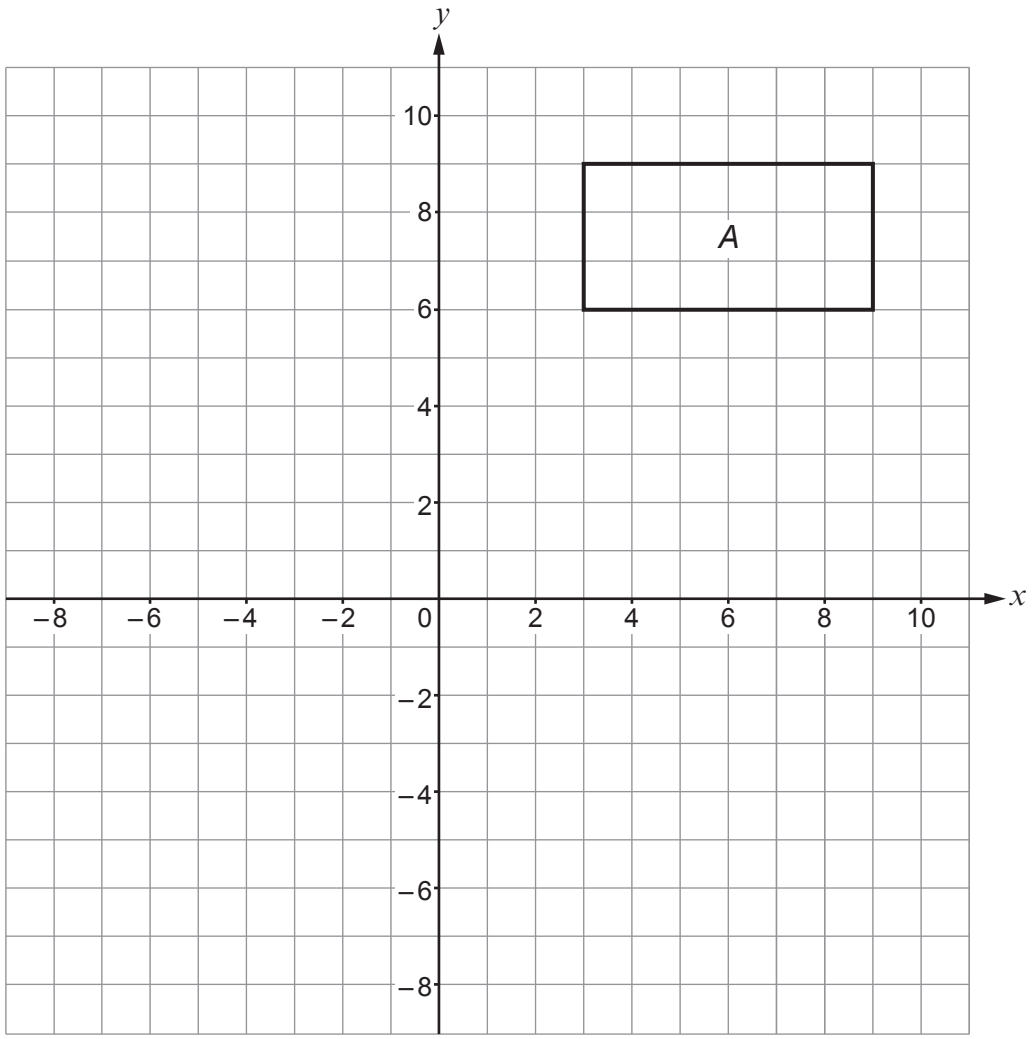
14. (a)



Draw the enlargement of rectangle *A* with scale factor $\frac{1}{3}$ and centre (0, 0). [2]

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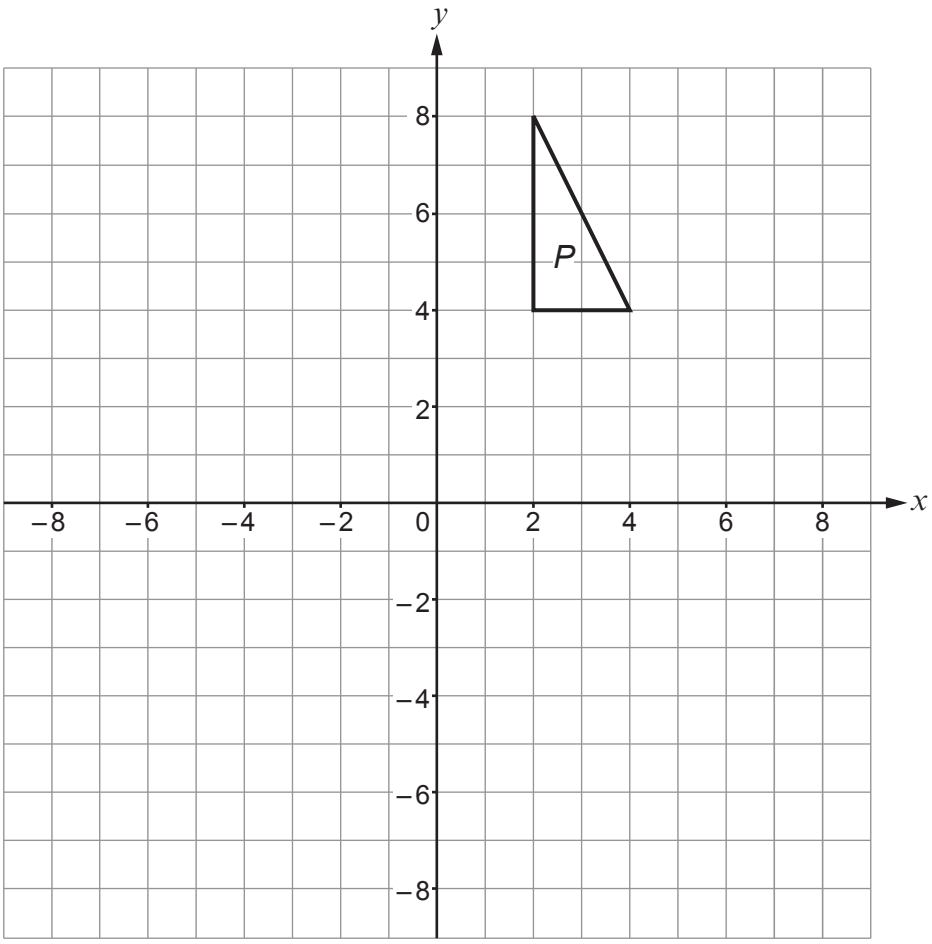
Examiner only

(b)



Triangle *P* is reflected in the line $y = x$.
The image is triangle *Q*.

Triangle *Q* is reflected in the line $y = -x$.
The image is triangle *R*.

Describe a **single** transformation that maps triangle *P* to triangle *R*. [3]

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15. A small tank is a cuboid. It has a square base of side 20 cm.
The tank contains some liquid but is not full.

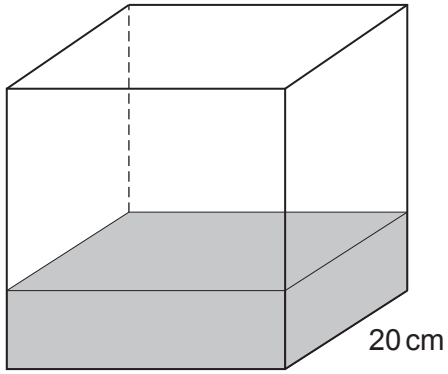

Diagram not drawn to scale

More of the same type of liquid is added to the tank:

- The total mass of the liquid in the tank is now 5400 grams.
- The depth of the liquid has increased by 50%.
- The density of the liquid is 0·9 g/cm^3.

Calculate the **original** depth of the liquid.
You must show all your working. [5]

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Examiner only

16. (a) Write $13^{-2} \times 13^{7}$ as a single power of 13. [1]

(b) Calculate the value of $\left(8^{-1}\right)^{\frac{1}{3}}$. [2]

(c) $3^{\frac{5}{a}} = b\sqrt{3}$ where a and b are integers.

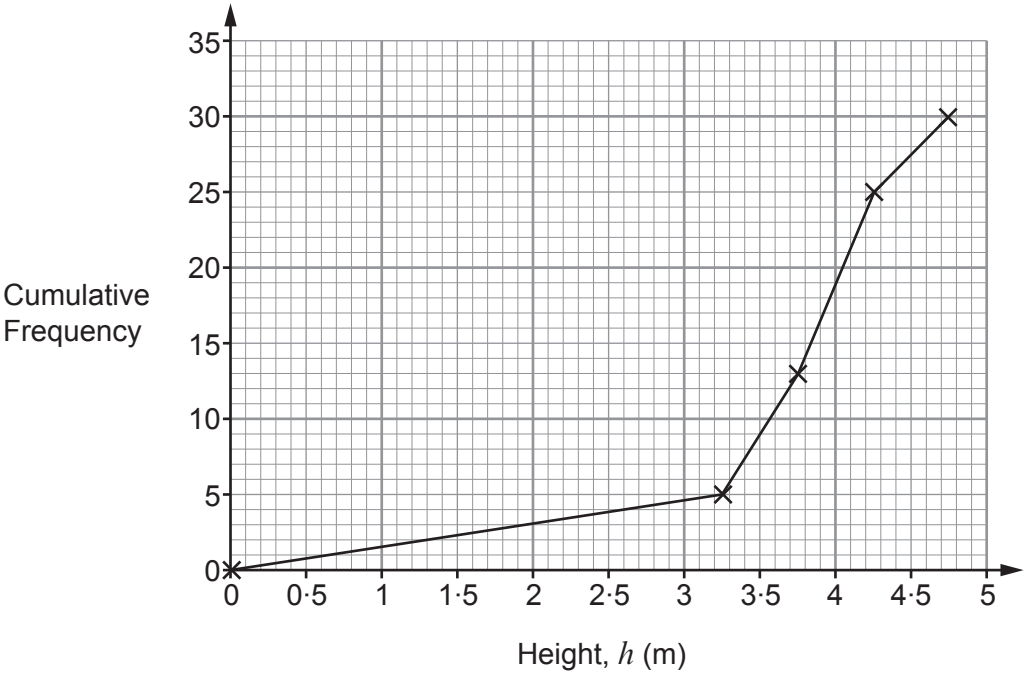
Find the value of a and the value of b. [2]

Examiner only

17. (a) Gracie has collected data about the heights of 30 giant sunflowers.
The table shows her results.

Height, h (m)	$3 < h \leqslant 3{\cdot}5$	$3{\cdot}5 < h \leqslant 4$	$4 < h \leqslant 4{\cdot}5$	$4{\cdot}5 < h \leqslant 5$
Frequency	5	8	12	5

Gracie attempts to draw a cumulative frequency diagram.



Make **two** different criticisms of Gracie's diagram. [2]

1. .....

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2. .....

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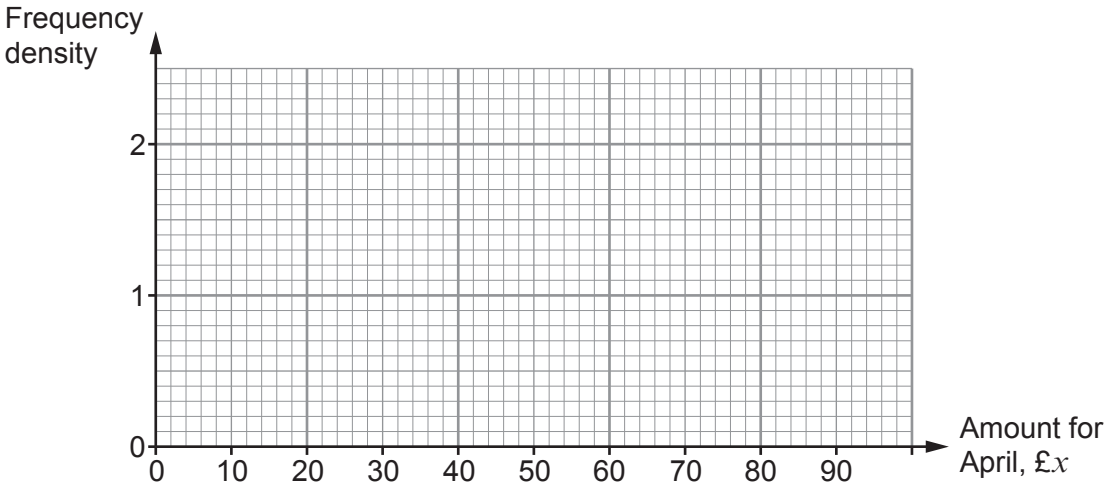
Examiner only

(b) Gracie also collects data about the amount of money each of a group of 40 gardeners spent on their gardens during the months of April and May.
The table shows the data for April.

Amount for April, (£x)	$0 < x \leqslant 30$	$30 < x \leqslant 40$	$40 < x \leqslant 50$	$50 < x \leqslant 60$	$60 < x \leqslant 80$
Frequency	6	9	12	5	8

(i) Draw a histogram to represent the data for April. [4]



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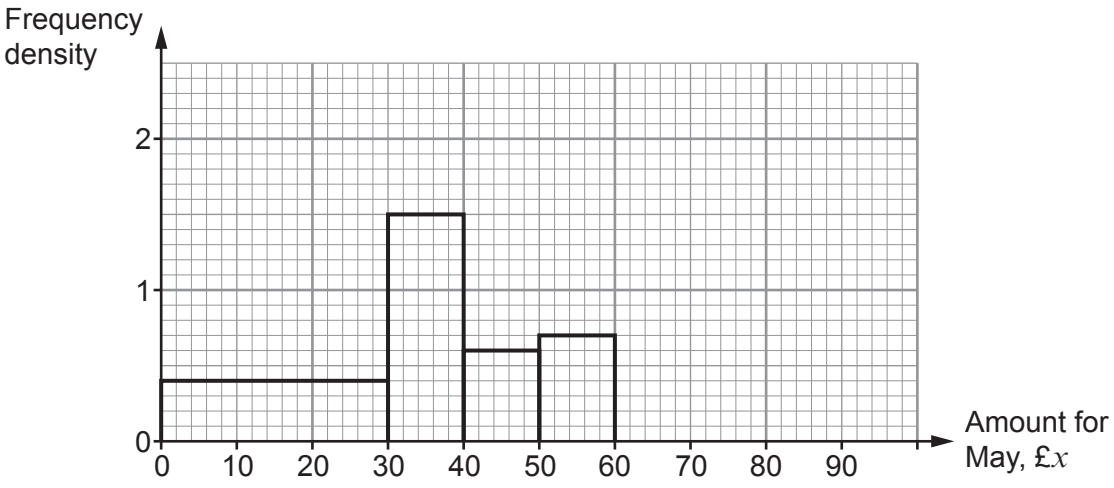
(ii) The histogram below represents the data for May.



Calculate an estimate of how many more of the 40 gardeners spent £45 or less in May than spent £45 or less in April?
You must show all your working. [3]

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Examiner only

18. (a)

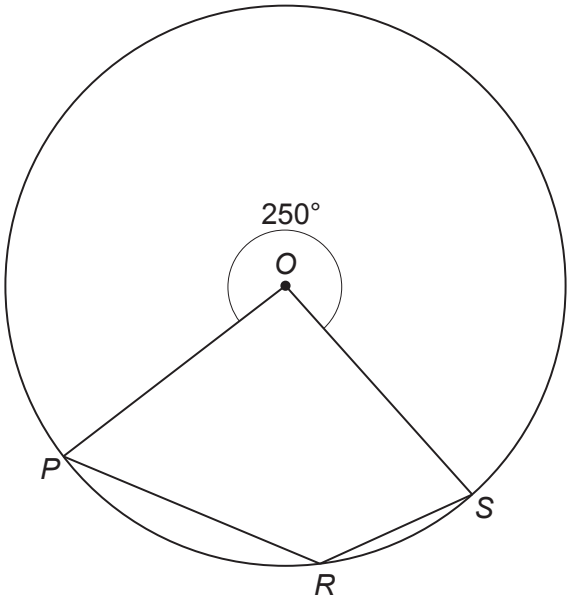

Diagram not drawn to scale

The diagram shows a circle, centre *O*.
Points *P*, *R* and *S* are on the circumference of the circle.

Reflex angle $P\hat{O}S$ = 250°.

$O\hat{P}R$: $O\hat{S}R$ = 2 : 3.

Calculate the size of $O\hat{P}R$.
You must show all your working. [3]

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(b)

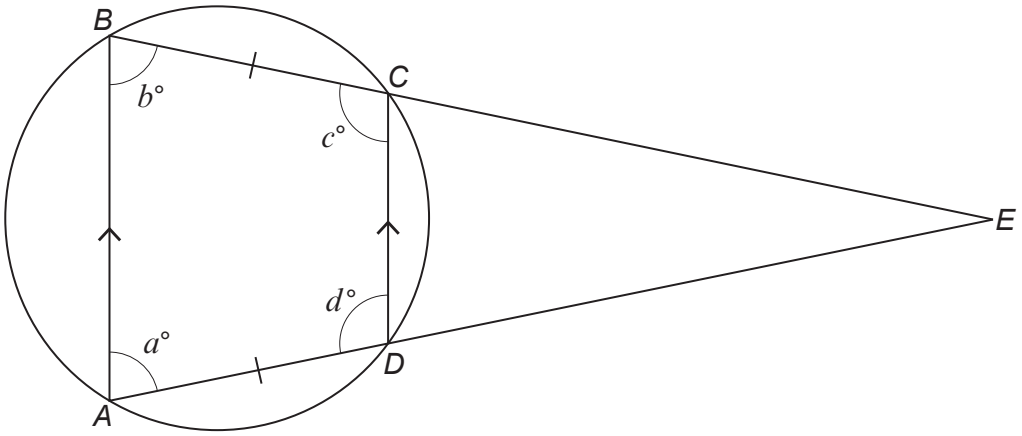


Diagram not drawn to scale

ABE is an isosceles triangle.
AB is parallel to *DC* so that *ABCD* is an isosceles trapezium.

Prove that *ABCD* is always a cyclic quadrilateral.
State any reasons that you use in your proof. [3]

Examiner only

19. You are given that y is inversely proportional to x^2.
When $x = 4,\ y = 3$.

(a) Find a formula for y in terms of x. [3]

(b) (i) Use your formula to find the value of y when $x = 8$. [1]

(ii) Use your formula to find the positive value of x when $y = 1200$. [2]

Examiner only

20. Write $3\dot{2}\dot{1}$ as a fraction.
Give your answer as a mixed number in its simplest form. [3]

21. In this question all lengths are in centimetres.

$\sqrt{5}+3$

Diagram not drawn to scale

The length of this rectangle is $\sqrt{5}+3$.

The perimeter of the rectangle is $8\sqrt{5}-2$.

Calculate the exact area of this rectangle. [5]

Examiner only

22.

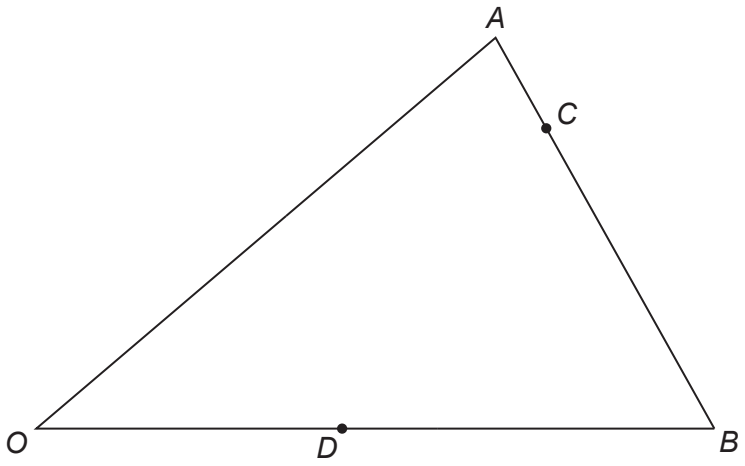


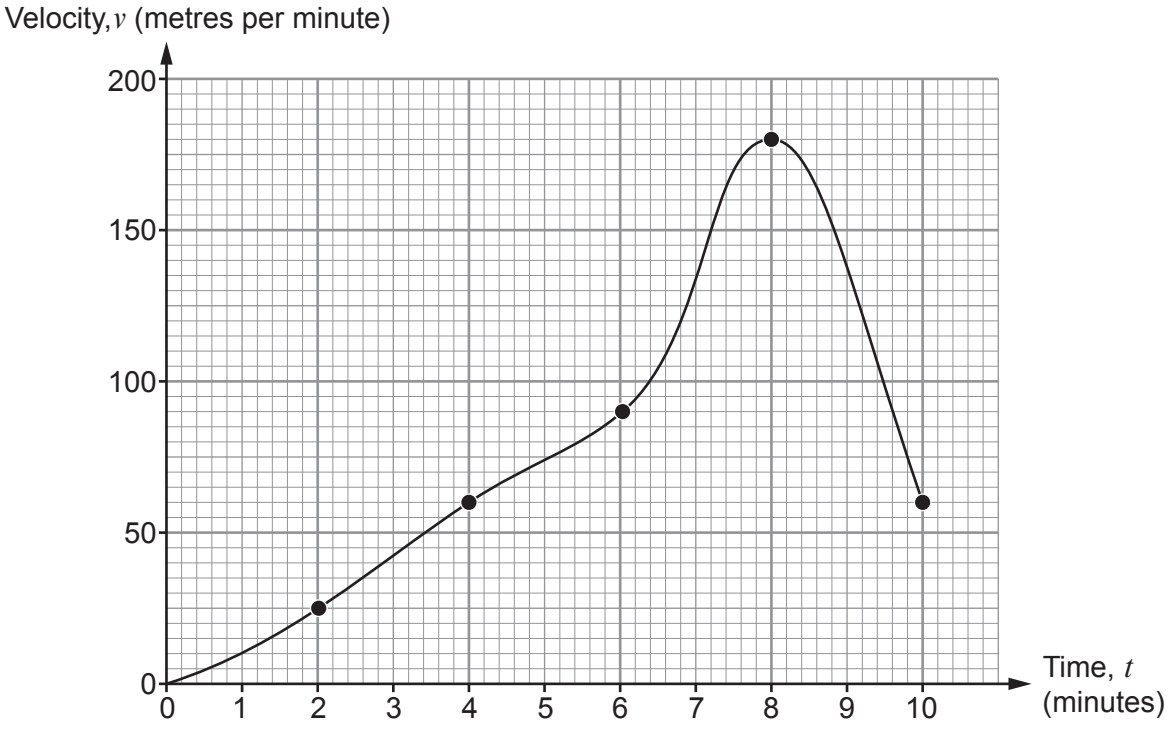
Diagram not drawn to scale

OA = $\mathbf{a}$ and **OB** = $\mathbf{b}$.
C is the point on *AB* such that *AC* : *AB* = 1 : 4.
D is the mid-point of *OB*.

Find **DC** in terms of $\mathbf{a}$ and $\mathbf{b}$.
Give your answer in its simplest form. [4]

Examiner only

23.



The diagram shows a velocity-time graph for the first 10 minutes of a cyclist's journey. The velocity is given in metres per minute and the time is given in minutes.

How many minutes after the start of the journey did the cyclist first travel at a velocity of **9 kilometres per hour**? [4]

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24. (a) Solve the equation $5x^2 - 8x - 1 = 0$.

Give your answers in the form $\frac{m \pm \sqrt{n}}{5}$, where m and n are integers. [3]

(b) Use factorisation to solve the following equation. [6]

$$\frac{4}{x-1} = 3 + \frac{2}{x}$$

Examiner only

25. The following probabilities are given for events *A* and *B*.

$$P(A) = 0 \cdot 3, \qquad P(A \cup B) = 0 \cdot 7, \qquad P(A \cap B) = 0 \cdot 1$$

(a) By drawing a Venn diagram, or otherwise, find the value of $P(B)$. [3]

(b) Find $P(A' \cup B')$. [2]

END OF PAPER