Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

C300UA0-1

A22-C300UA0-1

TUESDAY, 1 NOVEMBER 2022 – MORNING

MATHEMATICS – Component 1
Non-Calculator Mathematics
HIGHER TIER

2 hours 15 minutes

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.

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

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Formula list

Area and volume formulae

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

Curved surface area of a cone = πrl

Surface area of a sphere = $4\pi r^2$

Volume of a sphere = $\frac{4}{3}\pi r^3$

Volume of a cone = $\frac{1}{3}\pi r^2 h$

Kinematics formulae

Where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time taken:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

Examiner only

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

2, 3, 5, 8, 13, 21, 34, ...

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

4, 9, 14, 19, 24, ...

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2. (a) Tick (✓) the **two** correct statements about $3xy(y+2) \equiv 3xy^2 + 6xy$. [2]

It is an equation.	
It is true for all values of x and y.	
It is an identity.	
It is only true for certain values of x and y.	
It is an inequality.	
It is true for only one value of x and one value of y.	

(b) In this part of the question all lengths are in centimetres.

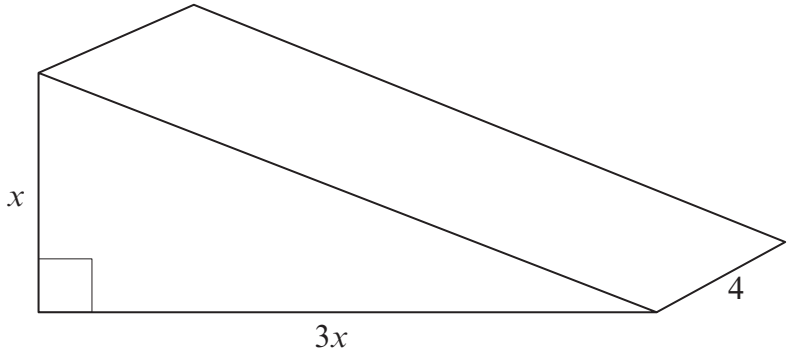

Diagram not drawn to scale

The diagram shows a prism.
The cross-section of the prism is a triangle with height x and base $3x$.
The volume of the prism is 216 cm^3.

Use an algebraic method to find the height of the triangle. [5]

Examiner only

3. (a) Mary and Paul run 100 metres.

Mary's time is between 14 and 15 seconds inclusive.
Paul's time is between 12 and 13 seconds inclusive.

Complete the inequality to show the least and greatest possible difference between the times of these two runners. [2]

..... ⩽ time difference ⩽ .....

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(b) Peter wants to go by ferry to France.
He is taking a van and a small trailer.
He knows:

- the van is 590 centimetres long, correct to the nearest 10 cm
- the trailer is 200 centimetres long, correct to the nearest 10 cm.

The ferry company uses the following rules for the length of vehicles.

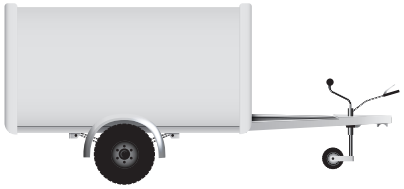

Diagram not drawn to scale

Small trailer: maximum length 2 m	Van: maximum length 6 m

Peter thinks that the length of his van and the length of his trailer will **both** fit the rules.

Use lengths to give one example to show how Peter **may** be correct, and one example to show how Peter **may not** be correct. [2]

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May be correct .....

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May not be correct .....

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Examiner only

4. (a) Work out $(6 \times 10^5) \div 20$.
Give your answer in standard form. [2]

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(b) At midday, the volume of water flowing over a waterfall is 3×10^8 litres per minute.

At midday, what is the volume of water flowing over the waterfall in litres per hour?
Give your answer in standard form. [3]

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Examiner only

5. A glass of water is placed on a small table. The table stands on horizontal ground.

(a) The total mass of the table and the glass of water is 9·6 kg.

Diagram not drawn to scale

You are given the ratios,

mass of table : mass of glass of water = 11 : 1,
mass of empty glass : mass of water = 3 : 5.

What is the mass of the empty glass? [3]

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(b) Use: $\text{Pressure} = \dfrac{\text{Force (N)}}{\text{Area (cm}^2\text{)}}$

The base of the table has an area of 1600 cm^2.
Some books are also placed on the table.
The books, glass of water and table exert a pressure of 0·1 N/cm^2 on the ground.

Diagram not drawn to scale

Calculate the force exerted on the ground by the books, glass of water and table.
Assume that the whole of the base of the table is in contact with the ground.

[2]

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(c) In fact, the assumption made in part (b) is incorrect. Part of the base of the table is not in contact with the ground.

Describe how this changes your answer to part (b). [1]

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6.

In a sale, jewellery is reduced in price by 40%.
The price of a ring is reduced to £1008 in the sale.

What was the price of the ring before the sale? [3]

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Examiner only

7. (a) Expand and simplify $(3x-4)(5x+7)$. [3]

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(b) Factorise each of the following.

(i) $2x^2y+12xy^2$ [3]

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(ii) x^2-64 [1]

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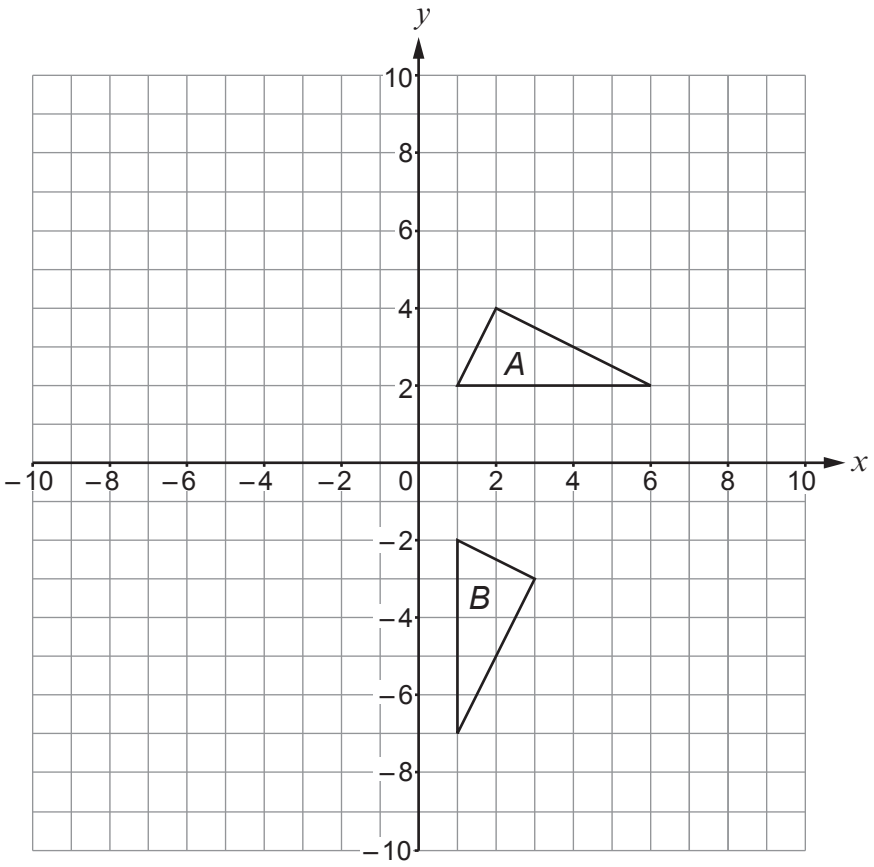

(a) Describe the **single** transformation that maps triangle *A* to triangle *B*. [3]

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(b) Triangle *C* **was mapped to** triangle *A* using an enlargement, scale factor $\frac{1}{3}$, centre (5, 1).

Draw triangle *C* on the grid above. [2]

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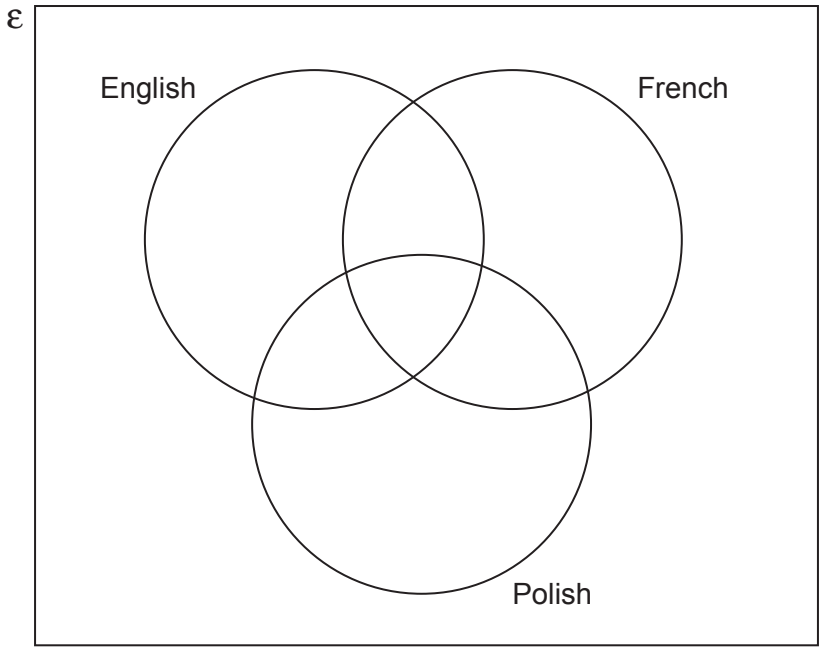
Examiner only

9. Fifty people were asked which languages they speak from English, French and Polish.

Of these 50 people:

- 8 speak all 3 languages
- 20 speak English only
- 1 speaks French only
- no-one speaks Polish only
- 12 speak English and French but not Polish
- 10 speak French and Polish
- 3 do not speak any of these languages.

(a) Complete the Venn diagram to show this information. [3]
The universal set, **ε**, contains all 50 people.



(b) One person is chosen at random.
Find the probability that this person does not speak French. [1]

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(c) One person is chosen at random from those who speak English.
Find the probability that this person speaks French or Polish but not both. [2]

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10. (a) Simplify each of the following.

(i) $\dfrac{x^9}{2x^5}$ [1]

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(ii) $\left(\dfrac{x}{\sqrt{5}}\right)^{-2}$ [2]

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(b) Jamal says,

"For all positive real numbers a and b, $\sqrt{a+b} = \sqrt{a} + \sqrt{b}$."

Give an example to prove that Jamal is incorrect. [1]

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(c) (i) $\sqrt[4]{y} = y^x$

Write down the value of x. [1]

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(ii) Evaluate $32^{\frac{3}{5}}$. [2]

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11. Rearrange $4x = \sqrt[3]{7y + xy}$ to make y the subject.
Give your answer in its simplest form. [4]

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12.

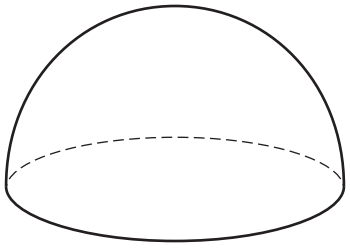


Diagram not drawn to scale

The volume of a hemisphere is $18\,000\pi\,\text{cm}^3$.

Find the radius of the hemisphere. [4]

Examiner only

13. Asha is taking part in a school cross-country race.

She:

- **runs** x km in 8 minutes, then
- walks 0·2 km in 2 minutes, then
- **runs** 1·8 km in 10 minutes.

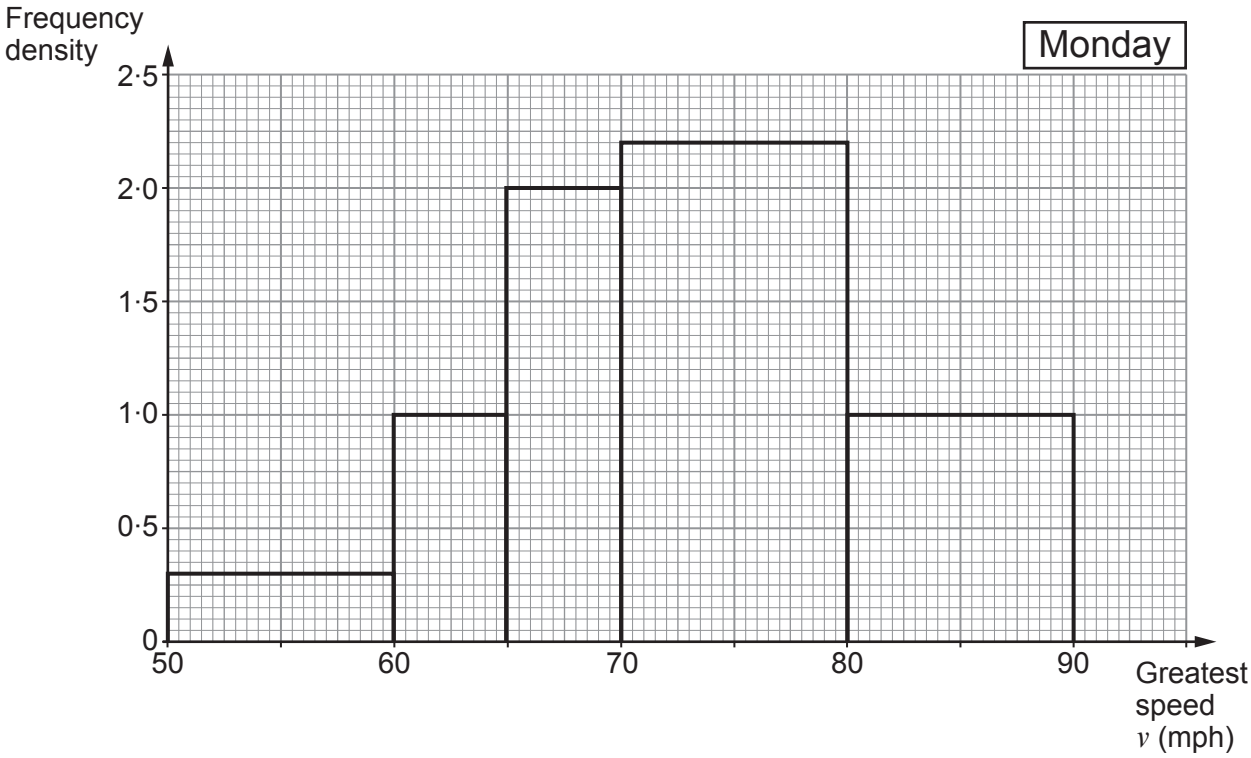
Asha's average speed for the whole race is $\frac{5x+2}{60}$ kilometres per minute.

Find the value of x and hence write the distance that she **runs** as a fraction of the total distance.

Give your answer in its simplest form. [6]

Examiner only

14. The histogram below represents the greatest speed, v mph, of a car when driven by 50 drivers on a section of racetrack on Monday.



(a) Calculate an estimate of the percentage of the 50 drivers who drove at a greatest speed of 75 mph or more on this section of racetrack. [3]

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(b) Use the histogram to complete this cumulative frequency table. [2]

Greatest speed, v (mph)	$v \leqslant 50$	$v \leqslant 60$	$v \leqslant 65$	$v \leqslant 70$	$v \leqslant 80$	$v \leqslant 90$
Cumulative frequency	0					50

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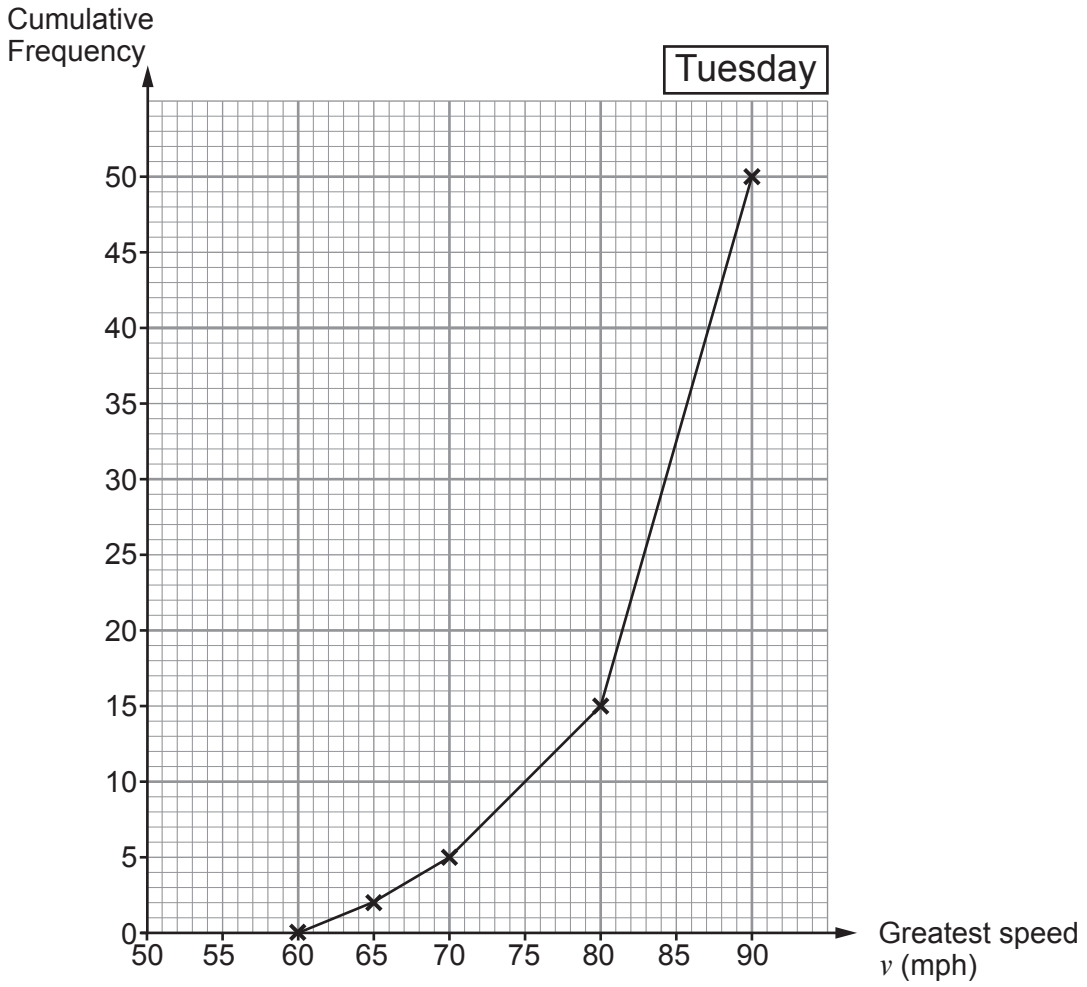
(c) The cumulative frequency diagram below represents the greatest speed, v mph, of the same car when driven by 50 different drivers on the same section of racetrack on Tuesday.



(i) On the grid above, draw the cumulative frequency diagram to represent the results of Monday's drivers. [2]

(ii) On one of the days, many of the drivers were racing drivers.

On which day was this likely to be?
Give numerical evidence and explain your decision. [2]

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15. Zofia sells two different mixes of seed, Type *A* and Type *B*. Each mix contains both wildflower seed and grass seed.

The table shows information about the percentage of seed in each mix and the maximum amount of each seed Zofia has available.

	Type *A*	Type *B*	Maximum available (kg)
Wild-flower seed	80%	90%	36
Grass seed	20%	10%	6
Total mass (kg)	x	y	

(a) You are given that $x > 0$ and $y > 0$.

(i) Use the information about wild-flower seed to show that $8x + 9y \leqslant 360$. [1]

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(ii) Find an inequality to represent the information about grass seed. [1]

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(b) For each kilogram that she sells, Zofia makes a profit of:
- £3 per kilogram of Type *A*
- £2.50 per kilogram of Type *B*.

She sells her seed mixes in whole kilograms only.

She makes the greatest profit from this seed when she sells 18 kg of Type *A*.

On the graph paper opposite, draw an appropriate region and find Zofia's greatest possible profit. [4]

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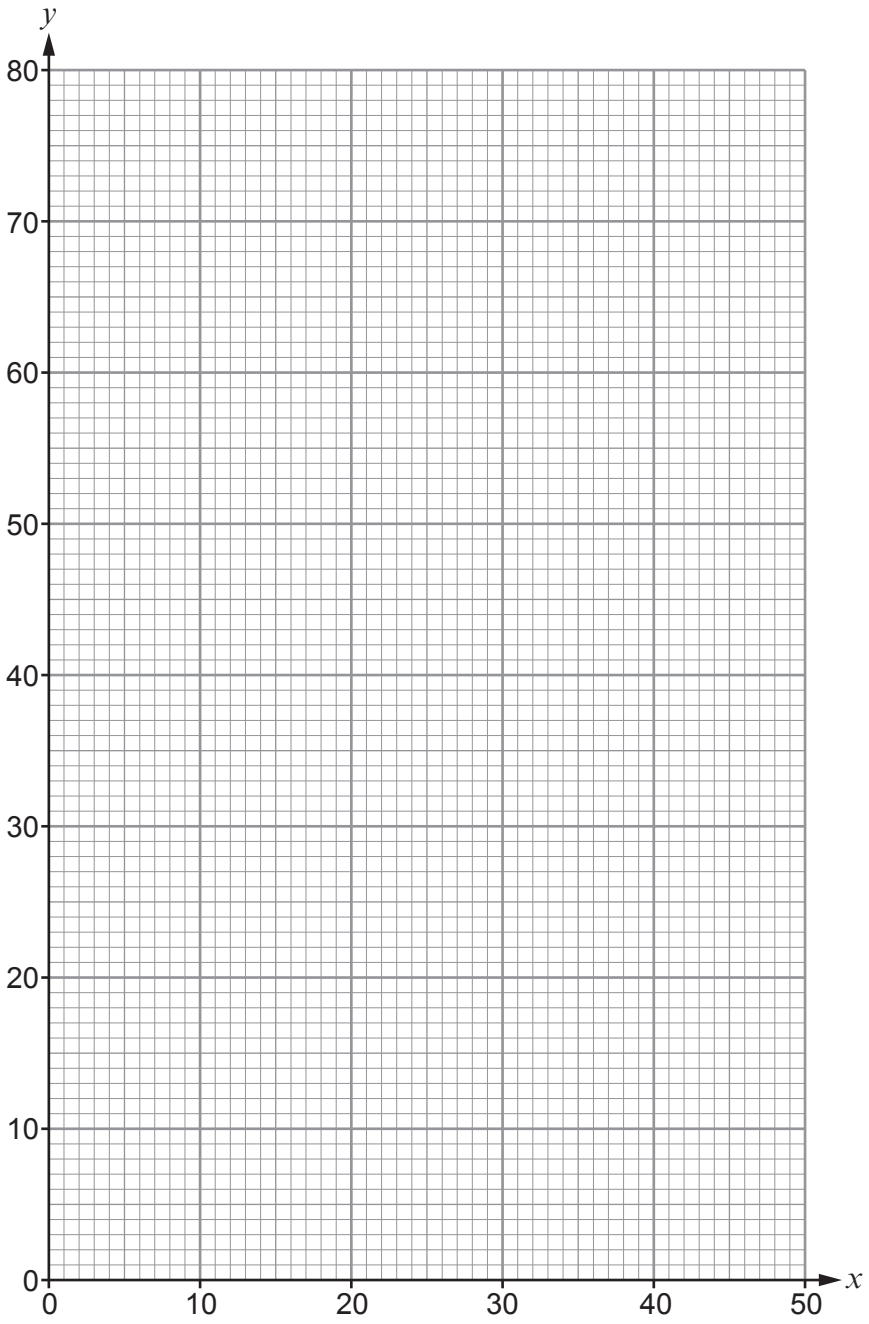

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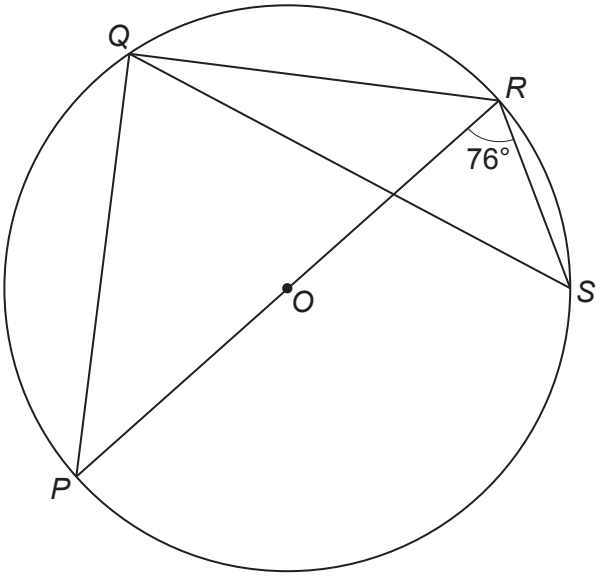

Diagram not drawn to scale

P, *Q*, *R* and *S* are points on the circumference of a circle with centre *O*.

PR is a diameter of the circle.

$P\hat{R}S$ is 76°.

Find $S\hat{Q}R$.

You must give a reason for each step of your working. [4]

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$S\hat{Q}R$ = ... °

Examiner only

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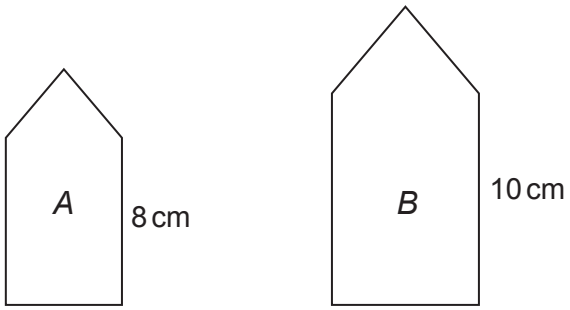

Diagram not drawn to scale

(a) Shape *A* is similar to shape *B*.
The area of shape *A* is 128 cm^2.

Calculate the area of shape *B*. [3]

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(b) Shape *A* is the uniform cross-section of prism *A*.
Shape *B* is the uniform cross-section of prism *B*.
Prism *A* and prism *B* are similar.

Write the following ratio in its simplest form.

volume of prism *A* : volume of prism *B* = ... : ..... [2]

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Examiner only

18. (a) Write $\frac{9}{55}$ as a recurring decimal. [1]

(b) Write $3\cdot\dot{7}1\dot{2}$ as a fraction. [2]

(c) Use the fact that $0\cdot0\dot{5} = \frac{1}{18}$ to write $0\cdot2\dot{5}$ as a fraction. [2]

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19. It is known that V is directly proportional to 3^t.
V is 9 when t is 4.

(a) Find a formula for V in terms of t. [3]

(b) (i) Find the value of V when $t = 0$. [1]

(ii) Find the value of t when $V = 27$. [2]

Examiner only

20. (a) Use the digits 1, 2, 3, 4 and 5.
How many different 3-digit whole numbers can be made, if each digit can be used more than once? [2]

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(b) What is the probability that a 3-digit whole number made using the digits 1, 2, 3, 4 and 5 has no repeated digit? [3]

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Examiner only

21. Write $7-\sqrt{27}+\dfrac{44}{5+\sqrt{3}}$ in the form $p+q\sqrt{3}$. [5]

Examiner only

22. A box contains 10 coloured counters.
6 are red,
3 are blue,
1 is pink.

They are identical apart from their colour.

Fran takes a counter at random and keeps it.
Jon takes a counter at random from those that remain.

Find the probability that one of these counters is red and the other is blue. [3]

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Examiner only

23. (a) A curve has equation $y = 4 - (x - 3)^2$.

Circle the correct description of the point (3, 4) on this curve. [1]

y-intercept maximum point minimum point root x-intercept

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(b) The diagram shows a sketch of the curve $y = (x - 5)^2 + a$

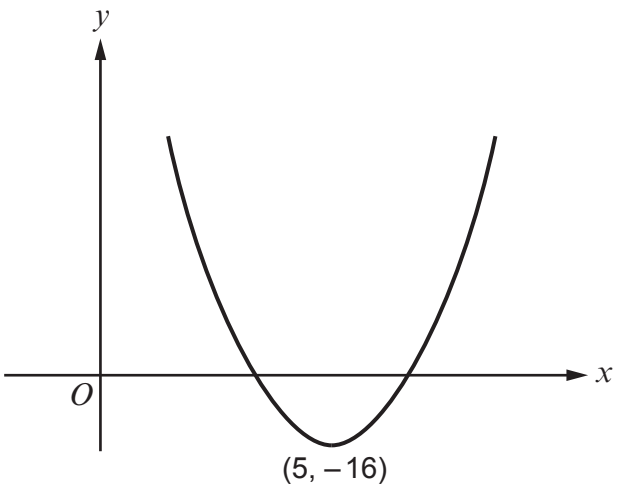

Diagram not drawn to scale

The minimum point of the curve is (5, –16).

Find the x-coordinates of the points where the curve cuts the x-axis.
You must show all your working. [4]

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