Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

C300UA0-1

S24-C300UA0-1-R1

THURSDAY, 16 MAY 2024 – 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** questions.

Write your answers in the spaces provided in this booklet. 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.	**3**	
3.	**5**	
4.	**2**	
5.	**4**	
6.	**5**	
7.	**4**	
8.	**5**	
9.	**3**	
10.	**4**	
11.	**6**	
12.	**4**	
13.	**2**	
14.	**4**	
15.	**6**	
16.	**13**	
17.	**3**	
18.	**9**	
19.	**7**	
20.	**8**	
21.	**4**	
22.	**4**	
23.	**7**	
24.	**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

Answer **all** questions.

1. Estimate the value of $\dfrac{2{\cdot}01^3 \times \sqrt{98{\cdot}5}}{0{\cdot}195}$. [3]

2. Solve $11c + 3 = 4(c + 2)$. [3]

3. (a) Write 2475 as a product of its prime factors in index form. [3]

(b) Write down the square root of $64 \times 5^4 \times 7^4$.
Give your answer as a product of prime factors in index form. [2]

C300UA01
03

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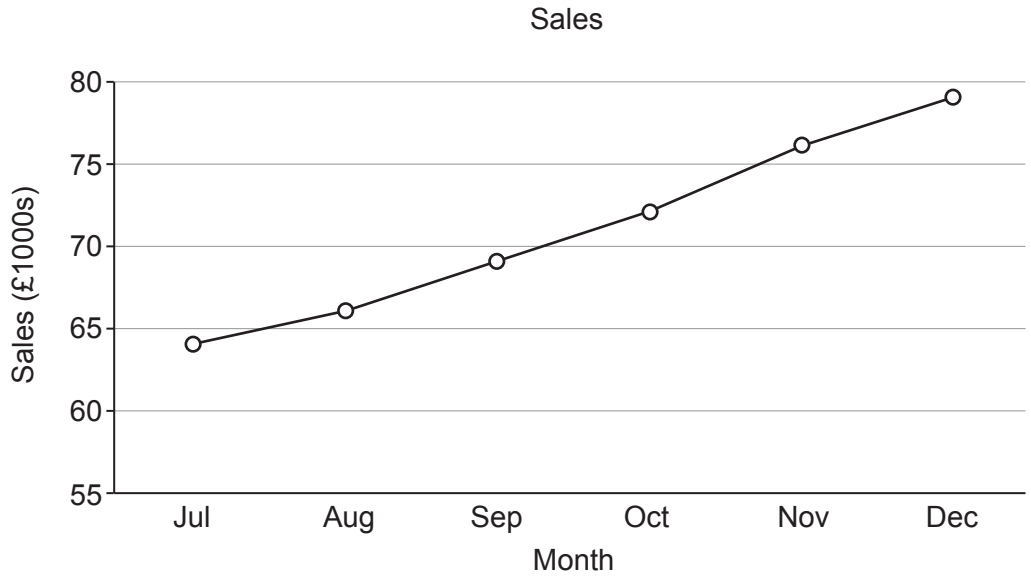
4. Sara works for the winter-clothing company Zipski.
The table below shows the monthly sales figures for 2023.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sales (£1000s)	90	83	75	68	65	62	64	66	69	72	76	79

Sara used the information in the table to draw the graph below.



Give **two** reasons why Sara's graph may be misleading. [2]

Reason 1: .....

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Reason 2: .....

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5. Pippa and Joe are working on a school project.
The project is based on the use of the local leisure facilities.

(a) Pippa decides to ask adults how much they spend on gym membership each month.
In the box below, write a suitable question with appropriate response boxes to collect this information. [2]

Question

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Response boxes

(b) Joe asked some adults how many hours they each spent at the leisure centre during the previous week.
His results are shown below.

Number of hours	0–4	5–9	10–14	15–19	20–24
Number of adults	9	2	1	1	2

Joe accurately calculated an estimate of the mean time spent per adult to be 7 hours.

In his project he stated:

'On average, the adults in my survey each spent 7 hours at the leisure centre last week.'

(i) Explain why the mean is not the best average to use for this data. [1]

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(ii) Give **one** other reason why Joe's results may not be reliable. [1]

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Examiner only

6. An empty water tank is filled using a hose with a steady rate of flow.

The tank takes:

- 30 minutes to fill if water is added at x litres/min
- 40 minutes to fill if the water is added at $(x-2)$ litres/min.

Form an equation in terms of x.
Solve the equation and hence find the capacity of the tank in litres. [5]

7. Three friends, Louis, Krystal and Jamal win some money in a competition.
They share the money in the ratio 3 : 7 : 11.

(a) What fraction of the total money won is given to Jamal? [1]

(b) **Jamal** spends £45 of the money he won.
He now has exactly twice as much as **Louis** won.
How much money did **Krystal** win? [3]

Examiner only

8. (a) p and n are two non-zero numbers.
p is a positive number and n is a negative number.

Look at the statements in the table below.
For each statement, choose one of the following:

'Always true', 'Never true' or 'Sometimes true'.

Tick (✓) **one** box for each statement. [2]

Statement	Always true	Never true	Sometimes true
$p^2 = n^2$			
$p < n$			
$\frac{n}{p} < 0$			
$n^2 > p^3$			

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(b) Calculate the value of the reciprocal of $3\frac{1}{2}$.
Give your answer in its simplest form. [2]

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(c) Write down the value of $0{\cdot}2^0$. [1]

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Examiner only

9. 6 printers take 36 minutes to print a number of identical booklets.
How long will it take 9 printers to print **half** as many of these booklets?
You may assume that all printers print at the same rate. [3]

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10. (a) The price of an item in a sale has been reduced by 25%.
If the sale price is £54, what was the original price of the item? [2]

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(b) Percentage change can be calculated using multipliers.

(i) A number is decreased by 33% of its value.
Circle the multiplier that would find the value after this decrease. [1]

0·67 –1·33 –0·67 0·33 0·77

(ii) A number is increased by 6% of its value.
This is done 3 times, each time increasing the previous value by 6%.
Circle the multiplier that would find the value after the 3 increases. [1]

1·06 1·18 $1·06^3$ 0·18 $0·06^3$

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11. Three friends, Luka, Mali and Nina buy some fruit.

Luka buys 3 apples and 4 bananas and pays £2.70.
Mali buys 2 apples and 3 bananas and pays £1.95.

Use an algebraic method to calculate how much Nina pays for 4 apples and 2 bananas. [6]

Nina pays .....

Turn over.

Examiner only

12. (a) Calculate the value of $\frac{1\cdot 29\times 10^{5}}{3\times 10^{-7}}$.

Give your answer in standard form. [2]

(b) Calculate the value of $\left(7\cdot 6\times 10^{5}\right)+\left(3\times 10^{4}\right)$.

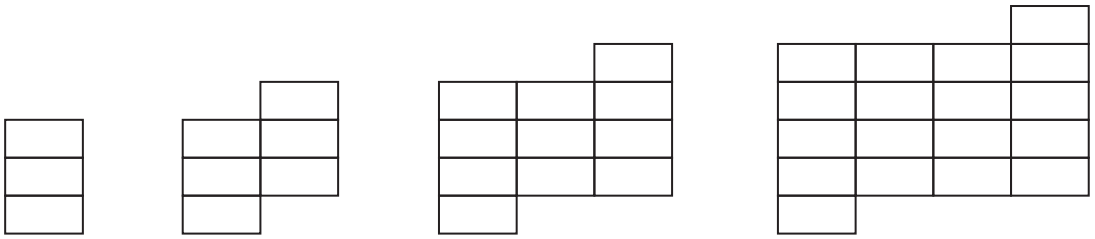
Give your answer in standard form. [2]

13. Write $32\times\left(2^{3}\right)^{7}$ in the form 2^{n}. [2]

Examiner only

14. (a) The nth term of a sequence is given by the expression $n^2 + 3n + 2$.
Prove that every term of the sequence is an even number.
Show all your working. [2]

(b) The diagram shows four patterns made using rectangular tiles.



Pattern 1 Pattern 2 Pattern 3 Pattern 4

Find an expression for the number of rectangular tiles needed for the nth pattern. [2]

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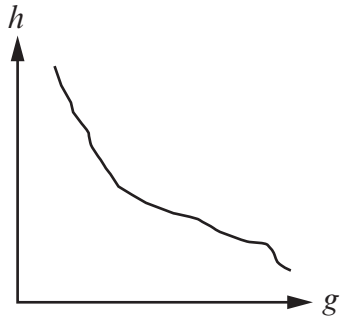
15. Pupils in a GCSE class have to perform two experiments.

(a) Jenny performs the first experiment.
She sketches a graph of her results.
She thinks the graph shows that the variable h is proportional to the cube root of the variable g.
Explain why Jenny cannot be correct. [1]



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Examiner only

(b) Results of a second experiment show that there is a relationship between two **positive** variables p and q.
It has been found that p is inversely proportional to the square root of q.

(i) When $p = 36$, $q = 25$.
Write a formula for p in terms of q. [3]

(ii) Use the formula to complete the table below. [2]

p		36	45
q	9	25	

Examiner only

16. (a) A new restaurant needs to buy some tables.
Small tables each seat 4 people.
Large tables each seat 6 people.

Each of the following three conditions must be met:

1. There must be more than 12 large tables.
2. The number of large tables must be less than double the number of small tables.
3. The total number of seats must be less than 120.

Let s represent the number of small tables and l represent the number of large tables.

(i) Complete the table below by writing the inequalities for conditions 2 and 3. [2]

Condition	Inequality
1	$l > 12$
2	
3	

(ii) On the graph paper opposite, draw the region that satisfies all three inequalities. Indicate clearly the region that is your answer. [4]

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(iii) The restaurant owner makes a 4th condition.
There cannot be exactly 13 large tables.

From your graph, write down the number of small and the number of large tables that can be bought where **all four conditions** are satisfied. [1]

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Number of small tables ☐ Number of large tables ☐

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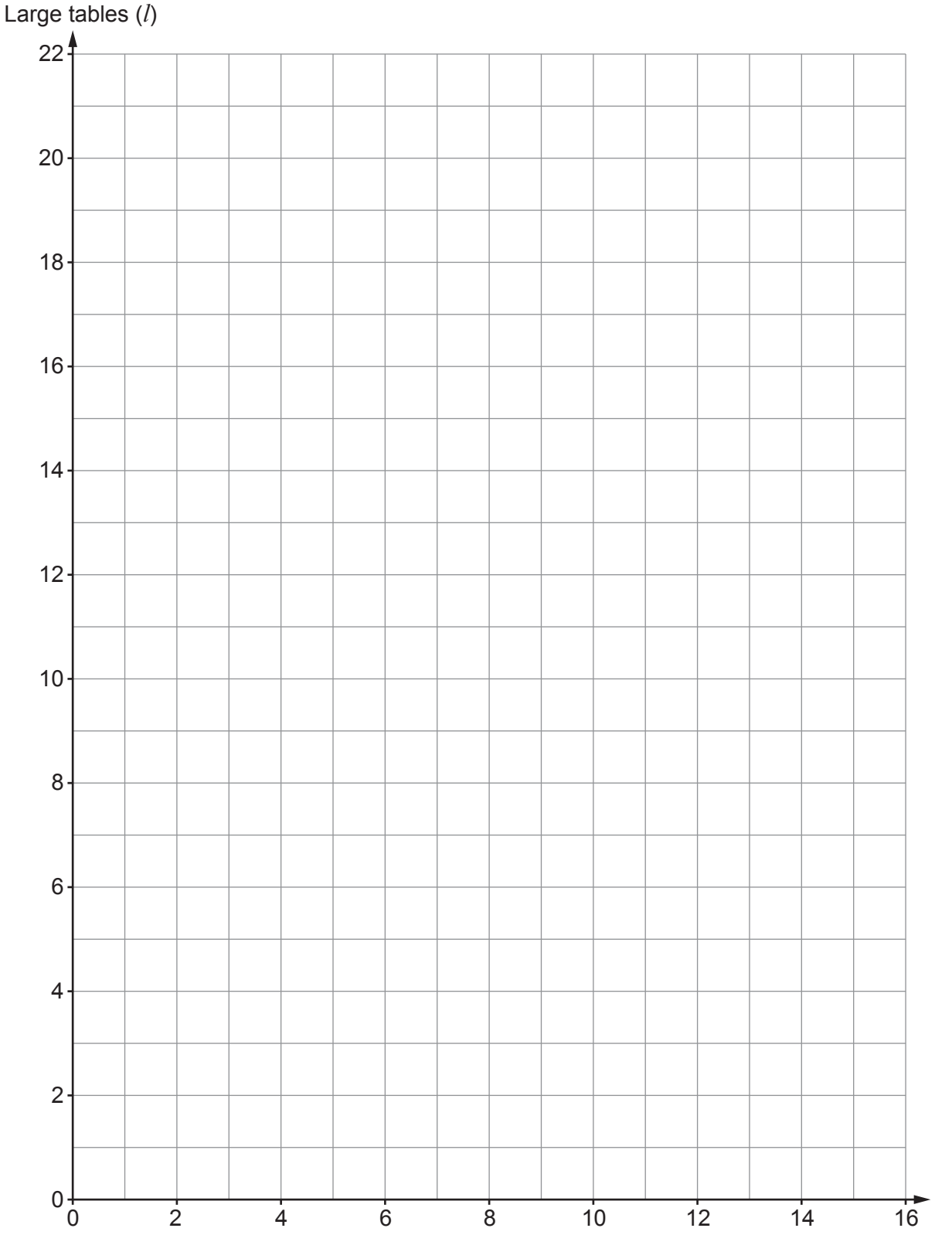

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(b) On the opening night of the restaurant, the time that each customer had to wait for their meal was recorded.

It is known that:

- 110 customers ate a meal at the restaurant
- 9 customers had to wait between 0 and 15 minutes
- every customer waited less than 1 hour.

(i) Complete the histogram below. [2]

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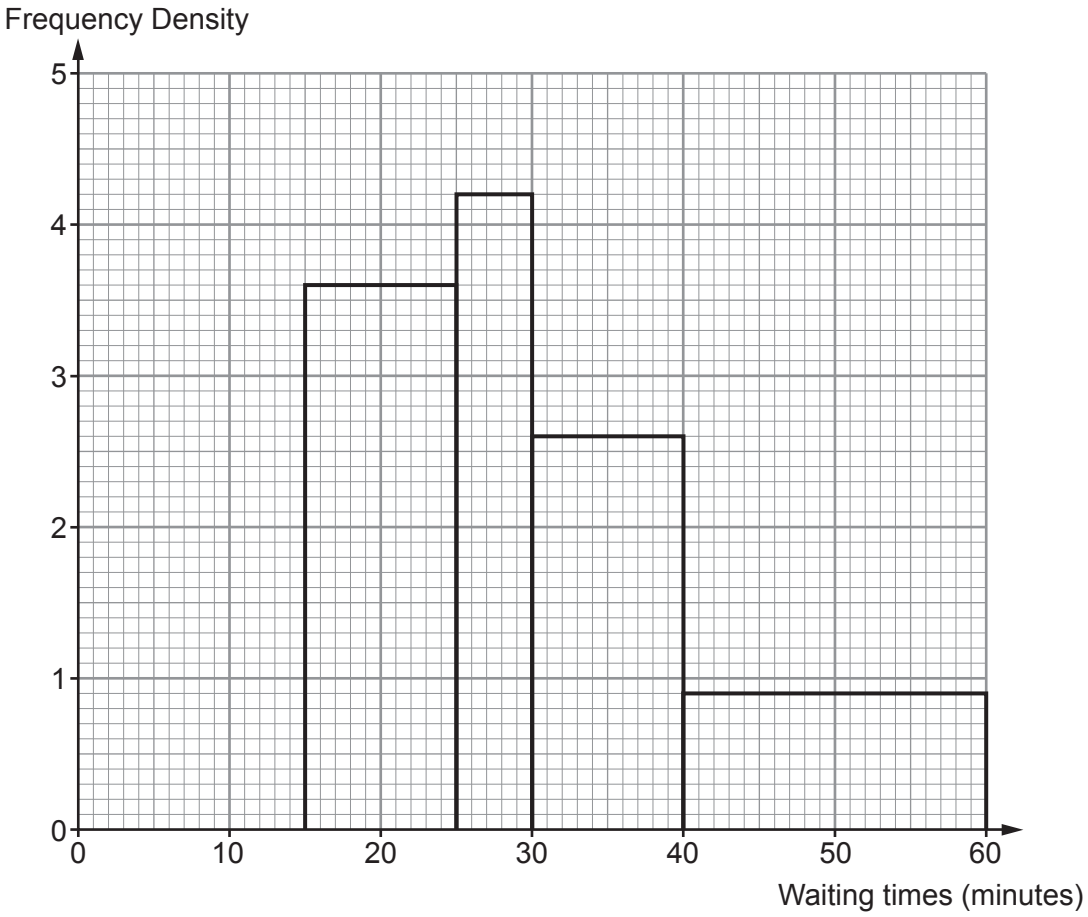

(ii) Calculate the **percentage** of the 110 customers who had to wait longer than 30 minutes for their meal. [4]

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Examiner only

17. Factorise and hence solve the following equation. [3]

$$3x^2 + 7x - 20 = 0$$

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18. A cheese factory makes two different types of cheese.
Both types of cheese are in the shape of a cylinder.

(a) The first cheese has radius 12 cm and height 7 cm.
Work out the total surface area of this cheese.
Give your answer as a multiple of π. [4]

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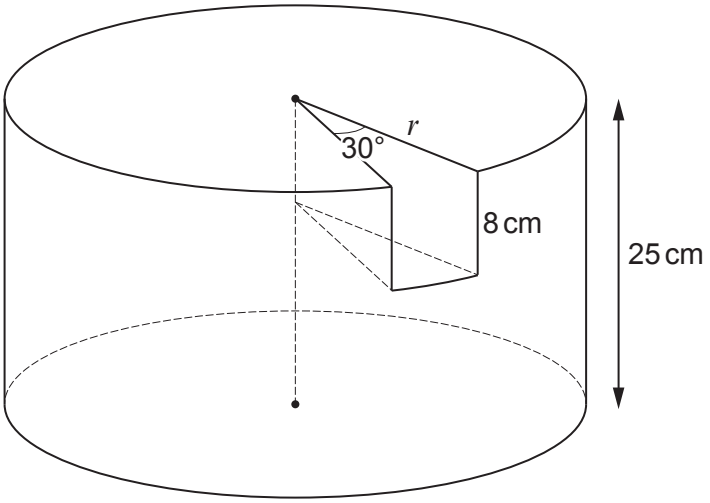
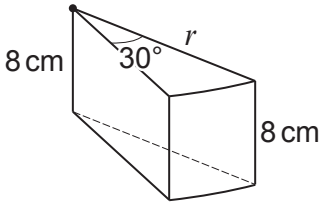
Examiner only

(b) The second cheese has radius r cm and height 25 cm.
A cheese taster working at the factory cuts a wedge-shaped piece out of this cheese.
It is cut to the centre of the cheese with an angle of 30° and a depth of 8 cm.

Work out the volume of the wedge-shaped piece as a **fraction** of the whole cheese.
Give your answer in its simplest form. [5]





Wedge-shaped piece

Diagrams not drawn to scale

Examiner only

19. Anya and Elis sit examinations at a college.

(a) Anya sits two examinations, one for Spanish and the other for French.
The probability that Anya passes Spanish is 0·6.
The probability that Anya passes French is 0·7.
The probability of Anya passing Spanish is **independent** of her passing French.

Anya tries to calculate the probability of her passing exactly one examination.

She writes $0{\cdot}6 \times 0{\cdot}3 = 0{\cdot}18$

(i) Without giving any calculations, explain why this answer is not fully correct. [1]

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(ii) Calculate the probability of Anya passing exactly one examination. [2]

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(b) Elis sits one examination.

The examination has 75 multiple choice questions.
For each question:

- there are five possible answers to choose from
- only one of the five possible answers is correct.

Elis knows the answer to 60% of the questions and will get these correct.
Of the remaining questions, he randomly selects one of the five possible answers.

A question is selected at random.
What is the probability that Elis answers this question correctly? [4]

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Examiner only

20. (a) Complete the table below.
Write both missing values in surd form.
The sketch of the equilateral triangle may help you. [2]

sin 30°	$\frac{1}{2}$
cos 30°	
tan 30°	

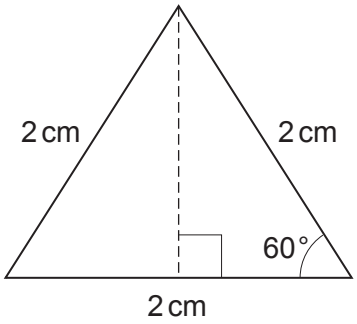

Diagram not drawn to scale

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(b) The diagram shows a cuboid.
A, *B*, *C* and *D* are vertices of the cuboid.

BD = 10 cm, *AC* = 12 cm and $D\hat{B}C$ = 30º.

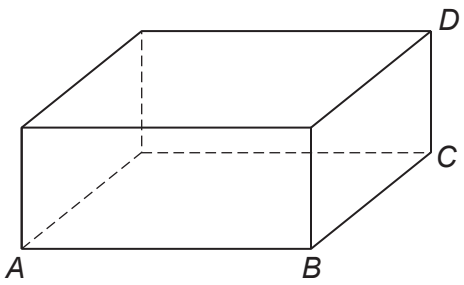

Diagram not drawn to scale

Calculate the distance *AD*.
You must show all your working. [6]

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21. The mean of the three values x, $\frac{12}{\sqrt{3}}$ and $\left(\sqrt{3}\right)^5$ is $6\sqrt{3}$.

Calculate the value of x.
Give your answer in the form $a\sqrt{3}$ where a is an integer. [4]

22. Use the method of completing the square to find the coordinates of the turning point of the curve $y = x^2 + 14x + 70$. [4]

Coordinates of the turning point (..... , ...)

Examiner only

23. The vectors **OP**, **OQ** and **OR** are shown in the diagram.

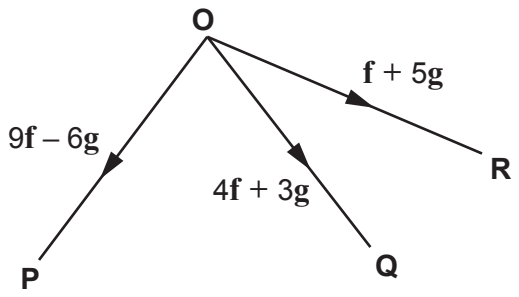

Diagram not drawn to scale

(a) (i) **RQ** = k**OP**.
Find the value of k.
You must show all your working. [3]

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The value of k = ...

(ii) Write down **two** facts about the lines OP and RQ. [2]

Fact 1: .....

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Fact 2: .....

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(b) O is the midpoint of the line PX.
Find **PX** in the form $m\mathbf{f} + n\mathbf{g}$ where m and n are integers. [2]

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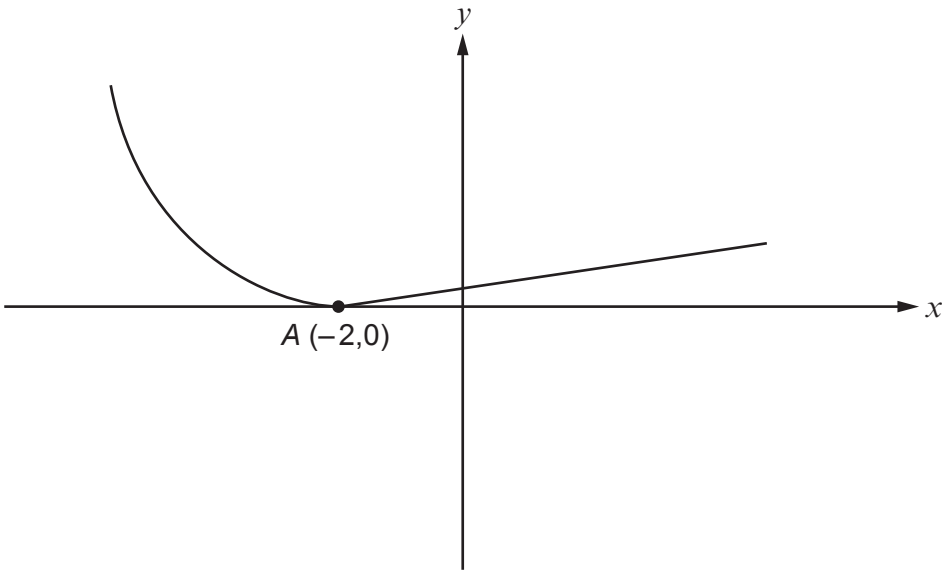
Examiner only

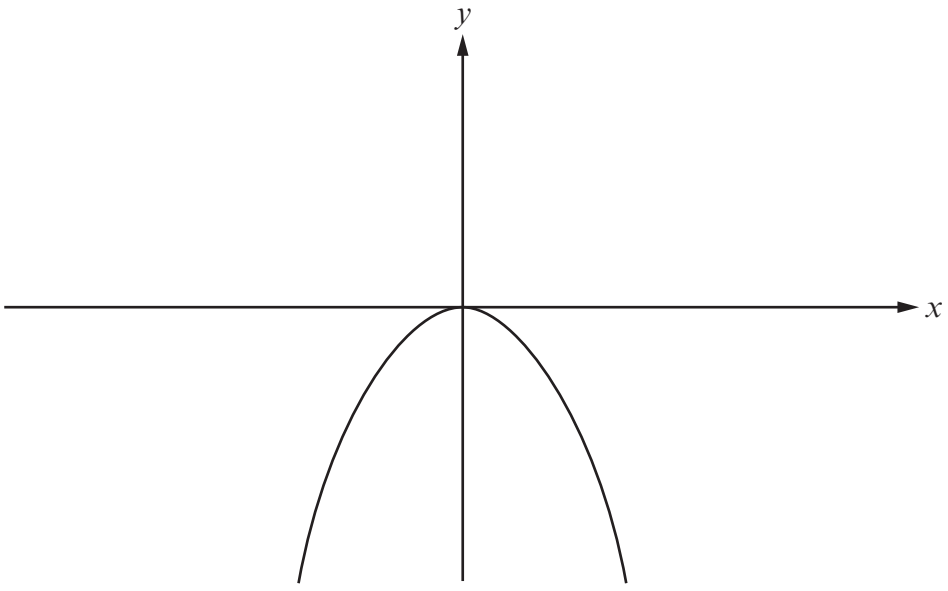
24. (a) The diagram below shows a sketch of $y = f(x)$.
The point *A* has the coordinates (–2,0).

On the same diagram, sketch $y = f(x-3)$.
Mark clearly the new coordinates of point *A*. [2]



(b) The diagram below shows a sketch of $y = g(x)$.

On the same diagram, sketch $y = -g(x) + 5$.
Mark clearly the coordinates of the point where this sketch intersects an axis. [3]



END OF PAPER

Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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