Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

C300UA0-1

A24-C300UA0-1

WEDNESDAY, 6 NOVEMBER 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.	**7**	
2.	**4**	
3.	**6**	
4.	**7**	
5.	**7**	
6.	**6**	
7.	**7**	
8.	**6**	
9.	**5**	
10.	**9**	
11.	**3**	
12.	**7**	
13.	**10**	
14.	**7**	
15.	**8**	
16.	**5**	
17.	**9**	
18.	**7**	
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:

$$v = u + at$$

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

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

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Answer **all** questions.

1. (a) Expand and simplify $3(5a-2)-7(a-4)$. [2]

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(b) Show that the triangle below is **not** isosceles.
You must use an algebraic method and not trial and improvement. [5]

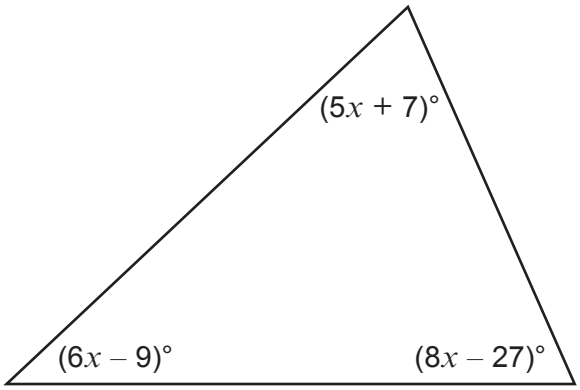

Diagram not drawn to scale

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2. $\mathbf{p} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$, $\mathbf{q} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

(a) Find the values of m and n such that $m(\mathbf{p} + \mathbf{q}) = \begin{pmatrix} 5 \\ n \end{pmatrix}$. [3]

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$m =$ ..... $n =$ .....

(b) Write down the vector $\mathbf{r}$ which is parallel to the vector $\mathbf{q}$ and is 3 times as long. [1]

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$\mathbf{r} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$

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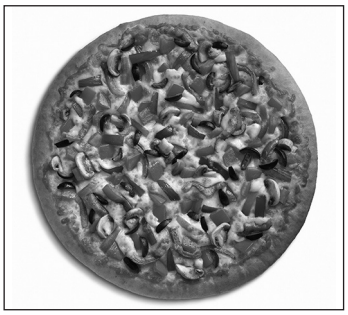
3. Jim works in the office for a pizza delivery company.
Last night he recorded the times for the first 50 deliveries.
These times are recorded in the table below.



Delivery time (t mins)	Number of deliveries
$0 < t \leqslant 10$	10
$10 < t \leqslant 20$	12
$20 < t \leqslant 30$	16
$30 < t \leqslant 40$	12

(a) Calculate an estimate of the mean time for these 50 deliveries. [4]

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(b) Calculate an estimate of the percentage of these deliveries that took 25 minutes or more. [2]

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4. (a) Write 882 as a product of its prime factors in index form. [3]

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(b) Two numbers, S and T, have been written as a product of prime factors in index form:

$$S = a^3 \times b \times c^2 \qquad T = a^2 \times b^3 \times c^3$$
$$= a^3bc^2 \qquad\qquad = a^2b^3c^3$$

(i) Circle the correct expression for the **highest common factor** of S and T. [1]

abc $\quad a^2bc^2$ $\quad a^5b^4c^5$ $\quad a^6b^3c^6$ $\quad a^3b^3c^3$

(ii) Circle the correct expression for the **lowest common multiple** of S and T. [1]

abc $\quad a^2bc^2$ $\quad a^5b^4c^5$ $\quad a^6b^3c^6$ $\quad a^3b^3c^3$

(c) Find the values of p, q and r so that the following is correct. [2]

$$7 \times 10^p + 6 \times 10^q + 8 \times 10^r = 7600 \cdot 008$$

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p = ... $\quad q$ = ... $\quad r$ = ...

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5. (a) Write down the next term in the following sequence. [2]

$$-\frac{2}{a},\quad \frac{4}{3a},\quad -\frac{8}{5a},\quad \frac{16}{7a},\quad \ldots$$

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(b) Write down an expression for the nth term of the following sequence. [2]

$$-3,\quad 3,\quad 9,\quad 15,\quad 21,\quad \ldots$$

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(c) (i) The first seven terms of a Fibonacci sequence are given by

$$1,\quad 1,\quad 2,\quad 3,\quad 5,\quad 8,\quad 13,\quad \ldots$$

Find the 11th term of this sequence. [1]

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(ii) The first four terms of a different Fibonacci-type sequence have been expressed algebraically.

$$c,\quad d,\quad c+d,\quad c+2d,\quad \ldots$$

Write the expression for the 7th term of this sequence.
Give your answer in its simplest form. [2]

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6. (a) Simplify the following ratio, [2]

$$15\,\text{cm}^2 : 300\,\text{mm}^2$$

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(b) Sura is making a cake. The main ingredients are flour, sugar and dried fruit.
She uses these ingredients with their masses in the ratio 5 : 3 : 7.

(i) What fraction of the main ingredients is the mass of the dried fruit? [1]

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(ii) The combined mass of the flour and sugar is 560 g.
What is the mass of the dried fruit? [3]

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7. Hannah and Imran often play badminton and tennis matches against each other.

The probability that Hannah wins a badminton match is $\frac{9}{10}$.

The probability that Hannah wins both a badminton match **and** a tennis match is $\frac{9}{50}$.

One Saturday, Hannah and Imran play one badminton match and one tennis match.
The outcomes of the matches are independent.

(a) Complete the tree diagram below. [4]

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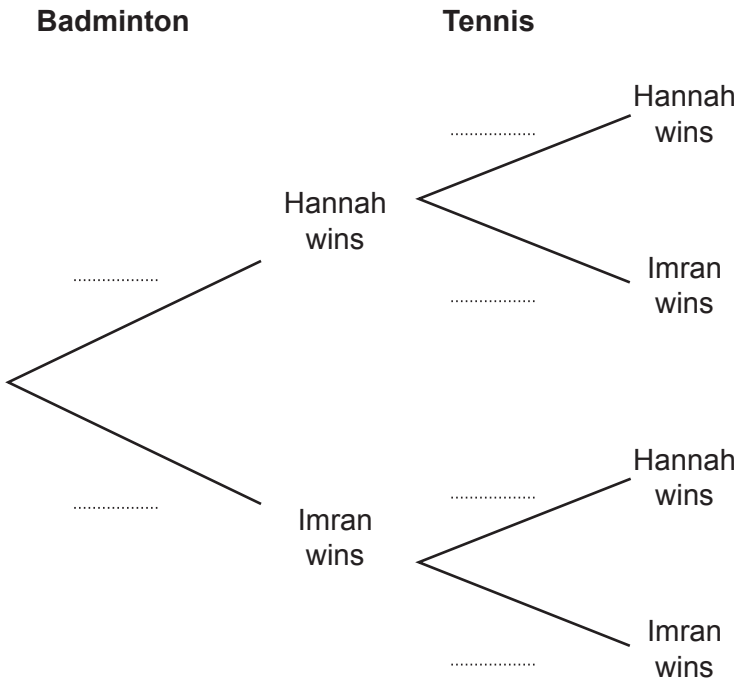

(b) Calculate the probability that Hannah wins exactly one match. [3]

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8. (a) Four triangles are shown in the diagram below.

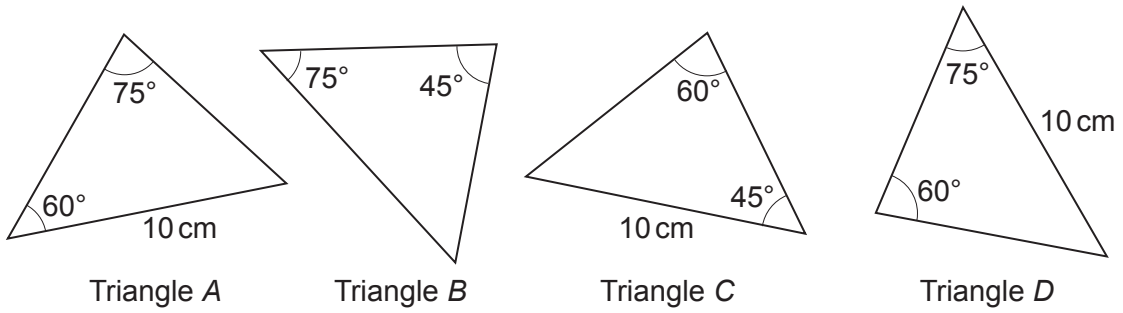

Diagram not drawn to scale

For each of the following statements choose 'True', 'False' or 'Need more information'.
Tick **one** box for each statement. [2]

Statement	True	False	Need more information
Triangle *A* is congruent to Triangle *B*			
Triangle *C* is congruent to Triangle *D*			
Triangle *A* is congruent to Triangle *C*			

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(b) Is it possible to draw an isosceles triangle with an exterior angle of 60º?
Tick the appropriate box and show working to explain your reason. [2]

Yes ☐ No ☐

Reason: .....

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(c) Two triangles are shown in the diagram below.

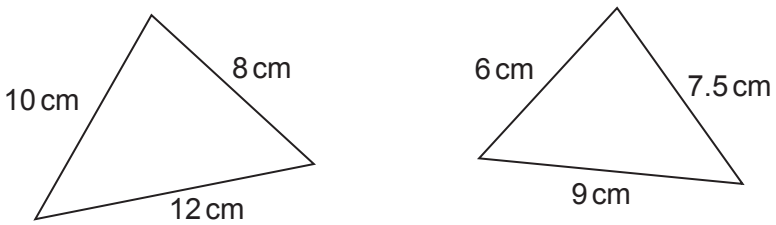

Diagram not drawn to scale

Show that the two triangles are mathematically similar. [2]

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9. The solid cylinder shown below has radius 4 cm and height h cm.

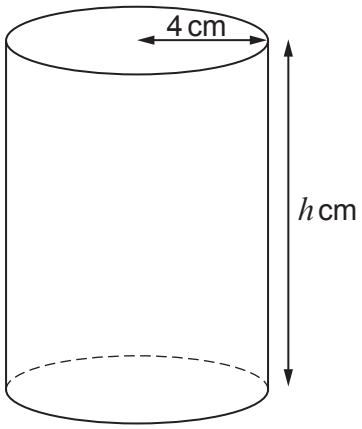

Diagram not drawn to scale

The total surface area of the cylinder is 104π cm^2.
Calculate the value of h. [5]

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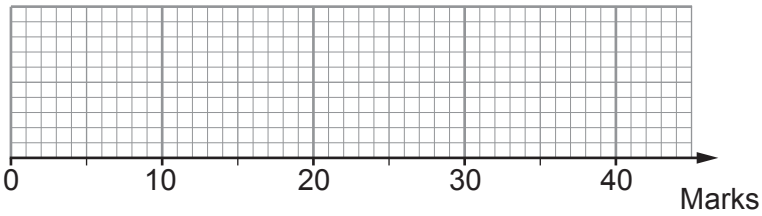
10. 280 students took tests in each of the three subjects, Biology, Chemistry and Physics. Each test consisted of questions worth a total of 40 marks.

(a) The following table shows a summary of the Biology test data.

Lowest mark	Highest mark	Lower quartile	Median	Interquartile range
12	40	22	29	13

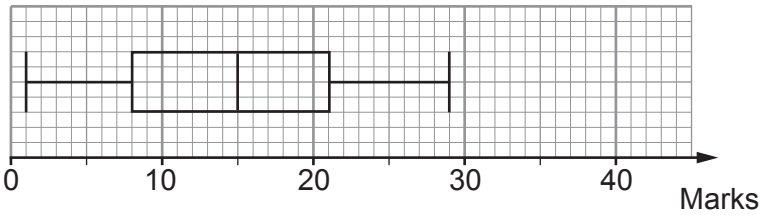
On the grid below, draw a box plot to represent this data. [3]

Biology test

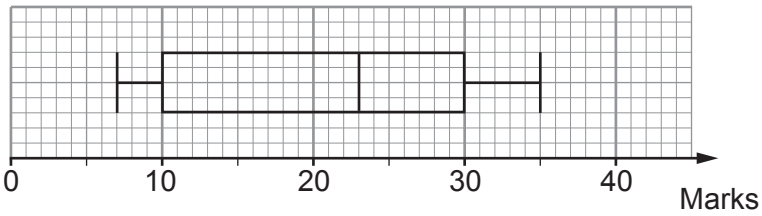


(b) Two box plots have been drawn representing the test data for Chemistry and Physics.

Chemistry test



Physics test



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(i) Calculate the number of students that were awarded 10 or more marks in Physics. [2]

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(ii) Two teachers disagree over the spread of the marks.

One teacher states that the **spread** of marks is the same for **all three** tests.
The other teacher states that the **spread** of the marks is the same in **only two** of the tests.

Explain why **both teachers** are correct.
You must give values to justify your answer. [3]

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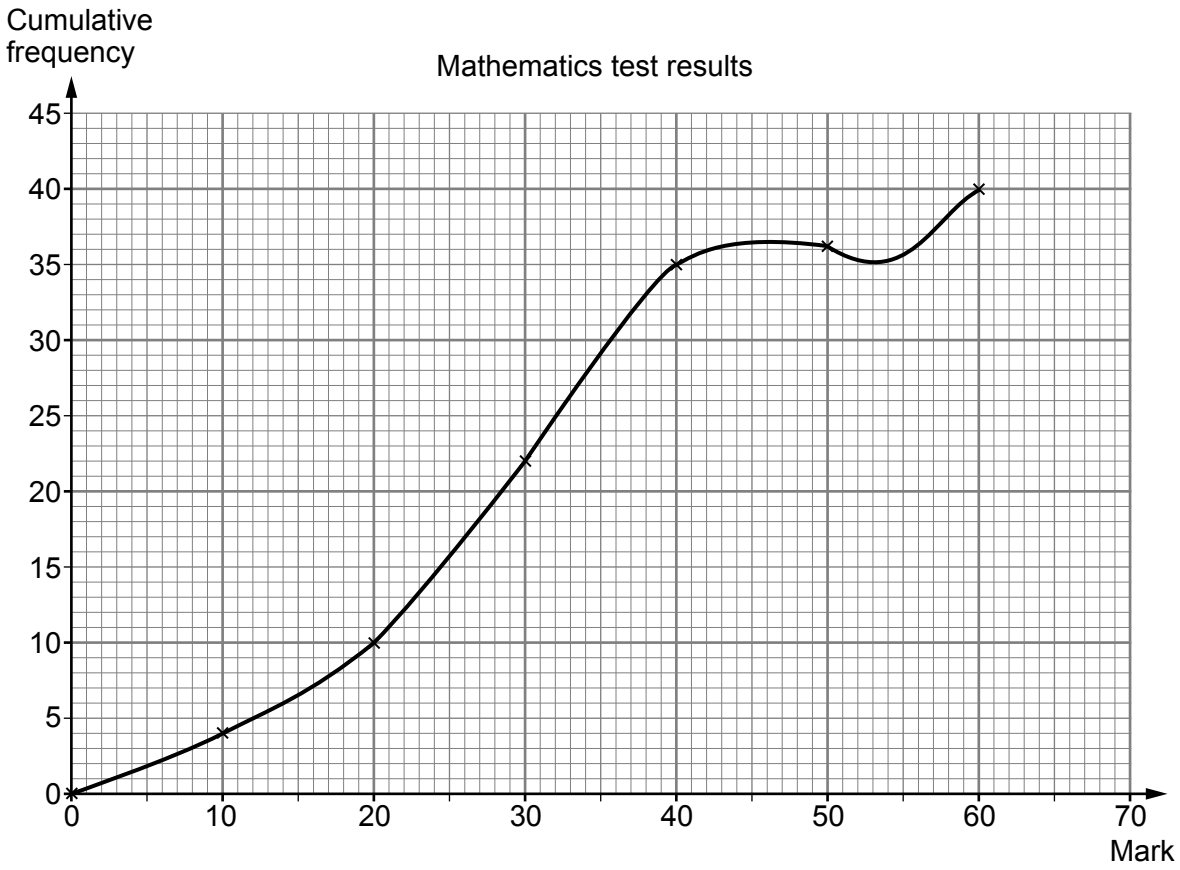
(c) A **different** set of students sat a mathematics test. The test was out of 60 marks. The results obtained were recorded in a table and a cumulative frequency graph was drawn.

Mark (m)	Cumulative Frequency
$0 < m \leqslant 10$	4
$0 < m \leqslant 20$	10
$0 < m \leqslant 30$	22
$0 < m \leqslant 40$	35
$0 < m \leqslant 50$	36
$0 < m \leqslant 60$	40



Criticise the above graph. [1]

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11. Alison lives in a town with a population of 45 000.

It is predicted that the population of the town will:
- increase by 2% **every six months** for the next 4 years
- decrease by 5% **per year** for the following 3 years.

(a) Alison wants to calculate what the population of the town will be after 7 years.
She completes the boxes in the calculation below:

Population = 45 000 $\boxed{\times 1.02^4}$ $\boxed{\div 1.05^3}$

Both boxes have been completed incorrectly.
Complete each box below with the correct calculation. [2]

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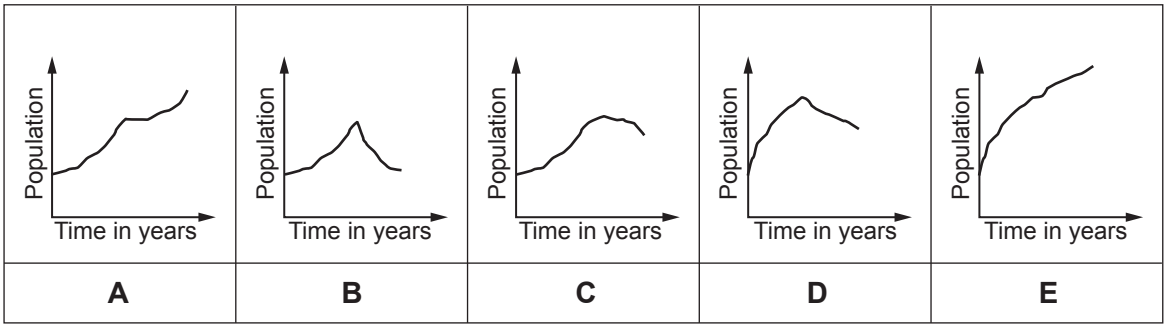
Population = 45 000 $\boxed{}$ $\boxed{}$

(b) Circle the sketch that best shows the town's changing population over the 7-year period. [1]



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12. (a) Evaluate $27^{\frac{2}{3}}$. [2]

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(b) Two solid shapes are similar.
The ratio of their surface areas is 1 : k.

Write, in terms of k, an expression for the ratio of their volumes. [1]

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(c) Rearrange the following formula to make g the subject. [4]

$$\frac{5g - 3f}{g} = 2w$$

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13. In this question all lengths are in metres.

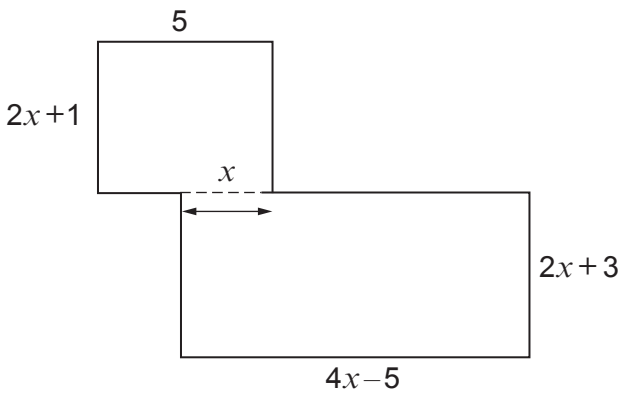

Diagram not drawn to scale

The shape above is made from two rectangles arranged as shown.
The total area of the shape is $98\,\text{m}^2$.

(a) Show that $2x^2+3x-27=0$. [4]

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(b) Calculate the perimeter of the shape.
You must use an algebraic method and show all your working. [6]

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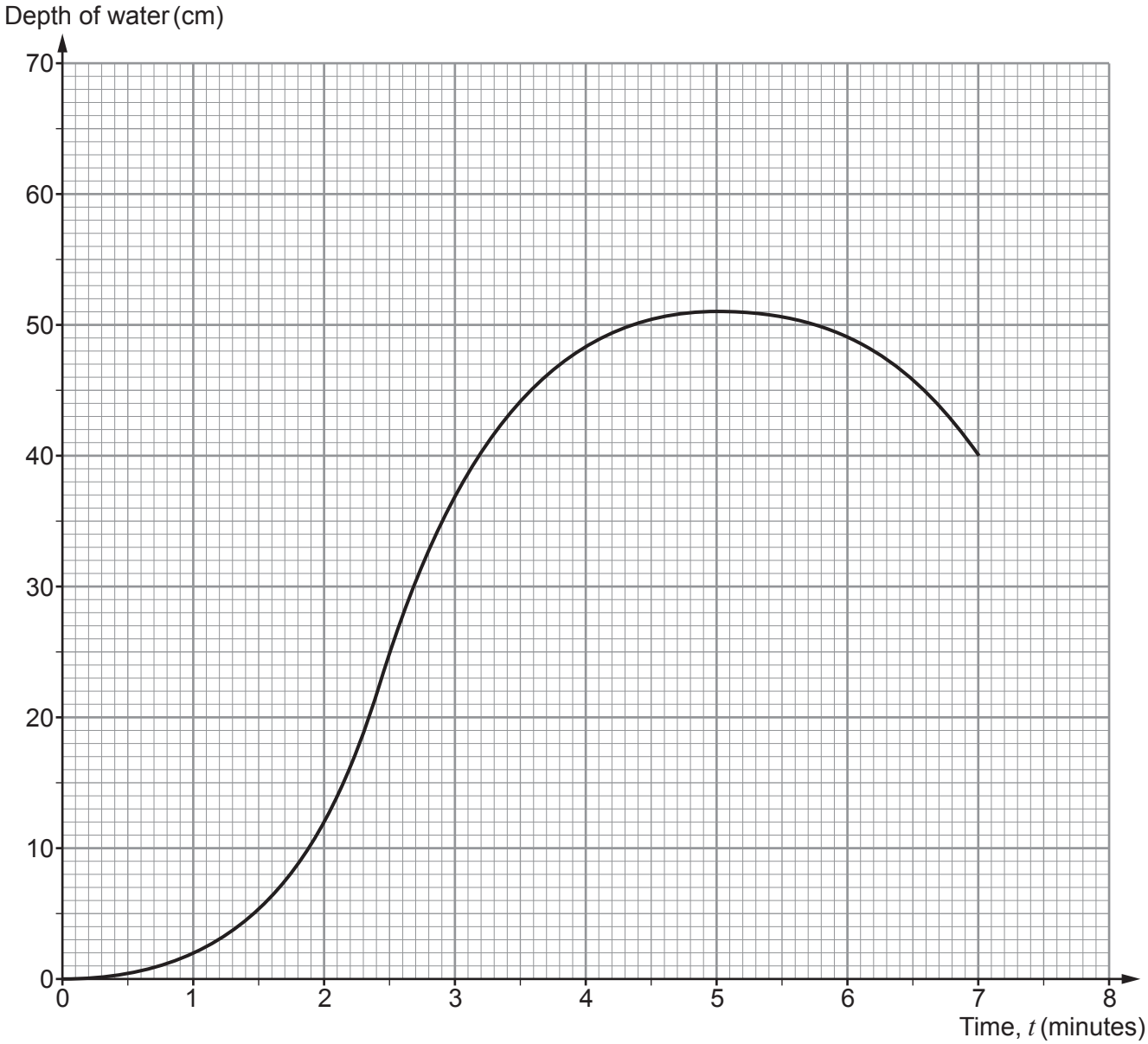
14. The graph shows the depth of water in a container over a period of 7 minutes.



(a) Calculate an estimate of the rate at which the water level is changing at $t = 6$. Simplify your answer as far as possible. [3]

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(b) Calculate the average rate at which the water level is changing between $t = 1$ and $t = 3$. [2]

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(c) From time $t = 7$ minutes, the rest of the water flows out of the container until it is empty. During this time the depth of water decreases at a constant rate of $\frac{5}{6}$ cm per second. Complete the graph. [2]

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15. (a) As part of a multiple-choice examination, students were asked the following question:

Evaluate $0{\cdot}20\dot{4}\dot{5} - 0{\cdot}003$

Choose the correct answer from the following:

A	**B**	**C**	**D**	**E**
$0{\cdot}20\dot{1}\dot{5}$	$0{\cdot}201\dot{5}$	$0{\cdot}20\dot{4}\dot{5}$	$0{\cdot}2015\dot{4}$	$0{\cdot}2015\dot{1}$

Derek chose **A**.
Is he correct?

Yes ☐ No ☐

Give calculations to support your answer. [2]

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(b) Express $0{\cdot}\dot{1}2\dot{3}\dot{4}$ as a fraction.
Give your answer in its simplest form. [3]

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(c) **Estimate** the value of $\left(1{\cdot}9 \times 10^3\right)^5$.

Give your answer in standard form. [3]

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16. The diagram shows a triangle ABC.

$AB = 14\,\text{cm}$, $AC = 15\,\text{cm}$ and $B\hat{A}C = 37°$.

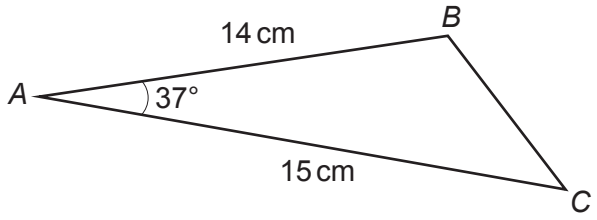

Diagram not drawn to scale

The ratio of the area of the triangle to the area of a circle is $7 : 16\pi$.
Given that $\sin 37° = 0{\cdot}6$, calculate the radius of the circle. [5]

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17. (a) Simplify $\frac{35}{\sqrt{5}} - \sqrt{5}$. [3]

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(b) Find the values of a and b to make the following equation correct.

$$\left(5+2\sqrt{3}\right)\left(4-a\sqrt{3}\right)+40+b\sqrt{3}=18$$ [6]

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a = ... b = ...

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18. The functions g and h are such that $g(x) = 2x + 3$ and $h(x) = x^2$.

(a) Find $g^{-1}(x)$. [2]

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(b) Given that $gh(x) = hg(x) - x^2 + 1$, show that $x^2 + 12x + 7 = 0$. [5]

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