Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

C300UA0-1

A23-C300UA0-1

eduqas
Part of WJEC

WEDNESDAY, 8 NOVEMBER 2023 – 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.	2	
2.	4	
3.	3	
4.	2	
5.	3	
6.	5	
7.	2	
8.	3	
9.	2	
10.	6	
11.	3	
12.	5	
13.	5	
14.	7	
15.	5	
16.	5	
17.	7	
18.	6	
19.	5	
20.	4	
21.	5	
22.	4	
23.	4	
24.	6	
25.	7	
26.	5	
27.	2	
28.	3	
Total	120	

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:

$$v = u + at$$

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

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

1. Ivy mixes lemon juice, pineapple juice and orange juice in the ratio 1 : 2 : 7 to make a fruit drink.
Ivy has 330 ml of her fruit drink in a glass.

How much pineapple juice is in Ivy's glass? [2]

....

....

....

.... ml

2. The shape below consists of a square surrounded by four semi-circles.
The diameter of each semi-circle is 12 cm.

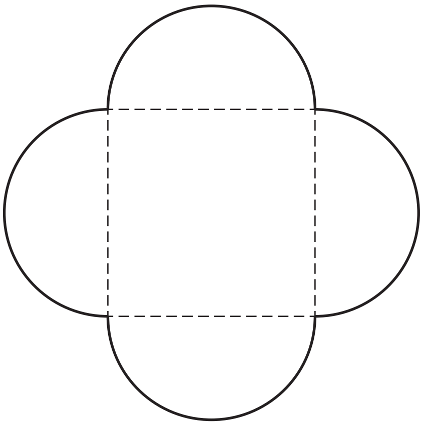

Diagram not drawn to scale

Work out the area of the shape.
Give your answer in the form $a + b\pi$. [4]

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Area = ... cm^2

3. Izaan has a block of stainless steel with volume 700 cm^3.
The stainless steel has a density of 7·5 g/cm^3.

Izaan says,

The block has a mass of less than 5 kg.

Is Izaan correct? [3]

☐ Yes ☐ No ☐ Cannot tell

Show how you decide.

4. Oliver and Kian bake cakes.

The mass of Oliver's cake is between 400 g and 500 g inclusive.
The mass of Kian's cake is between 200 g and 300 g inclusive.

Complete the inequality to show the least and greatest possible differences between the mass of their cakes. [2]

.... $\leqslant$ mass difference $\leqslant$ ....

....

....

5. Jen is mixing some paints to make brown paint.

She made orange paint by mixing red paint and yellow paint.
40% of the orange paint was red paint.

She then mixes the orange paint with some blue paint in the ratio 20 : 21 to make brown paint.

What fraction of the brown paint is red paint? [3]

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6. The diagram below shows an **equilateral triangle** and a square.

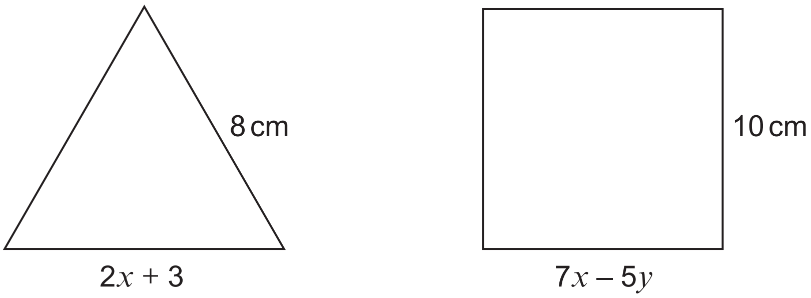

Diagram not drawn to scale

Use an algebraic method to find the value of x and the value of y.
You must show all your working. [5]

x = ...

y = ...

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7. (a) Simplify $7\sqrt{2} \times 3$ [1]

....

....

(b) Complete the calculation below.

$2\sqrt{11} \times$ .... $= 22$ [1]

....

8. Factorise $3xy^2 + 6x^2y$ [3]

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9. Hans thinks of a number.
When his number is multiplied by $2{\cdot}4 \times 10^5$, the answer is $9{\cdot}6 \times 10^8$.

What number did Hans think of?
Write your answer in standard form. [2]

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....

Turn over.

10. Kate is visiting London.

The probability that she will go on a train is 0·4.
The probability of Kate going to the theatre is independent of her going on a train.

The probability that she goes on a train and goes to the theatre is 0·28.

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

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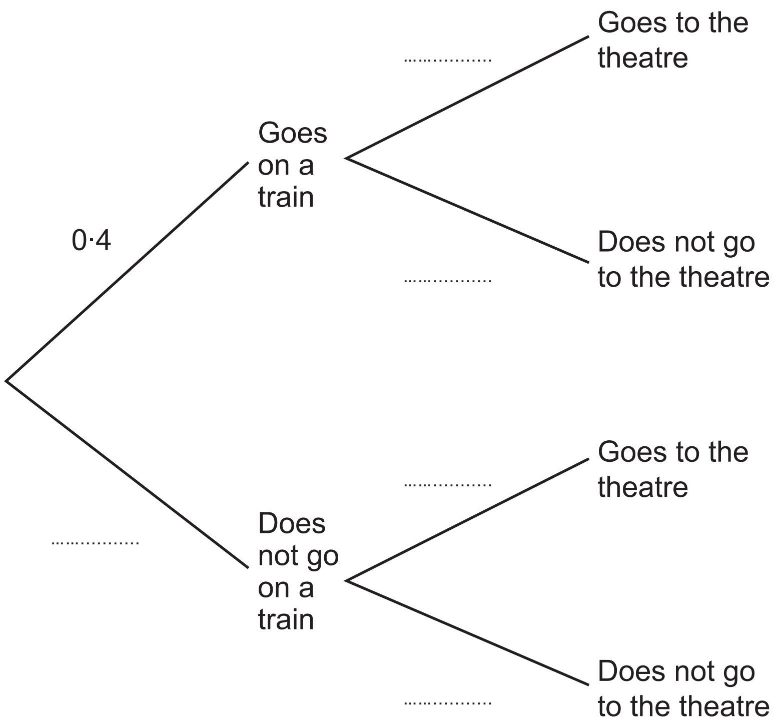
0·4
....
Goes on a train
Does not go on a train
....
Goes to the theatre
....
Does not go to the theatre
....
Goes to the theatre
....
Does not go to the theatre

(b) Calculate the probability that Kate does not go on a train and does not go to the theatre. [2]

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Examiner only

11. It takes 2 hours to empty 8 identical tanks of water using 9 identical pumps.

How long would it take to empty 2 of these tanks using 3 of these pumps? [3]

Turn over.

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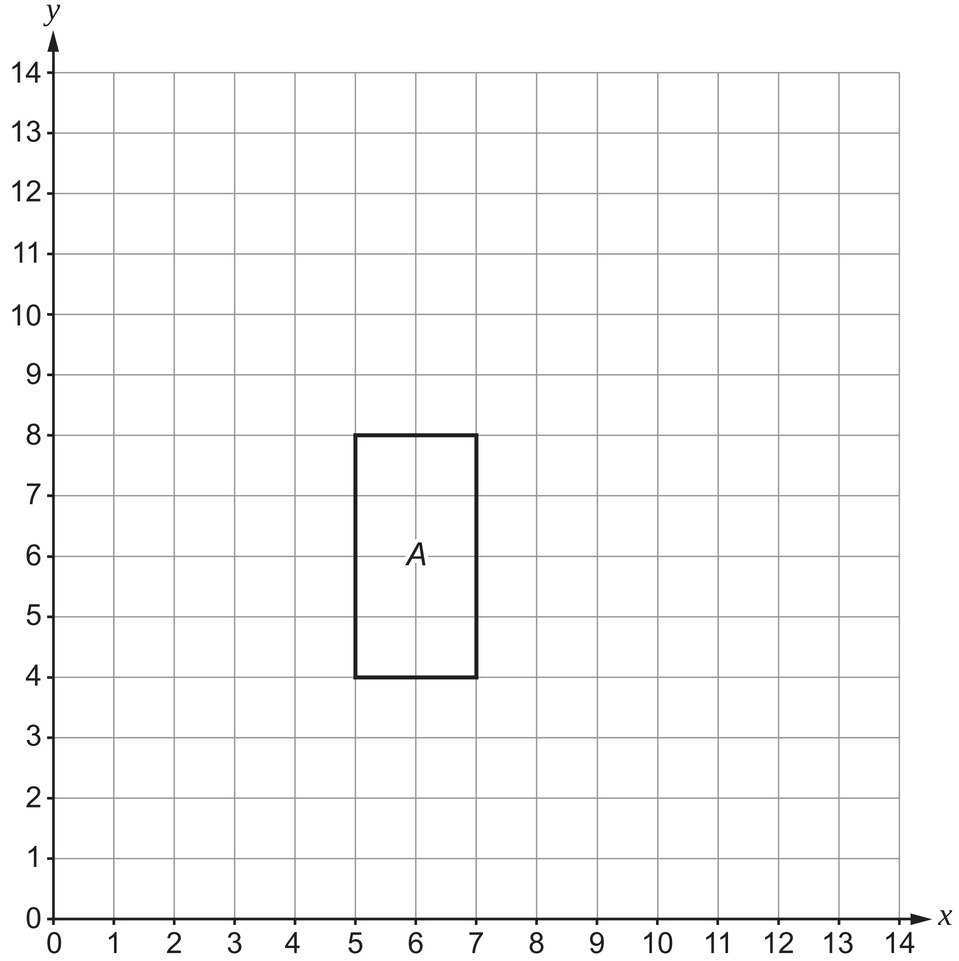
12. (a)

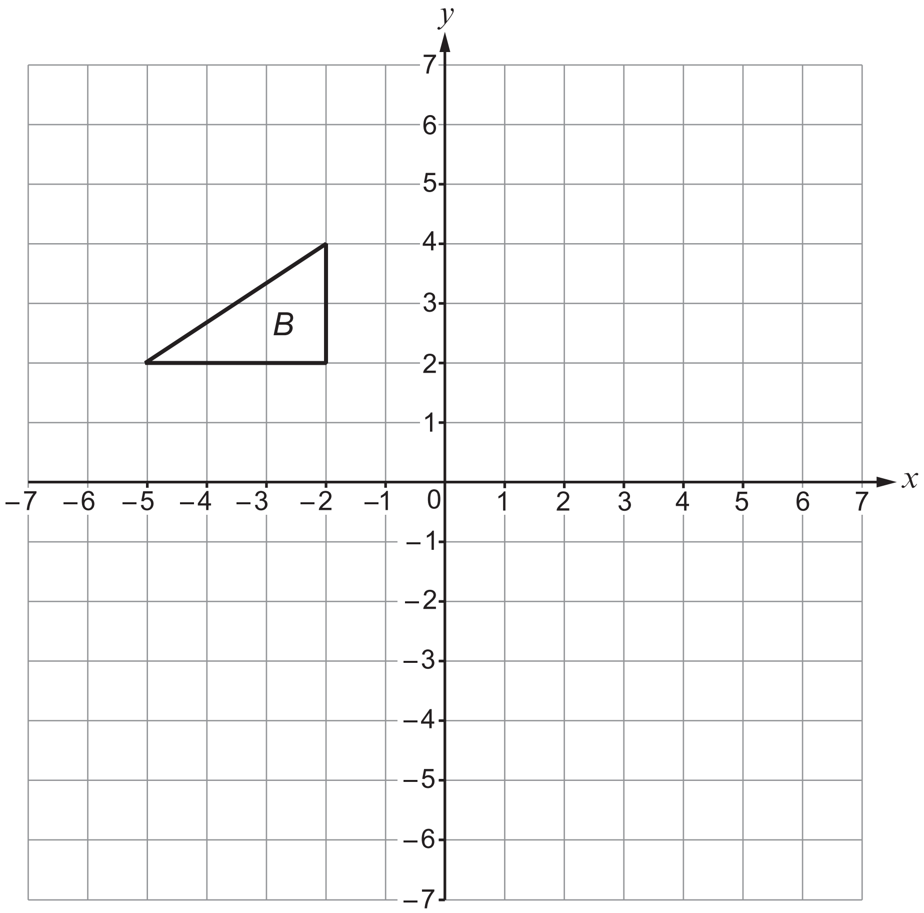

y
x
A
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14

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

....

....

(b)



Triangle *B* is reflected in the line $x = 0$ to give triangle *C*.

Triangle *C* is rotated 90° clockwise about (0, 0) to give triangle *D*.

(i) Draw triangle *C* and triangle *D*. [2]

(ii) Describe the **single** transformation that maps triangle *B* to triangle *D*. [1]

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13. (a) Show that the lines

$$3y - 12x = 9 \text{ and } 2y = 8x - 13$$

are parallel to each other. [3]

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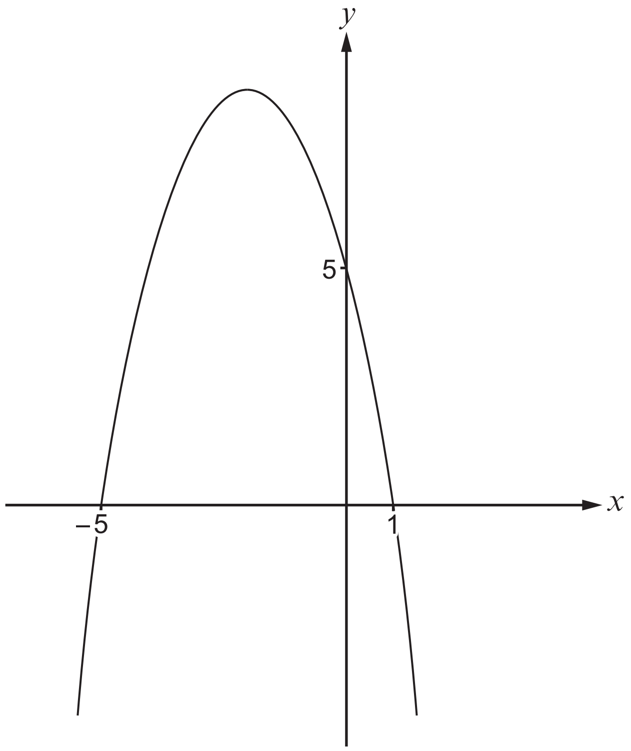
(b) The diagram shows the curve $y = 5 - 4x - x^2$.



Calculate the coordinates of the turning point of the curve. [2]

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(........................ , ...)

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14. (a) (i) Find the next term in this sequence. [2]

$$\frac{5}{2} \qquad -\frac{25}{4} \qquad \frac{125}{8} \qquad -\frac{625}{16} \qquad \ldots\ldots\ldots$$

....

....

....

(ii) Find the next term in this Fibonacci-style sequence. [1]

10 15 25 40 65 ....

....

....

(b) The nth term of a sequence is $(10\sqrt{5})^n$.

Calculate the 4th term of this sequence.
You must simplify your answer. [2]

....

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....

4th term = ...

(c) Find the nth term of the sequence below. [2]

3 15 35 63 99 ....

....

....

....

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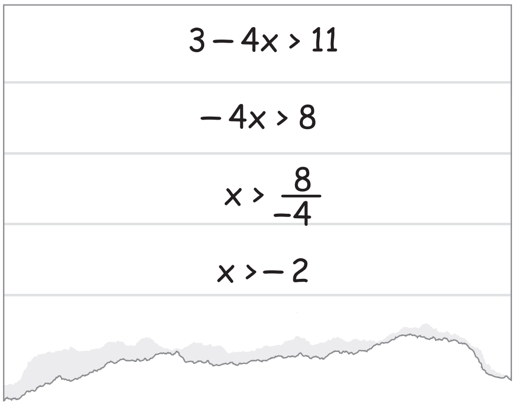
....

nth term = ...

15. (a) Factorise $5x^2 + 13x + 6$. [2]

(b) Adrian is trying to solve $3 - 4x > 11$.
He writes the following:



$3 - 4x > 11$

$-4x > 8$

$x > \frac{8}{-4}$

$x > -2$

Adrian's method is incorrect. Explain why. [1]

(c) Simplify $\frac{(x^4)^3}{x^2}$. [2]

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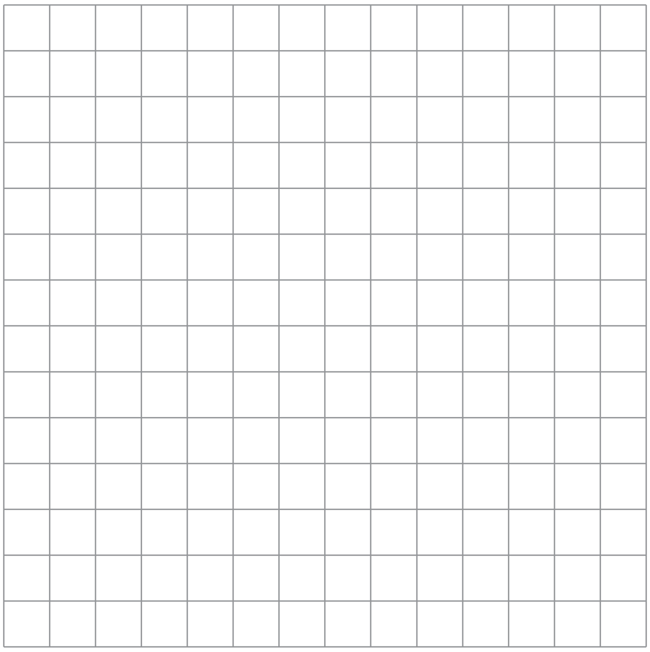
16. (a) The vector $\boldsymbol{t} = \begin{pmatrix} 7 \\ -2 \end{pmatrix}$ and the vector $\boldsymbol{w} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$.

On the grid below, draw the vector $\boldsymbol{t} + \boldsymbol{w}$. [2]



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(b)

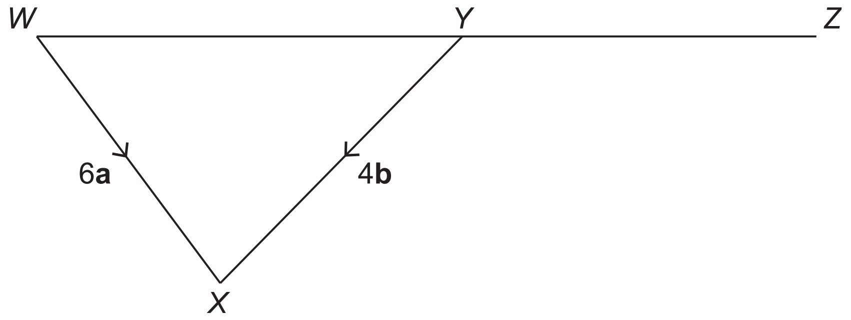

Diagram not drawn to scale

WYZ is a straight line.

The vectors **WX** and **YX** are shown in the diagram.

Given that *WY* : *YZ* = 2 : 3, write the vector **WZ** in the form m**a** + n**b**. [3]

17. (a) Evaluate $8^{\frac{5}{3}}$. [2]

(b) Write $\frac{6}{\sqrt{2}}$ in the form $a\sqrt{2}$ where a is an integer. [2]

(c) **Estimate** the value of $\frac{(1{\cdot}96 \times 10^8) + (6{\cdot}89 \times 10^8)}{298}$.

Write your answer in standard form. [3]

18. Lena sold 200 drinks on Saturday.

This table shows some information about these drinks.

	Tea	Coffee	Milkshake	Totals
Small	5			61
Medium			6	
Large		42		
Totals			66	200

On that Saturday:

- 15% of the drinks sold were large teas.
- The ratio of the number of medium teas to the number of medium milkshakes sold was 3:1.
- The number of large milkshakes sold was double the number of small milkshakes sold.

Complete the table above using this information.

One of the drinks is selected at random.
Find the probability that this drink was either a medium tea or a medium coffee. [6]

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Probability of selecting a medium tea or a medium coffee = ...

19. 1134 can be written as $2 \times 3^4 \times 7$.

(a) Find the highest common factor of 504 and 1134.
Give your answer as an integer. [4]

Highest common factor of 504 and 1134 = ...

(b) What is the smallest whole number 1134 can be divided by to give a square number? [1]

20. *X*, *Y* and *Z* are points on the circumference of a circle with centre *O*.

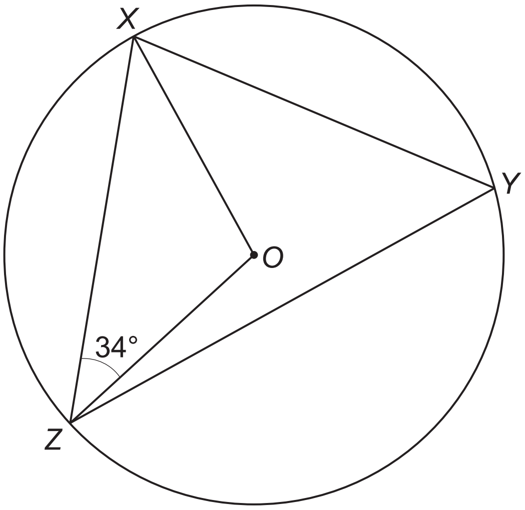


Diagram not drawn to scale

Maia thinks that $X\hat{Y}Z$ is 58°.
Prove that Maia is incorrect.

You must show all your working and give a reason for each step of your proof. [4]

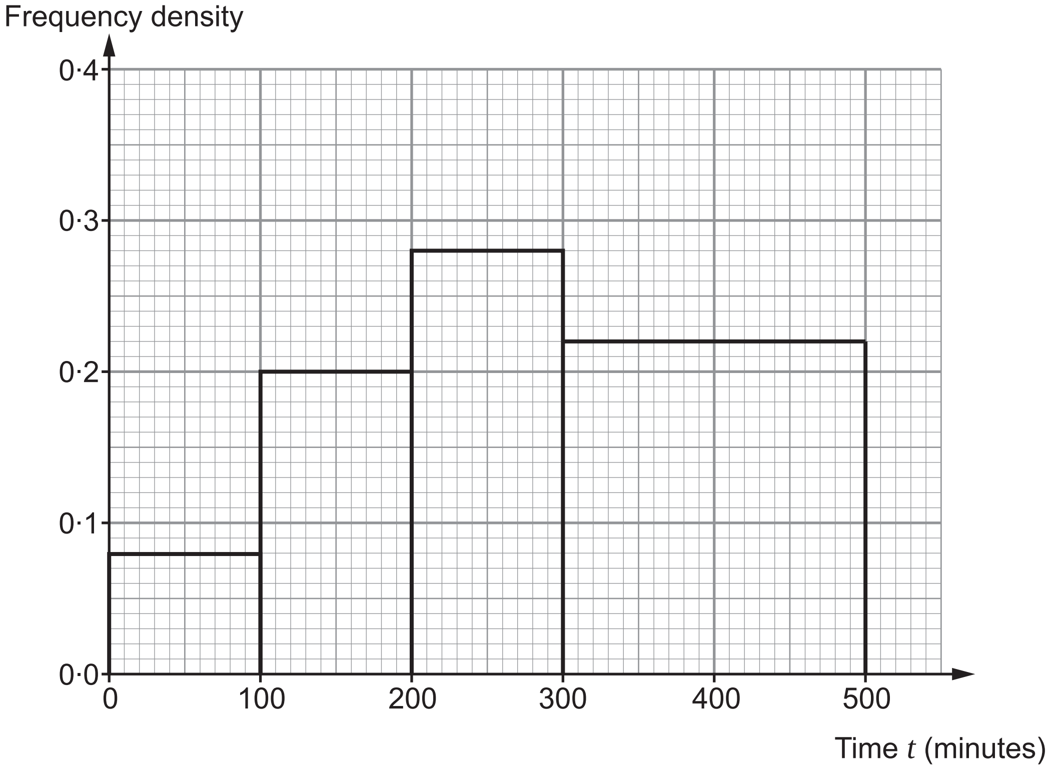
21. Alice is investigating how much time, in minutes, pupils at her school spend on their mobile phones.
She asks 100 students in Year 11 and 100 students in Year 7 to record how much time they each spend on their mobile phones on a Monday.

(a) The results for Year 11 are shown in the table below.

Time t (minutes)	$0 \leqslant t < 50$	$50 \leqslant t < 100$	$100 \leqslant t < 200$	$200 \leqslant t < 300$	$300 \leqslant t < 400$	$400 \leqslant t < 500$
Number of students	3	5	20	28	30	14

Alice displays her results in the histogram shown below.

Year 11 results



Give **one** criticism of Alice's histogram. [1]

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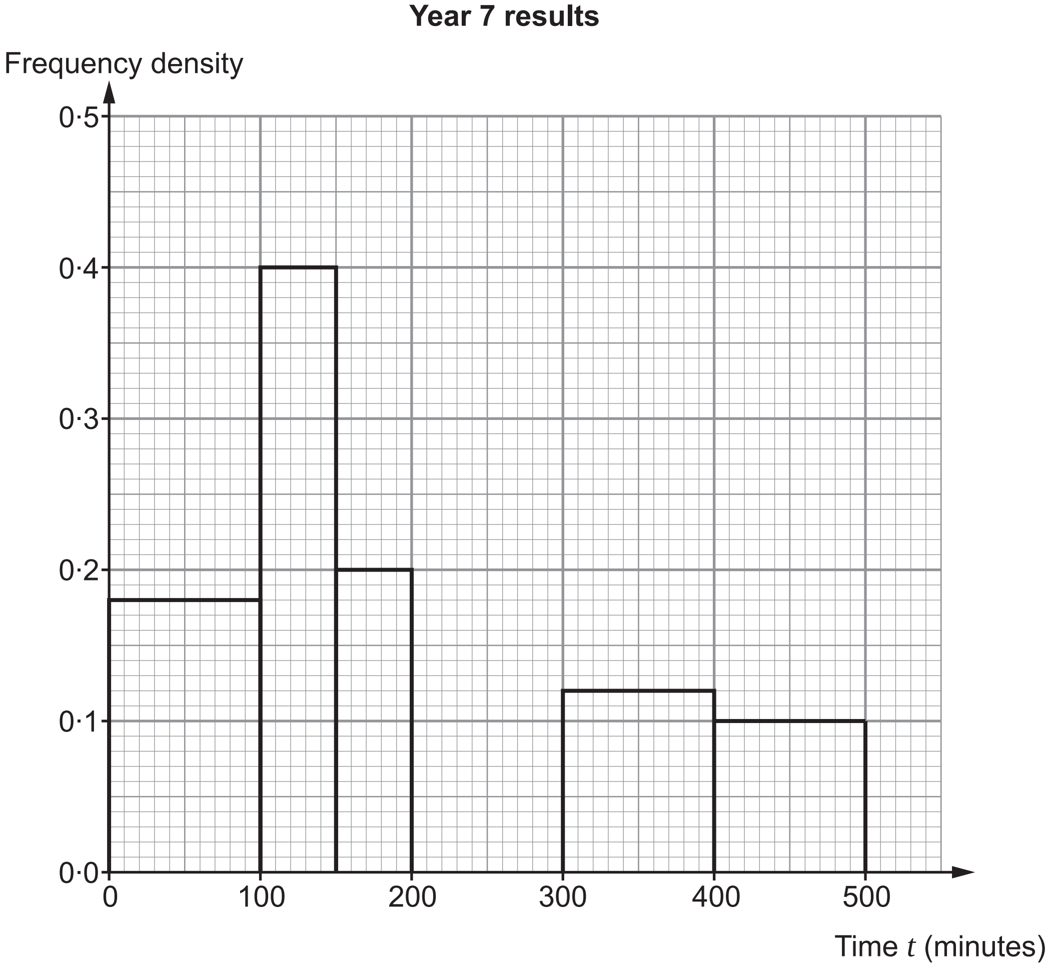
(b) Alice's histogram showing the results for the 100 Year 7 students is shown below.
The group with time $200 \leqslant t < 300$ is missing.



Complete the histogram.
You must show all your working. [3]

(c) Make **one** comparison between the amount of time spent on their mobile phones by **all** the students in Year 11 and **all** the students in Year 7. [1]

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22. The following iterative formula can be used to find the number of cells of bacteria after n days.

$$B_0 = 1000$$
$$B_{n+1} = 1{\cdot}2B_n \text{ where } n \geqslant 0$$

(a) Show that the number of cells of bacteria after 1 day is 1200. [1]

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....

(b) Use this formula to find the number of cells of bacteria after 3 days. [3]

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Number of cells of bacteria after 3 days = ...

23. Adina has 5 wooden blocks. Each block is a different colour.

Blue	Red	Green	Yellow	Purple

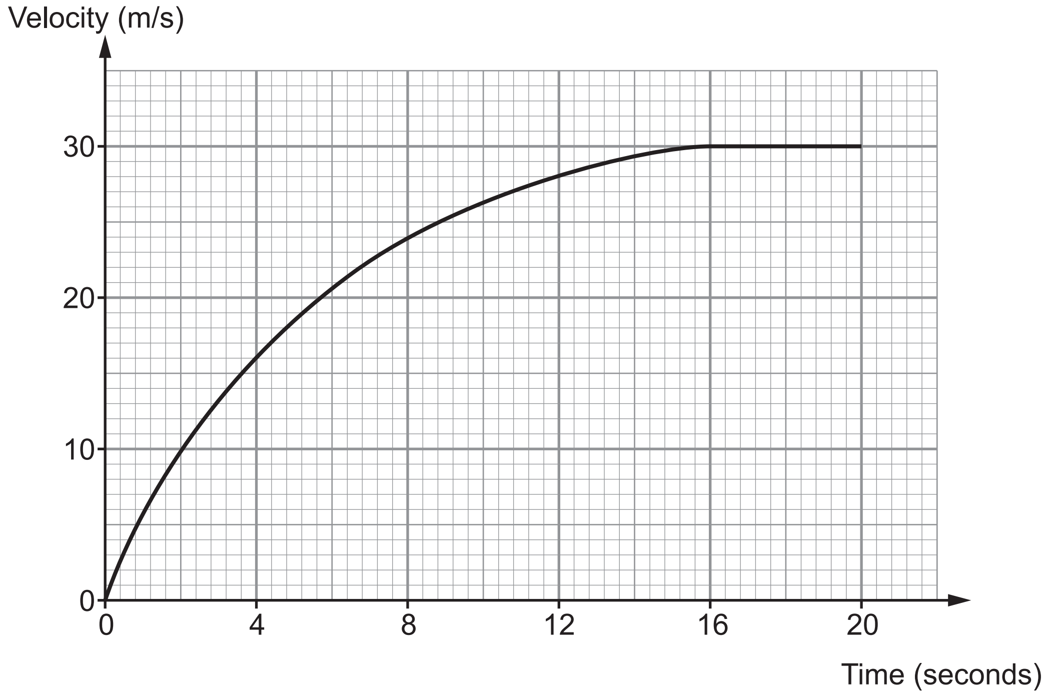
Adina selects 3 of these wooden blocks at random.
Each time she does this, she places them on top of each other.
Two ways of arranging the blocks are shown below.

Blue	Green
Yellow	Red
Red	Purple

(a) Calculate the number of different ways of arranging the blocks. [2]

(b) How many arrangements are there where the middle block is **either** blue **or** red? [2]

24. The velocity-time graph below shows the velocity of a car for the first 20 seconds from rest.



(a) Calculate an estimate of the acceleration of the car at time 8 seconds. [3]

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Acceleration = ... m/s^2

(b) Use 5 vertical strips of equal width to calculate an estimate of the distance travelled by the car during the first 20 seconds of motion. [3]

Distance travelled = ... m

25. (a) $h(x) = x^2 + 3.$

Show that $h^{-1}(x)$ has no solutions for $x < 3$. [3]

(b) $f(x) = x^2 + 5.$
$g(x) = x - 4.$

Show that $fg(x) - gf(x) = 20 - 8x$.
You must show all your working. [4]

26. Make e the subject of the following formula. [5]

$$3e = \sqrt{7 - de^2}$$

27. Express $0{\cdot}3\dot{4}\dot{5}$ as a fraction. [2]

28.

Sofia's dog is running through a field.
Its speed at t seconds is w metres per second.

The diagram below shows the speed of the dog for part of its run.

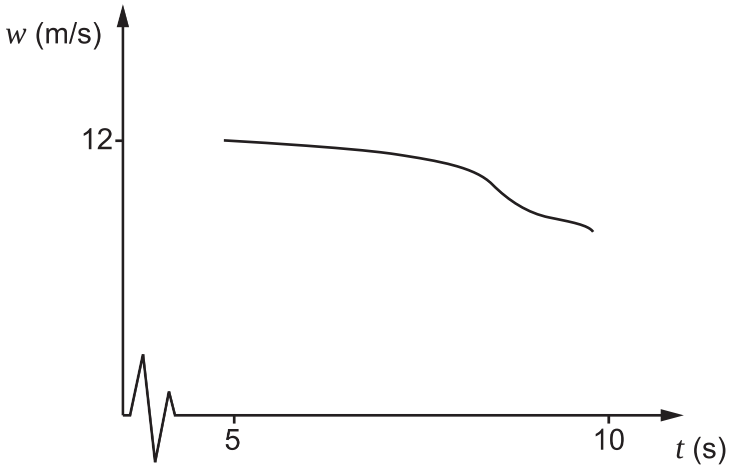

Diagram not drawn to scale

When $t = 5$, $w = 12$.
The average deceleration of the dog between 5 and 10 seconds is $1{\cdot}5\,\text{m/s}^2$.

Calculate the speed of Sofia's dog when $t = 10$.
You must show all your working. [3]

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Speed when $t = 10$ is .... m/s

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