

Surname	Centre Number	Candidate Number
Other Names		0



GCSE LINKED PAIR PILOT

4361/02

APPLICATIONS OF MATHEMATICS UNIT 1: APPLICATIONS 1 HIGHER TIER

A.M. WEDNESDAY, 13 June 2012

2 hours

ADDITIONAL MATERIALS

A calculator will be required for this paper.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

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.

Take π as 3.14 or use the π button on your calculator.

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.

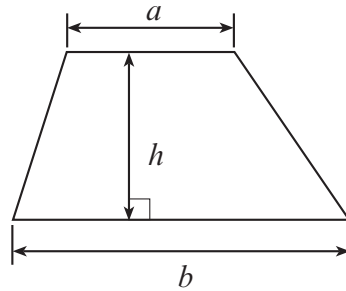
The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question 8.

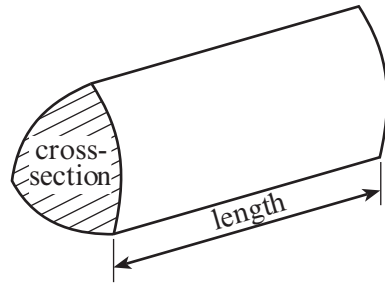
For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	6	
2	4	
3	3	
4	5	
5	5	
6	9	
7	12	
8	7	
9	15	
10	4	
11	6	
12	5	
13	8	
14	5	
15	6	
TOTAL MARK		

Formula List

Area of trapezium = $\frac{1}{2}(a + b)h$

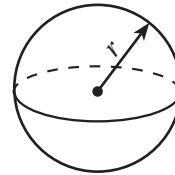


Volume of prism = area of cross-section \times length



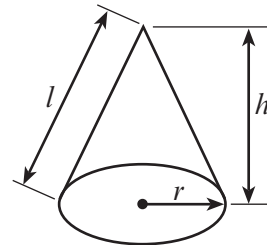
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

Curved surface area of cone = $\pi r l$

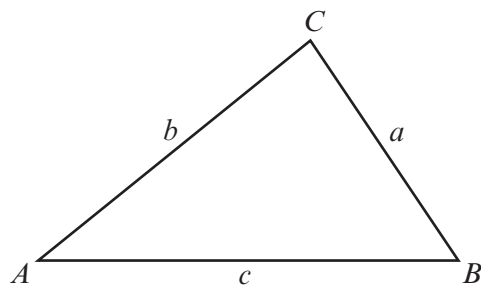


In any triangle ABC

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle = $\frac{1}{2}ab \sin C$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$

where $a \neq 0$ are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

1. (a) A plan of the layout of a number of cycle tracks to be made around a park is shown below.
In order to mark out the cycle tracks the size of the angles a , b , c and d need to be found.

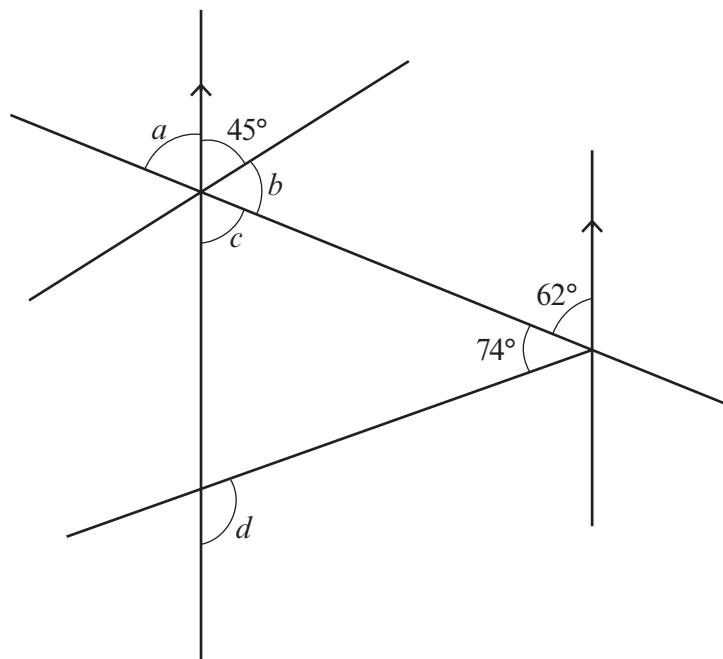


Diagram not drawn to scale

Calculate the angles marked a , b , c , and d .

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$$a = \text{.....}^\circ$$

$$b = \text{.....}^\circ$$

$$c = \text{.....}^\circ$$

$$d = \text{.....}^\circ$$

[4]

- (b) In another section of the park there is a flowerbed in the shape of a rhombus.
One of the angles of the rhombus is 46° .
Calculate the size of the other three angles of the rhombus.

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[2]

2. (a) Two boxes are stacked on top of each other.
The height of each box is 6 cm, measured to the nearest centimetre.

Explain why these two boxes may not fit in a space that is 12 cm high.

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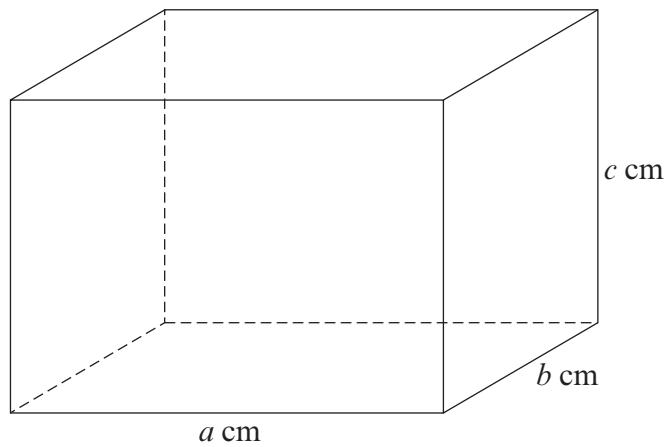
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[2]

- (b) Joseph works in a factory that makes boxes.
The boxes are all cuboids.
Each cuboid has dimensions a cm, b cm and c cm.



Joseph has been asked to write a simplified expression for the total length of all the edges of the cuboid.

Joseph writes down the expression $2a + 3b + 4c$.

Joseph's expression is incorrect.

What should the correct simplified expression be for the total length of all the edges?

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[2]

3. A pattern using dots is to be created on a background for a large window display. The instructions say that the background should be a grid 9 squares across by 16 squares up and the coordinate system for plotting should be used. Dots are then placed at points where the x -coordinate is a factor of 9 and the y -coordinate is a factor of 16, for example (3, 4). Use the grid below to plot all the dots for the window display.

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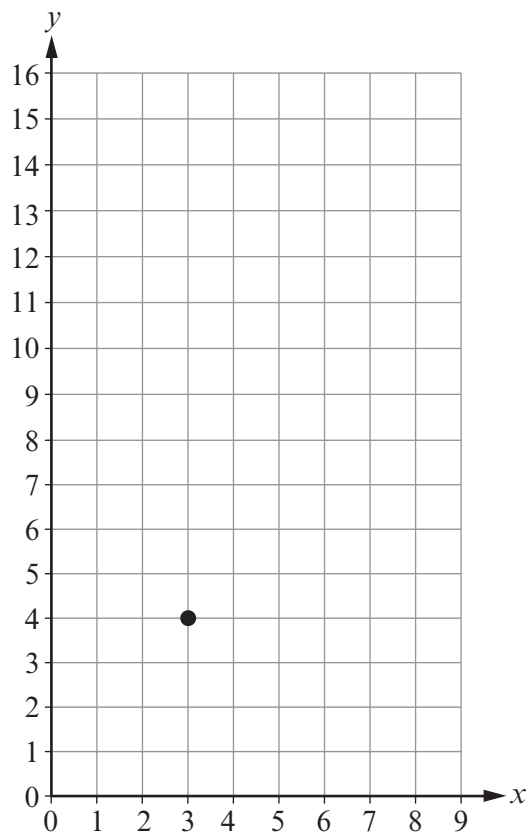
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4. You are asked to check Damian's homework.
He has answered 7 questions.
The homework questions and Damian's answers are given in the table below.

Question number	Question	Damian's answer
1	Calculate $48 + 62$	100
2	Simplify $3a - 5b + 26a - 26b$	$29a + 31b$
3	Expand $6(x + 2)$	$6x + 12$
4	Simplify $3(2x + 5) - (x - 3)$	$5x + 12$
5	Factorise $24x + 8$	$8(3x + 0)$
6	Factorise $3x + 15$	$3(x + 5)$
7	Find the value of $2a - 3b$ when $a = 6$ and $b = -4$	0

Complete the table below to indicate if Damian's answers are correct or not.
If any of his answers are incorrect, you must give the correct answer.

Question number	Correct? Yes or No	If no, give the correct answer
1	No	110
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3		
4		
5		
6		
7		

Extra working space

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[5]

5. A chart is kept to show the position of a yacht at three times during the day. These are the notes that have been kept in order to plot the positions of the yacht on the chart.

Notes:

- Start time was 12 noon
- At 13:00 its position was 6 nautical miles on a bearing of 134° from the start
- At 14:00 its position was 4 nautical miles on a bearing of 200° from its position at 13:00

(a) Use a scale of **1 cm to represent 1 nautical mile** to complete the chart.

[3]



(b) Write down the bearing of the yacht and its distance from the start position at 14:00.

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Bearing $^\circ$

Distance nautical miles

[2]

6. The manager of an electrical store had a plan to gradually decrease the number of ordinary light bulbs, on the shelves, between 2005 and 2011.

At the same time, the plan was to increase the number of low energy light bulbs on the shelves.

The number of both types of light bulbs, on the shelves, has followed the general trends as planned.

There were no variations to the trend.

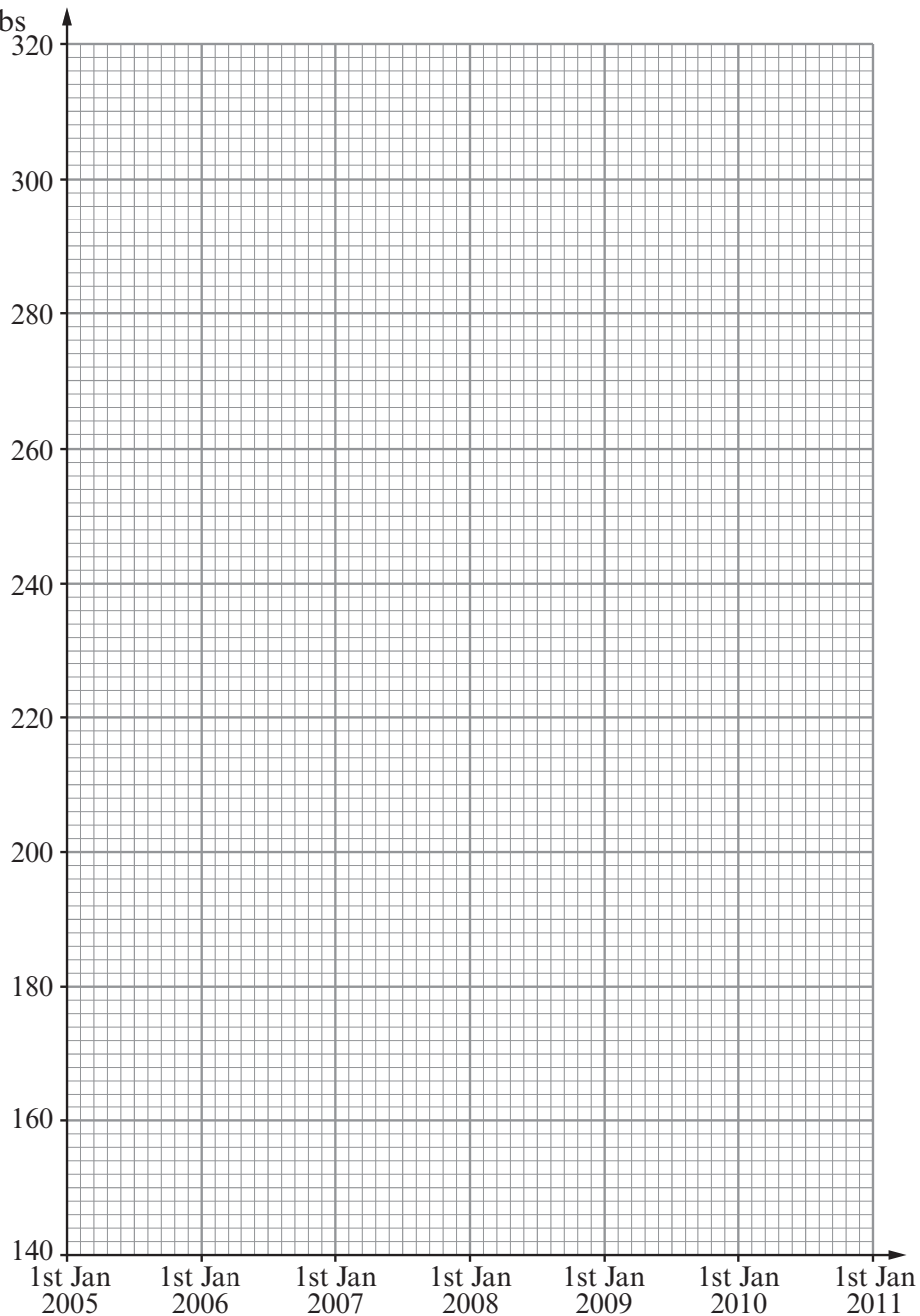
- (a) The number of low energy light bulbs was recorded each year on the 1st January. The table gives this information from 2005 to 2011.

1st January, Year	2005	2006	2007	2008	2009	2010	2011
Number of low energy light bulbs	150	172	198	248	300	310	320

- (i) Use the graph paper below to display this information.

[3]

Number of low energy light bulbs



7. Cheryl and Ben planned a cycle ride using a 1 : 25 000 scale map.
The route they planned measured approximately 80 cm on the map.

(a) Calculate approximately how far they planned to cycle.
You must give your answer in km.

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(b) After the ride Cheryl's cycle-computer showed that she travelled 24 km.
What was this measurement on the map in centimetres?

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(c) Ben and Cheryl's cycle-computers showed 24 km after the ride.
The ratio of the distance Ben cycled to the distance he pushed his bike uphill was 5:1.
The ratio of the distance Cheryl cycled to the distance she pushed her bike uphill was 11:1.

Calculate how far Ben cycled and how far he pushed his bike uphill.

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Cycled km Pushed bike uphill km

Calculate how far Cheryl cycled and how far she pushed her bike uphill.

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Cycled km Pushed bike uphill km

[4]

8. *You will be assessed on the quality of your written communication in this question.*

A fishing competition is to be held out at sea in a rectangular area that is 5 km by 4 km and marked out by buoys. Safety boats are positioned at two different corners of the rectangular area marked out by the buoys.

Each safety boat patrols an area not exceeding 3 km from its initial position.

Consider the options for positioning the two safety boats.

Decide which of your options is best for positioning the two safety boats.

You must clearly show and explain why your solution is the best option.

Explanation:

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[7]

9. (a) The depth of a lens in a pair of glasses is measured as shown below.



A number of people wearing glasses were surveyed.
The depth of the lens in their glasses was measured and recorded correct to the nearest mm.
The results are summarised in the table.

Depth of lens, x mm, to the nearest mm	Number of people
$10 \leq x \leq 19$	6
$20 \leq x \leq 29$	28
$30 \leq x \leq 39$	48
$40 \leq x \leq 49$	18

- (i) Calculate an estimate for the mean depth of a lens.

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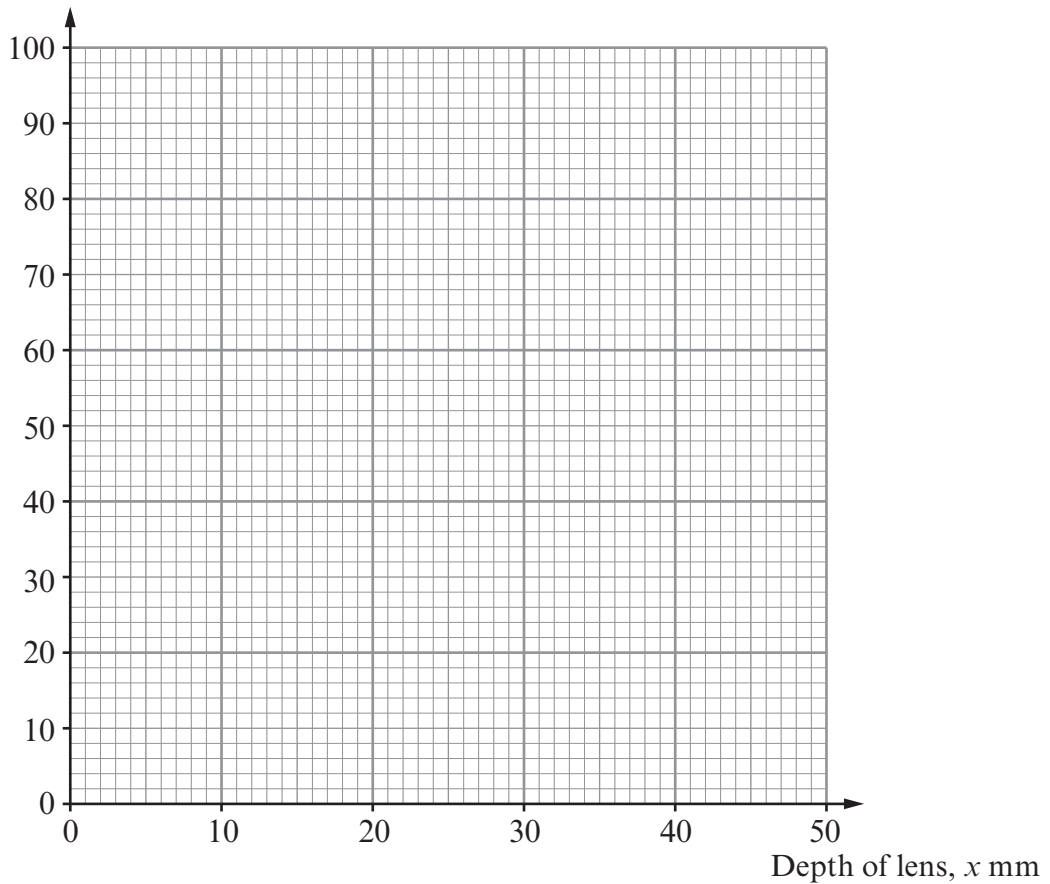
(ii) Complete the following cumulative frequency table.

Depth of lens, x mm	$x < 9.5$	$x < 19.5$	$x < 29.5$	$x < 39.5$	$x < 49.5$
Cumulative frequency	0	6	34		

[1]

(iii) On the graph paper below, draw a cumulative frequency diagram to show this information. [2]

Cumulative frequency



(iv) Use your graph to estimate each of the following.

The median depth of a lens.

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The interquartile range for the depth of a lens.

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[3]

(b) An optician records the number of pairs of glasses she sells in each season.

Year	2011				2012	
Season	Winter	Spring	Summer	Autumn	Winter	Spring
Number of pairs of glasses	1084	2124	4326	1242	1348	2456

(i) Calculate the 4-point moving averages and complete the table below.

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4 season time period ending:	Autumn 2011	Winter 2012	Spring 2012
4-point moving average:			

[3]

(ii) In the summer of 2011 the optician had the following offer

Buy one pair and get a second pair half price.

She has decided not to repeat this offer in the summer of 2012, but instead to have a promotion in the autumn of 2012

Buy one pair get one free.

Explain fully what impact this may have on the 4-point moving average for the 4 season time period ending in the summer of 2012.

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[2]

- 10.** Jade entered a number into her calculator.
 To this number, she added the square of the original number and the cube of the original number.
 Jade got the answer 432·288.
 Find the number that Jade first entered into her calculator.
 Show all your working.

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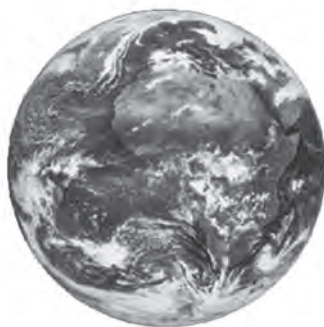
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11. The Earth is approximately spherical.



- (a) The radius of the Earth is 6378.1 km.
Calculate the circumference of the Earth, giving your answer in standard form correct to 3 significant figures.

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[4]

- (b) The total surface area of the Earth is approximately 5.112×10^8 square kilometres.
Oceans cover an approximate area of 3.618×10^8 square kilometres and the remainder of the surface is covered by land.
Calculate the area of the Earth covered by land, giving your answer in standard form.

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[2]

12. The fee for advertising on an Internet website includes a charge for the number of words in an advertisement, as well as a standard charge.

There is a standard charge of R pounds for the placement of each advertisement.

The charge, in pounds, for the number of words in an advertisement is equal to one-tenth of the total number of words.

(a) Derive a formula for B , the total fee in pounds, for placing an advertisement which has h words.

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(b) A seller is charged a fee of £4.60 for placing an advertisement on this website. The standard charge is £2. Calculate how many words were placed in the advertisement.

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13. A production line making chocolates sometimes develops a fault and shuts down.

The distance the chocolates travel towards the next process before shut down is d metres.
The speed of the production line is v m/s.

When the fault occurs, it is noticed that the distance the chocolates travel towards the next process, is inversely proportional to the square of the speed of the production line.

The fault last occurred when the distance the chocolates moved on towards the next process was 8 m and the speed of the production line was 4 m/s.

- (a) Find an expression for d in terms of v .

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- (b) Calculate d when $v = 6$ m/s.

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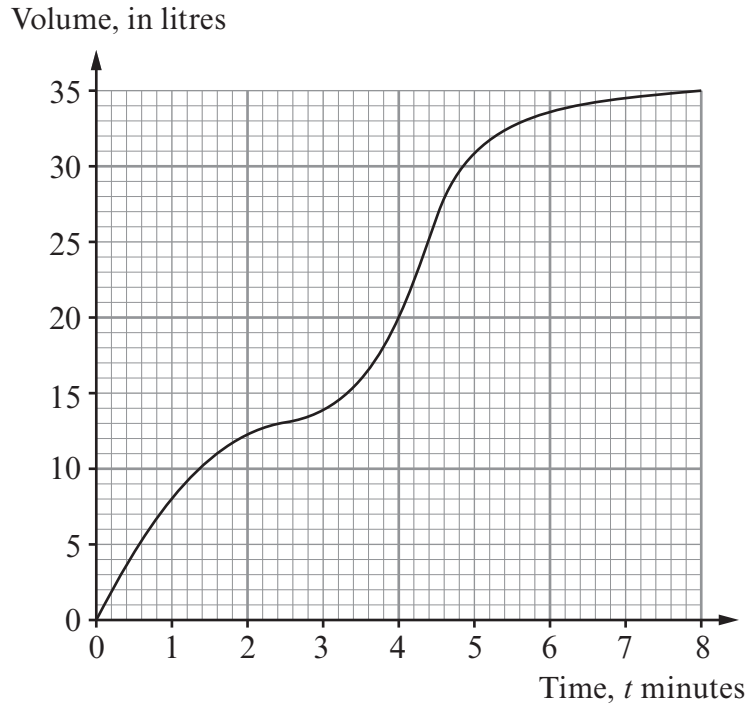
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- (c) Calculate v when d is 25 cm.

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14. A tank has been filled with water.
The graph below shows the volume of water in the tank over a time period of 8 minutes.



- (a) Calculate the gradient of the graph at time $t = 3$.
You must state the units of your answer.

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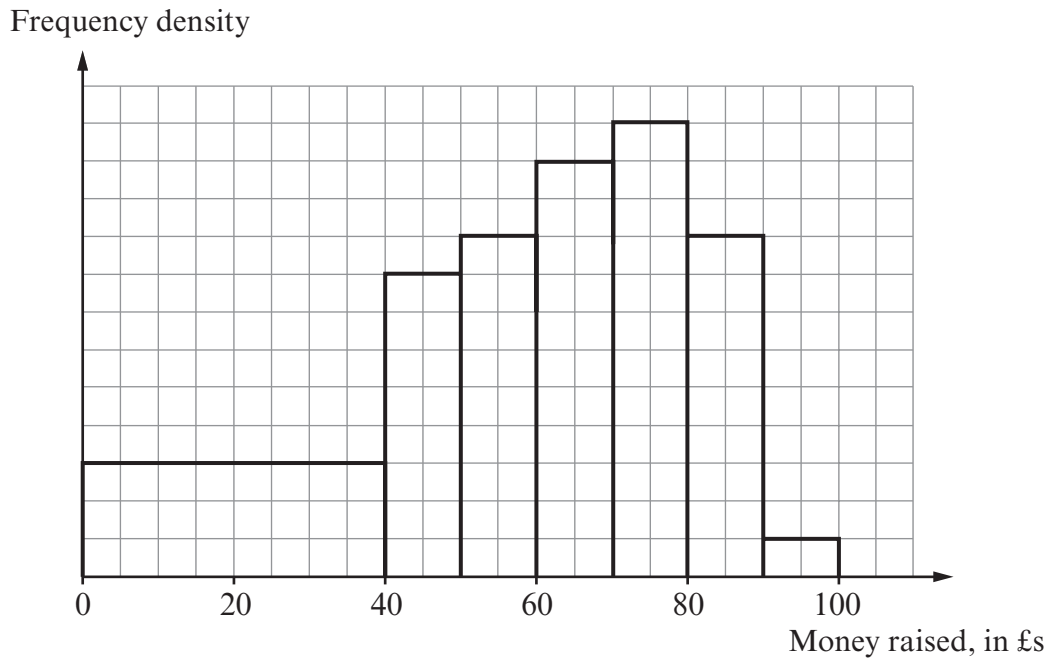
- (b) Explain what the gradient of the graph is measuring.

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[1]

15. Jack arranged a raffle to raise money.
He has drawn a histogram to show the distribution of money raised from the raffle.



Jack has forgotten to write the scale on the vertical axis.
He knows that 40 people each raised £50 or less.
Calculate an estimate for the total money raised.

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