WJEC GCSE MATHEMATICS (UNITISED)

MATHS



EXAM QUESTION PACK

UNIT 3 HIGHER TIER 4353 PAPERS

STEMUP

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4353/02

S16-4353-02

MATHEMATICS (UNITISED SCHEME)
UNIT 3: Calculator-Allowed Mathematics
HIGHER TIER

A.M. TUESDAY, 14 June 2016

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a 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.

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 continuation page at the back of the booklet, taking care to number the question(s) correctly.

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 **7***(a)*.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**3**	
2.	**4**	
3.	**4**	
4.	**2**	
5.	**5**	
6.	**5**	
7.	**10**	
8.	**5**	
9.	**2**	
10.	**3**	
11.	**4**	
12.	**4**	
13.	**8**	
14.	**3**	
15.	**2**	
16.	**6**	
17.	**3**	
18.	**6**	
19.	**7**	
20.	**4**	
Total	**90**	

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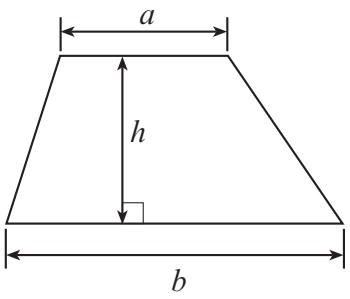
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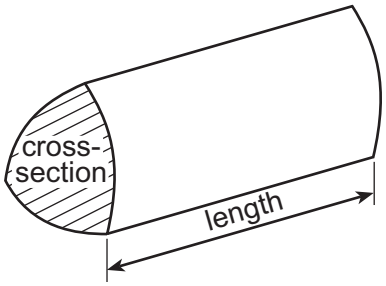
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Formula List

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

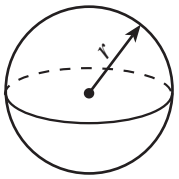


Volume of prism = area of cross-section × length



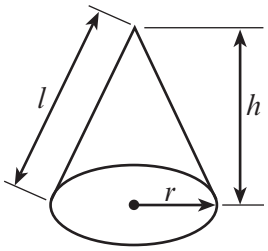
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

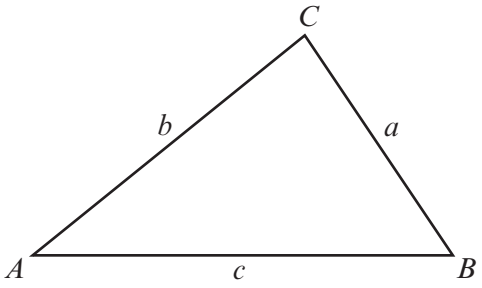


In any triangle ABC

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

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

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1. *(a)* Factorise $8x + 6y$. [1]

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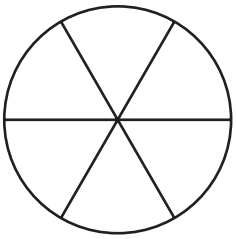
(b) Evaluate $\sqrt[3]{\left(\frac{9{\cdot}8}{3{\cdot}1-1{\cdot}7}\right)^2}$. Give your answer correct to 2 decimal places. [2]

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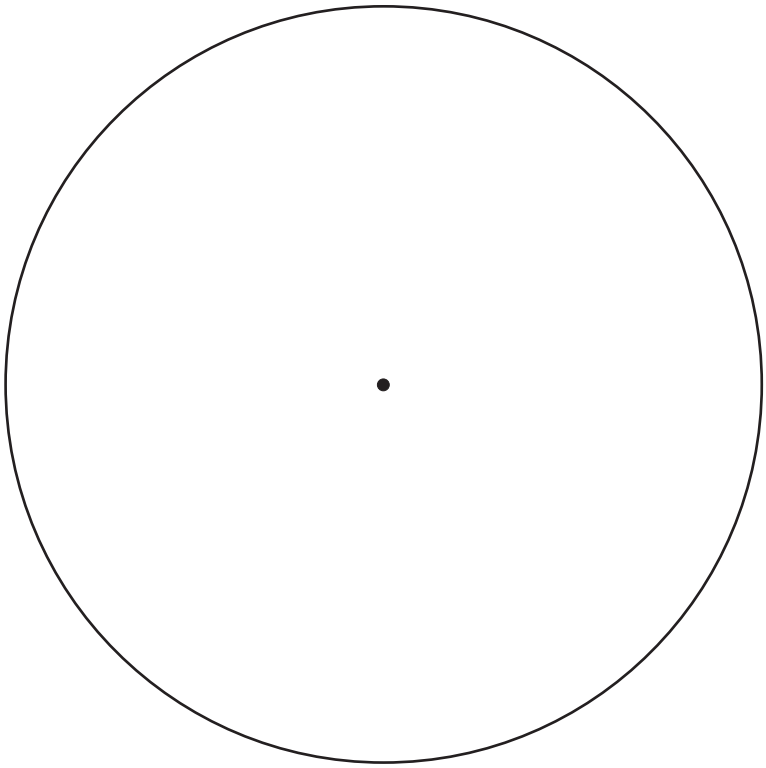
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2. A company's logo consists of a circle split into 6 equal sectors as shown in the diagram below.



A version of the logo with the circle of radius 5 cm is to be put on the packaging of some of the company's products.
Using a ruler and compasses only, construct an accurate diagram of this version of the logo.
You must show your construction arcs. [4]



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Turn over.

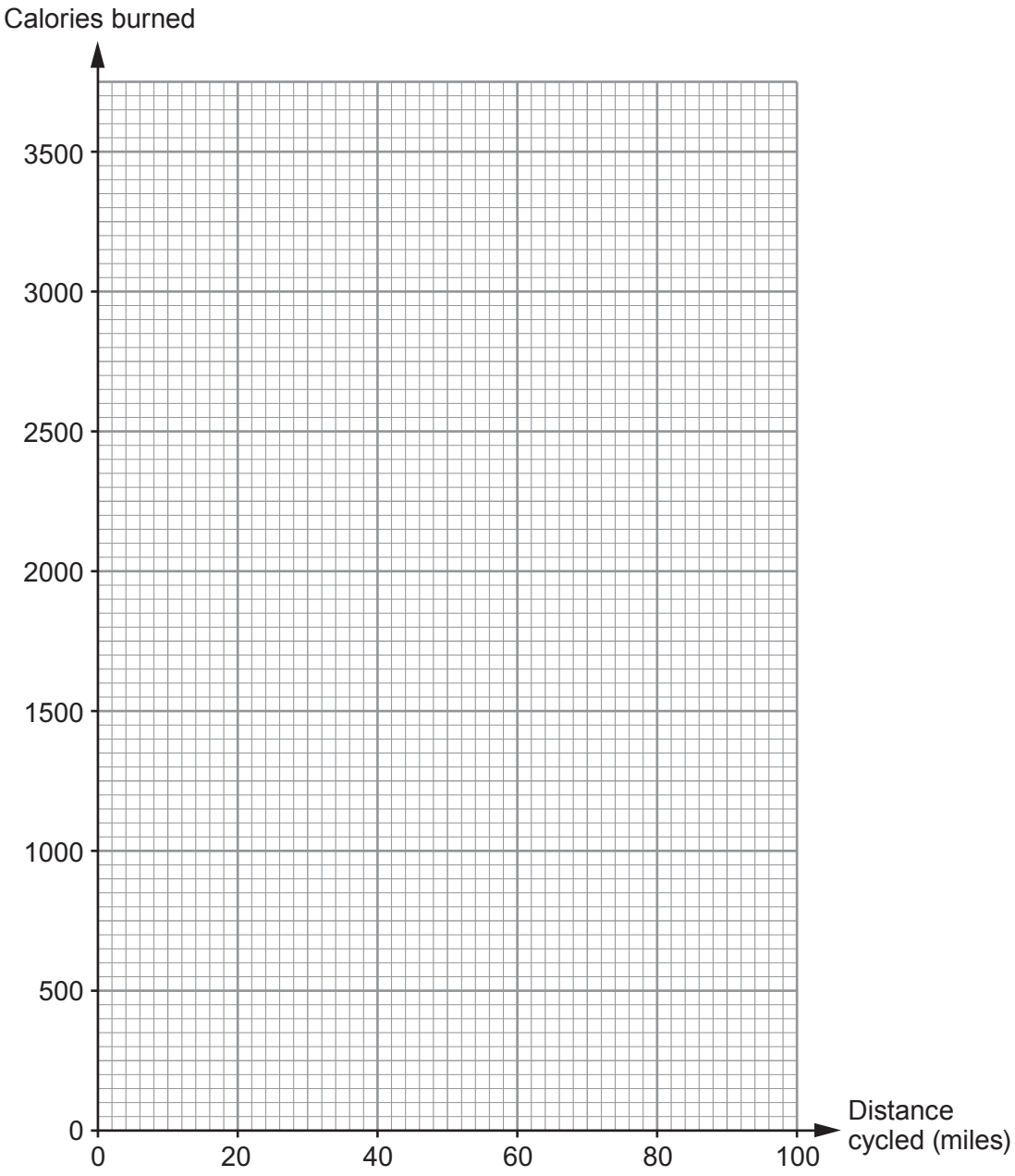
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3. A cyclist used an App on his mobile phone to record the distance he cycled and the calories he burned, on each of his last six rides.
His results are shown in the table below.

Distance cycled (miles)	60	28	86	52	24	76
Calories burned	2100	1500	3500	2500	800	3000

(a) Draw a scatter diagram of this data. [2]



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(b) What type of correlation is shown in the scatter diagram? [1]

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(c) Give a possible reason why the cyclist burned fewer calories on the 60 mile ride than he did on the 52 mile ride. [1]

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4. Jamal has a number of 3 kg bags of potatoes and a different number of 8 kg bags of potatoes.
The mean weight of the bags of potatoes is 6 kg.
What is the least number of 3 kg and 8 kg bags of potatoes that Jamal has? [2]

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Jamal has .....3 kg bags and .....8 kg bags

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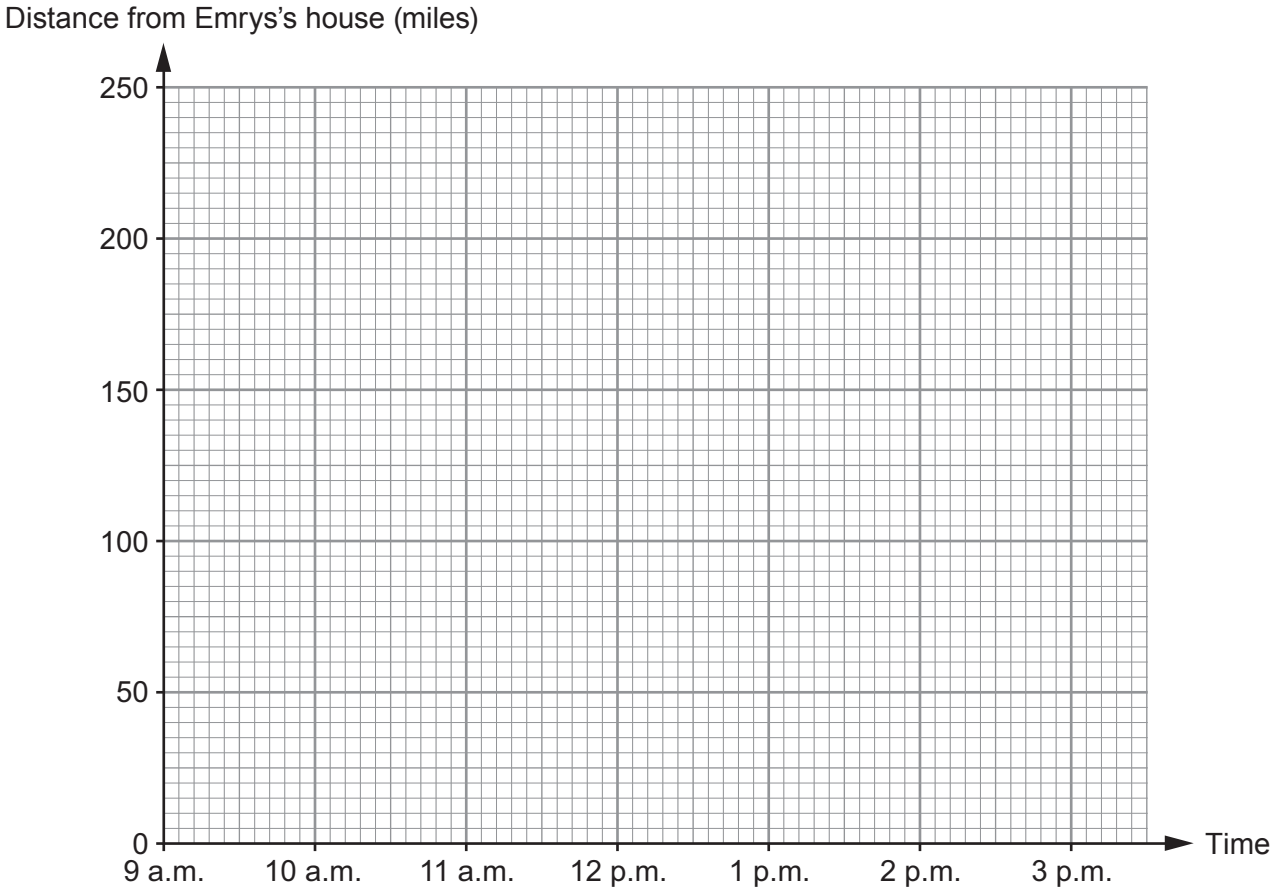
5. Emrys drove to visit his sister who lives 240 miles away from him.
He set out at 9 a.m., travelling the first 110 miles at an average speed of 50 mph.
After travelling 110 miles, Emrys stopped for a break.
At 12 p.m. he continued on his way, arriving at his sister's house at 3 p.m.

(a) Use the information above to draw a distance-time graph of Emrys's journey. [3]

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(b) Calculate Emrys's average speed, in mph, between 9 a.m. and 3 p.m. [2]

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6. *(a)* Solve the equation $\frac{x+5}{6} = 3$. [2]

(b) Solve the equation $5(2x - 3) - 8x = 10$. [3]

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7. The diagram below shows the uniform cross-section of a metal beam.

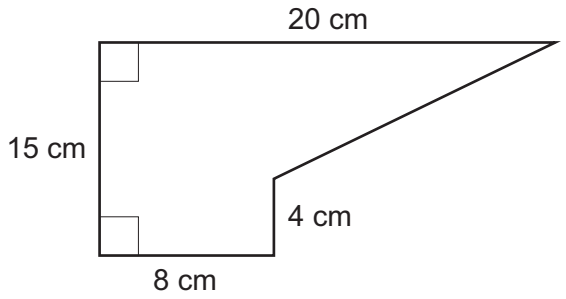


Diagram not drawn to scale

(a) *You will be assessed on the quality of your written communication in this part of the question.*

Calculate the area of the cross-section.
You must show your working. [6]

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(b) The length of the metal beam is 2 m and its mass is 108 kg.
Calculate the density of the metal, giving your answer in g/cm^3. [4]

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8. Catherine had a stall at a charity event to raise money for two local charities.

(a) Catherine made a fruit juice drink to sell at her stall.
She started by thoroughly mixing 200 ml of lime juice with 300 ml of cranberry juice.
Catherine drank 100 ml of the mixture to test its taste, and decided it was too bitter.
She then mixed in 400 ml of lemonade, and decided that she was happy with this new mixture.
Write down the ratio of lime juice to cranberry juice to lemonade for Catherine's new fruit juice drink. [3]

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lime juice : cranberry juice : lemonade

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(b) Catherine made a profit of £84.80 from selling her fruit juice drink at the charity event.
She decided to share the money between the charities in the ratio 5 : 3.
Calculate the amount of money she gave to each of the two charities. [2]

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9. A regular polygon has exterior angles of 24°.
How many sides does the regular polygon have? [2]

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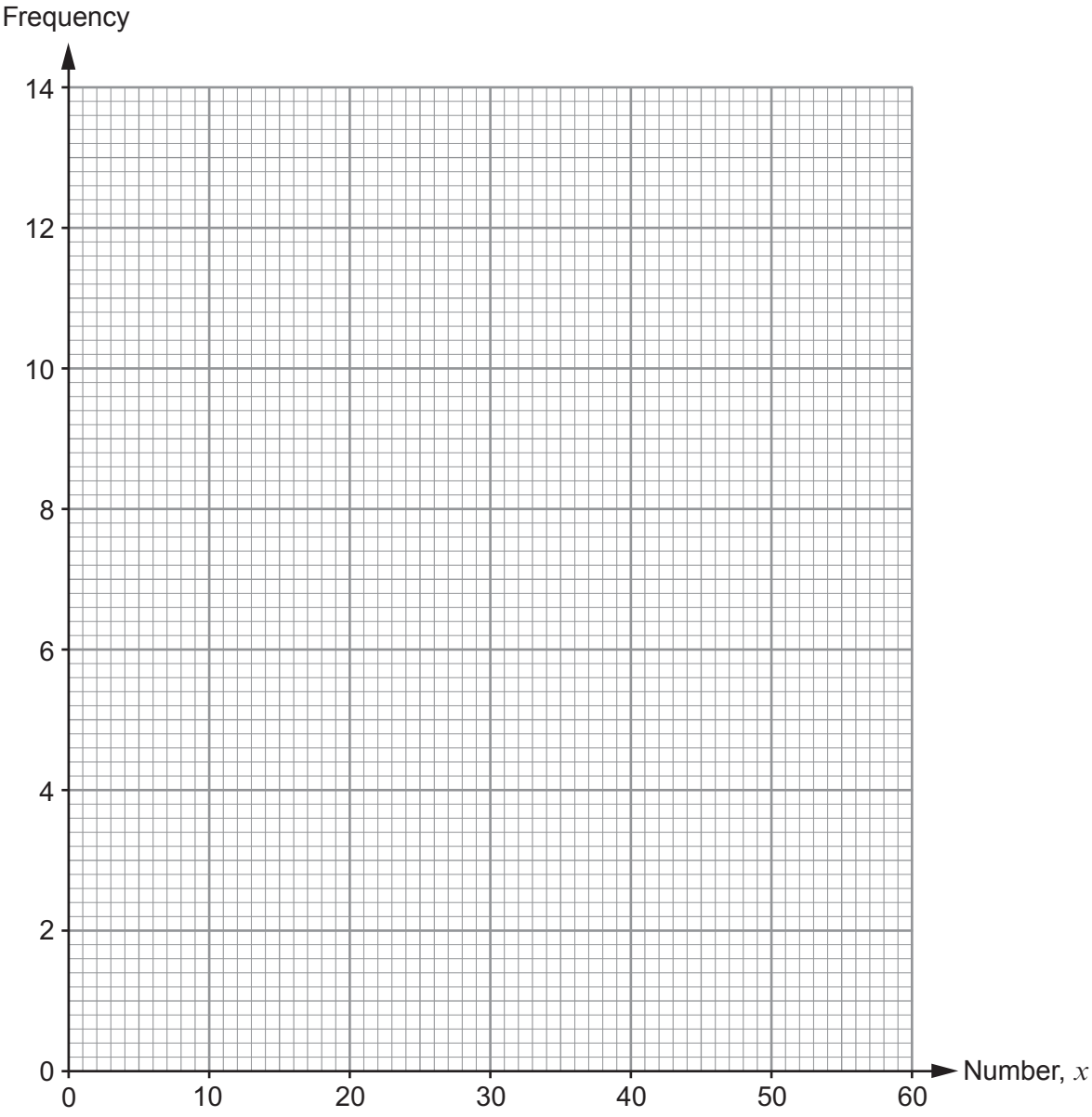
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10. A list of 50 numbers has been summarised in the grouped frequency table below.

Number, x	Frequency
$0 \leqslant x < 10$	3
$10 \leqslant x < 20$	5
$20 \leqslant x < 30$	9
$30 \leqslant x < 40$	13
$40 \leqslant x < 50$	12
$50 \leqslant x < 60$	8

(a) Draw a frequency polygon to show this data. [2]



(b) Write down the group that contains the median. [1]

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11. A vertical flagpole, *AB*, is of height 40 m.
The points *B*, *C* and *D* lie on level ground, and *BCD* is a straight line.
Point *C* is 20 m from the base of the flagpole.
The angle of elevation of the top of the flagpole from point *D* is 51°.

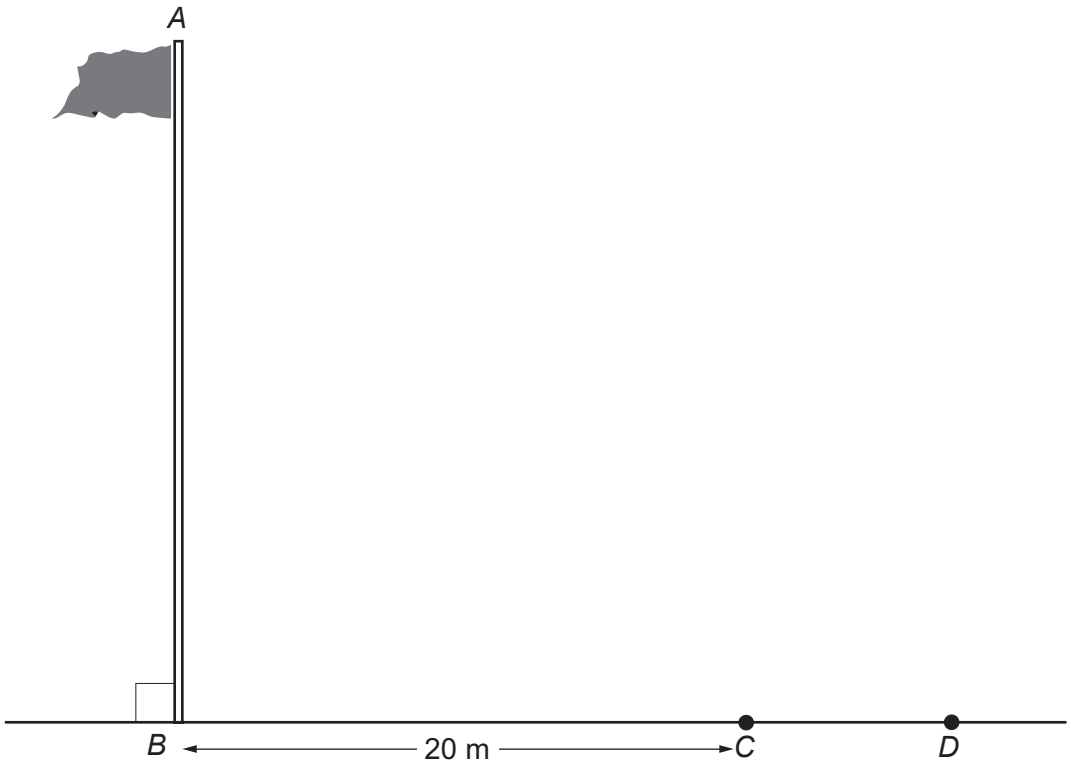


Diagram not drawn to scale

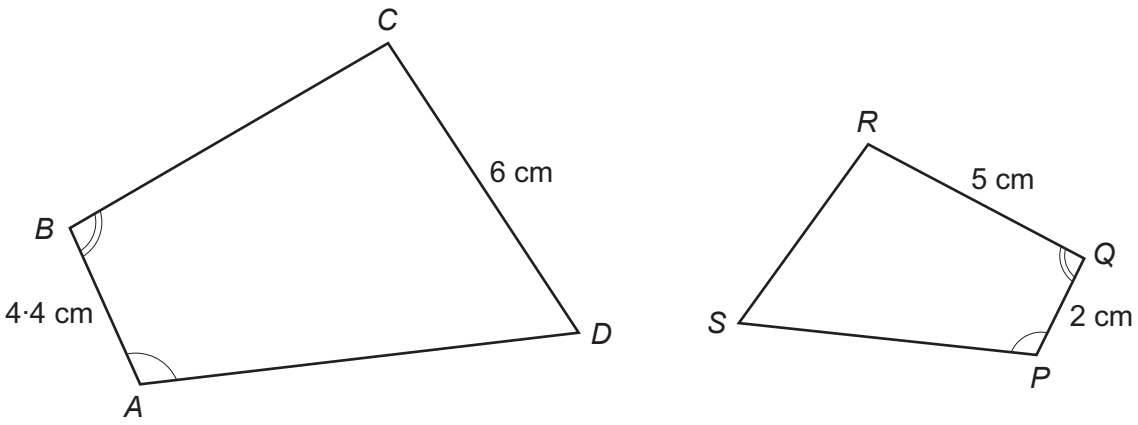
How far apart are points *C* and *D*? [4]

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12. The diagram shows two similar quadrilaterals, *ABCD* and *PQRS*.



Diagrams not drawn to scale

(a) Calculate the length *BC*. [2]

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(b) Calculate the length *RS*. [2]

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13. A right-angled triangle is shown below.

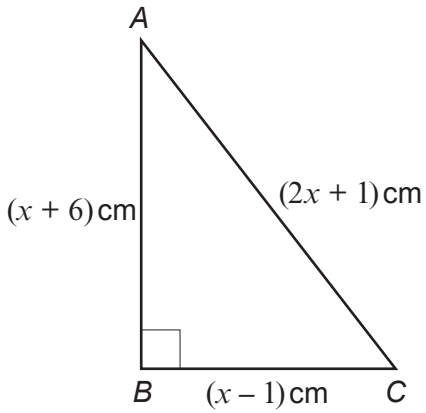


Diagram not drawn to scale

(a) Show that $x^2 - 3x - 18 = 0$. [4]

(b) Factorise the expression $x^2 - 3x - 18$, and hence solve the equation $x^2 - 3x - 18 = 0$. Write down the lengths of the sides of the right-angled triangle. [4]

AB = ... cm *AC* = ... cm *BC* = ... cm

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14. At an average speed of 80 km/h, it would take approximately 90 years to travel over the entire road network of the world.
Use this information to calculate the approximate length of the road network of the world in kilometres.
Give your answer in standard form, correct to 2 significant figures. [3]

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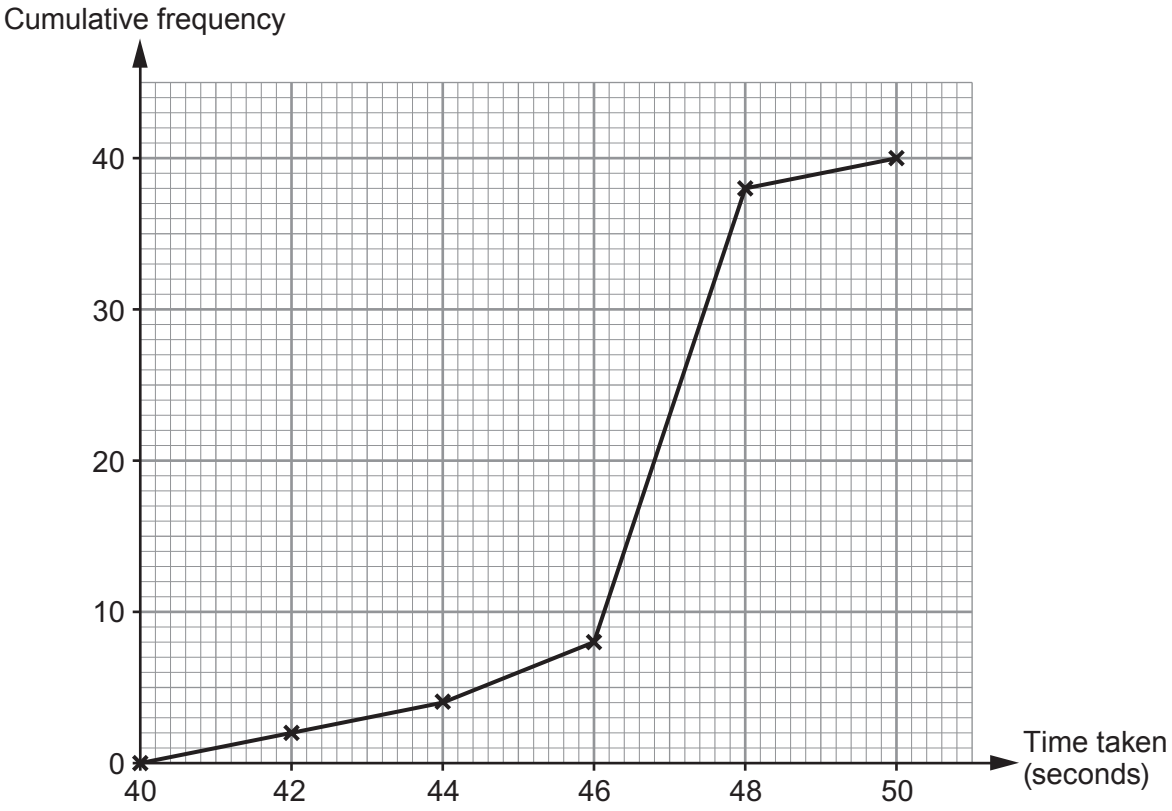
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15. At the start of a new football season, a coach recorded the times taken by the 40 players in his squad to carry out a fitness drill.
He grouped the times taken by the 40 players and drew the cumulative frequency diagram shown below.



(a) What was the median time taken to complete the fitness drill? [1]

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(b) The coach sets a target over the next week to get the median time for the fitness drill down to 46 seconds.
Of the players who took more than 46 seconds, how many need to improve their times to 46 seconds or under, so that the median time would be 46 seconds? [1]

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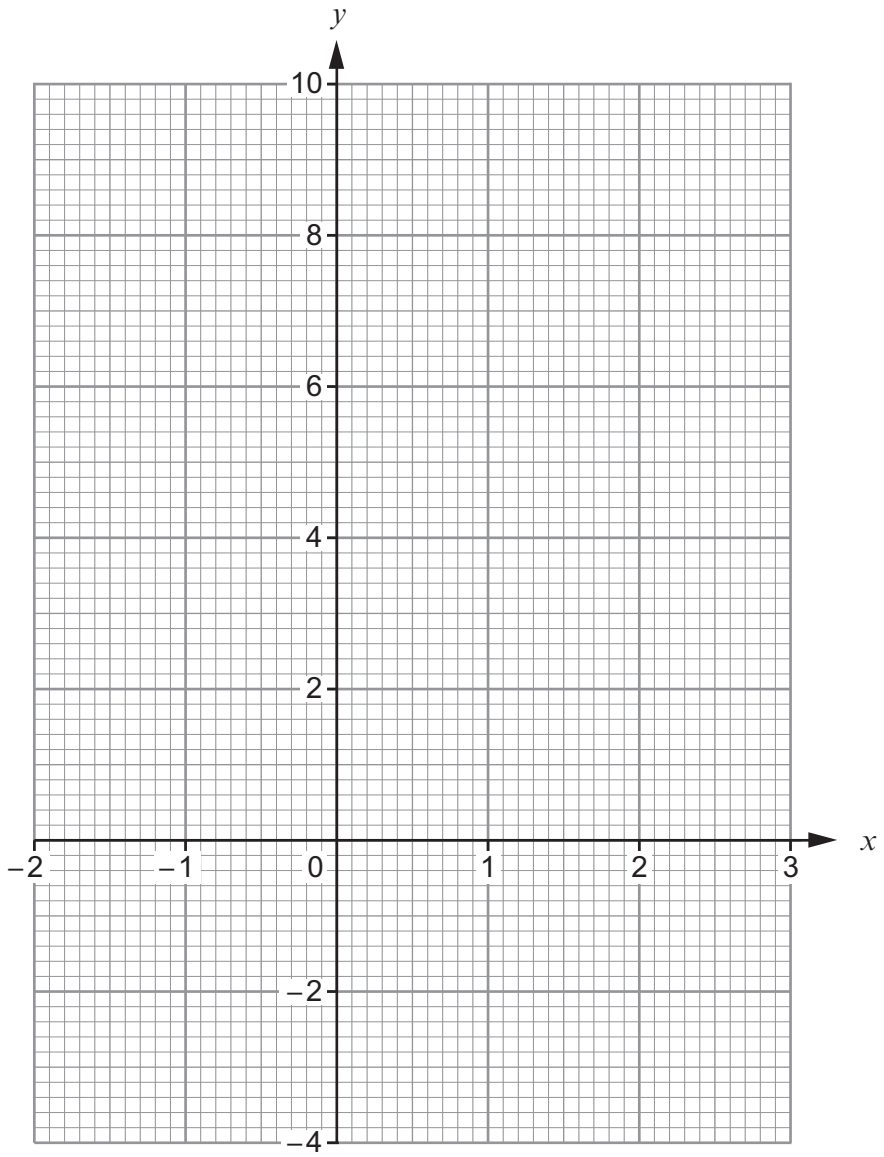
16. *(a)* Complete the table below that shows some of the values of $y = x^2 - 2x - 2$, for values of x from -2 to 3. [1]

x	-2	-1	0	1	2	3
$y = x^2 - 2x - 2$	.....	1	-2	-3	-2	1

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(b) On the graph paper below, draw the graph of $y = x^2 - 2x - 2$, for values of x from -2 to 3. [2]



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(c) By drawing an appropriate line, solve the quadratic equation $x^2 - 2x - 2 = -x + 1$. [3]

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17. Solve the quadratic equation $5x^2 - 10x + 3 = 0$, giving your answers correct to 2 decimal places. [3]

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18. It is known that y is inversely proportional to x^3, and $y = 2$ when $x = 2$.

(a) Find an expression for y in terms of x. [3]

(b) Calculate y when $x = -4$. [1]

(c) Calculate x when $y = 0{\cdot}016$. [2]

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19. Three triangles are joined together to form the pentagon *ABCDE* shown below.

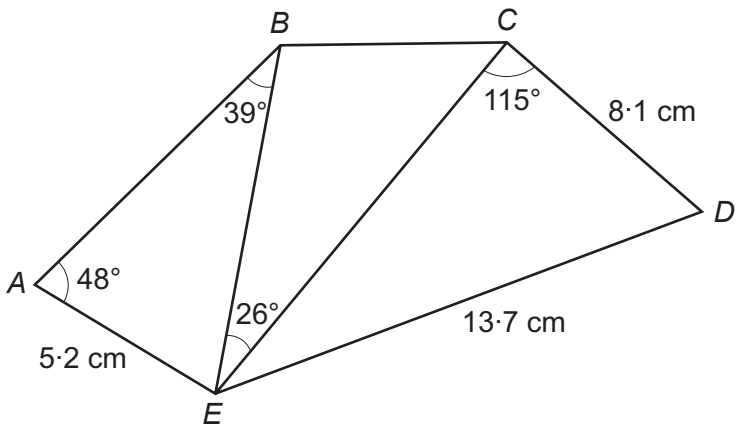


Diagram not drawn to scale

Calculate the length *AD*. [7]

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20. An empty tank is to be filled with water.
The graph below shows the rate of flow of water through a pipe during the controlled filling of the tank.
After 5 minutes the tank is full and the water is turned off.



Using the ordinates $t = 0$, $t = 1$, $t = 2$, $t = 3$, $t = 4$ and $t = 5$, estimate the volume of water in the tank when it is full. State the units of your answer. [4]

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GCSE MARKING SCHEME

SUMMER 2016

GCSE MATHEMATICS UNITISED UNIT 3
HIGHER TIER

4353/02

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INTRODUCTION

This marking scheme was used by WJEC for the 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

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GCSE Mathematics - Unitised Unit 3 Higher Tier
Summer 2016 Mark Scheme

Summer 2016 Unitised Unit 3 Higher Tier	✓	Mark	Comments
1. *(a)* $2(4x + 3y)$		B1	
1. *(b)* 3·66		B2	B1 for 3·6(5930571) or 3·7
2. **Use Overlay.** Sight of 60(°) or use of a 60° angle. Suitable arc(s) drawn for 60° angle. One complete sector. Completed diagram.		 B1 M1 A1 A1	 Allow ±2°.
3. *(a)* All points plotted correctly.		B2	B1 for 3, 4 or 5 points plotted correctly, not joined, OR B1 for all points plotted correctly but joined.
3. *(b)* Positive.		B1	
3. *(c)* Valid reason e.g. "The 60-mile ride could have been over flat roads whereas the 52-mile ride could have been uphill.", or "The wind could have helped on the 60-mile ride.", or "The cyclist may have ridden more slowly on the 60-mile ride", or "The weather was hotter on the 52-mile ride".		E1	
4. Method of trial and improvement. Two 3kg bags and three 8kg bags.		M1 A1	e.g. 1 × 3kg + 2 × 8kg = 19kg 19 ÷ 3 ≠ 6. 2 × 3kg + 1 × 8kg = 14kg. 14 ÷ 3 ≠ 6. 2 × 3kg + 3 × 8kg = 30kg. 30 ÷ 5 = 6. If no marks awarded, SC1 for 2n (3kg) and 3n (8kg) for $n \geq 2$.
5. **Ribbon marked.** *(a)* A line from (9am, 0) to (11:12am, 110). Horizontal line, joining the end of the 1st line with (12pm, 110). A line from the end of the horizontal line to (3pm, 240)		 B1 B1 B1	 Doesn't have to be a straight line. FT from their 1st line. FT from the end of their 2nd line. Doesn't have to be a straight line.
5. **To be viewed with graph.** *(b)* 240/6 = 40 (mph)		 M1 A1	 FT their d-t graph provided at least B1 awarded in (a).
6. *(a)* $x + 5 = 18$ OR $x/6 = 13/6$ $x = 13$		B1 B1	FT until 2nd error. Accept embedded answers.
6. *(b)* $10x – 15 – 8x = 10$ $10x – 8x = 10 + 15$ $x = 25/2$ or 12·5		B1 B1 B1	FT until 2nd error.
7. **Ribbon marked** *(a)***To be viewed with diagram.** (Area of rectangle =) 8×15=120 OR 8×4=32 (cm^2) (Area of triangle =) (12×11)÷2 OR (Area of trapezium =) 0·5(8+20)×11 = 66 (cm^2) OR 154 (cm^2) (Total area =) 186 (cm^2) QWC: Look for • correct units used i.e. cm^2 • spelling in at least 1 statement/sentence • clarity of text explanations QWC2: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer QWC1: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer	 ✓ ✓ ✓ ✓ ✓ ✓	 B1 M1 A1 B1 QWC 2	 If 2 rectangles are formed their total area needs to add to 120. FT provided first B1 awarded, and a correct formula used for the area of a triangle or trapezium. QWC2 Presents material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.

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Summer 2016 Unitised Unit 3 Higher Tier	✓	Mark	Comments
7. *(b)* 186 × 200	✓	M1	FT 'their 186' × 200.
= 37 200 (cm^3)	✓	A1	
108 000 ÷ 37 200	✓	M1	FT 108 000 ÷'their derived 37 200'.
= 2·9(032…) (g/cm^3)	✓	A1	
			If no marks awarded, SC1 for 'their mass' ÷ 'their volume'.
8. *(a)* Volume of lime = (4/5 × 200 =) 160		B1	
Volume of cranberry = (4/5 × 300 =) 240		B1	
160:240:400 or 2:3:5 or equivalent.		B1	FT 'their 160' and 'their 240' provided they add to 'their lemonade' and 'their lime' ≤ 'their cranberry' Correct answer implies all 3 marks.
8. *(b)* (1 part =) (£)84.80 ÷ 8 (=£10.6(0))		M1	
(£)53 AND (£)31.8(0)		A1	
9. 360 ÷ 24 OR equivalent work involving the internal angle.		M1	
= 15 (sides)		A1	
10. *(a)* Points plotted at mid-points of groups and straight lines connecting the points.		B2	B1 for at least 4 points plotted and joined correctly, OR for all points plotted correctly but not joined. Accept intention of straight lines. Ignore any lines outside the first and last points.
10. **To be viewed with frequency table.**			
(b) 30 ≤ x < 40		B1	
11. (*BD* =) 40 ÷ tan51(°)	✓	M2	M1 for tan51(°) = 40 ÷ *BD*.
	✓		
(*BD* =) 32(·391…) (m)	✓	A1	
(*CD* =) =12(·391…) (m)	✓	A1	FT 'their 32(·391…)' – 20 provided at least M1 awarded and their 32(·391…) >20. If no marks awarded, SC2 for (incorrect placement of the 51° in the diagram leading to) a correct evaluation of tan51(°) × 40 – 20 (29(·395…)) SC1 for (incorrect placement of the 51° in the diagram leading to) tan51(°) × 40
12. **Ribbon marked. To be viewed with diagram.**			
(a) 5 × (4·4 ÷ 2) or 5 ÷ (2 ÷ 4·4) or equivalent		M1	
= 11 (cm)		A1	
12. *(b)* 6 ÷ (4·4 ÷ 2) or 6 × (2 ÷ 4·4) or equivalent		M1	FT their scale factor from *(a)*.
= 2·7(2727….) (cm)		A1	
13. *(a)* **To be viewed with diagram. Ribbon marked.**			
Correct statement of Pythagoras' theorem.			
e.g. $(2x + 1)^2 = (x + 6)^2 + (x – 1)^2$	✓	M1	
Sight of one correct expansion			
$4x^2 + 4x + 1$ OR $x^2 + 12x + 36$ OR $x^2 – 2x + 1$	✓	B1	
$4x^2 + 4x + 1 = (x^2 + 12x + 36) + (x^2 – 2x + 1)$	✓	A1	
$2x^2 – 6x – 36 = 0$ leading to $x^2 – 3x – 18 = 0$	✓	A1	
13. *(b)* $(x – 6)(x + 3)$	✓	B2	B1 for $(x…6)(x…3)$.
	✓		
$x = 6$ (AND $x = −3$)	✓	B1	FT from B1.
AB = 12, AC = 13, BC = 5	✓	B1	CAO.
14. 80 × 90 × 365 × 24 OR 80 × 90 × 52 × 7 × 24	✓	B1	
= 63 072 000 OR 62 899 200	✓	B1	Or their equivalents but not in standard form.
= 6·3 × 10^7	✓	B1	FT their answer provided of equivalent difficulty.
15. **Ribbon marked. To be viewed with graph.**			
(a) 46·8 (seconds)		B1	
15. *(b)* 12 (players)		B1	
16. **Ribbon marked. To be viewed with graph.**			
(a) 6		B1	
16. *(b)* Plotting at least 4 points correctly.		P1	FT 'their 6'.
Plotting all 6 points correctly connected with a curve.		C1	
16. *(c)* y = − x + 1 drawn		M2	M1 for a straight line with either a correct gradient, OR for a straight line with a correct intercept and a gradient < 0.
(x =) −1·3 AND 2·3		A1	FT their curve and their straight line, provided at least M1 awarded AND there are 2 solutions.
17. $x = \frac{10 \pm \sqrt{(-10)^2 - 4 \times 5 \times 3}}{2 \times 5}$		M1	Allow 1 slip in substitution.
$x = \frac{10 \pm \sqrt{40}}{10}$		A1	CAO.
$x = 1·63,\ x = 0·37$		A1	CAO. Both answers must be given.

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Summer 2016 Unitised Unit 3 Higher Tier	✓	Mark	Comments
18. **Ribbon marked.** *(a)* $y = k \div x^3$ OR $y \propto 1/x^3$ $2 = k \div 2^3$ or $k = 16$ $y = 16/x^3$		B1 M1 A1	
18. *(b)* −0·25		B1	FT in parts *(b)* and *(c)* for their non-linear expression from *(a)*.
18. *(c)* $x^3 = 16/0{\cdot}016$ (=1000) (x =) 10		M1 A1	
19. **To be viewed with diagram.** Strategy of sine rule to calculate the angle at E, then cosine rule. $\frac{\sin C\hat{E}D}{8{\cdot}1} = \frac{\sin 115}{13{\cdot}7}$ $\sin C\hat{E}D = \frac{\sin 115}{13{\cdot}7} \times 8 \cdot 1$ (angle CED =) 32(·4013…) (°) $AD^2 = 5{\cdot}2^2 + 13{\cdot}7^2 - 2\times5{\cdot}2\times13{\cdot}7\times\cos 151$(·4013…) $AD^2 = 339{\cdot}8$(265…) OR (AD =) $\sqrt{339 \cdot 8(265\ldots)}$ (AD =) 18·4(343…) (cm)	✓ ✓ ✓ ✓ ✓ ✓ ✓	S1 M1 A1 A1 M1 A1 A1	FT 93 + 26 + 'their 32·4(013…)'
20. **To be viewed with the graph.** Split into 5 areas and attempt to sum. (Volume) ½×1×(0 + 2×52 + 2×55 + 2×46 + 2×30 + 0) = 183 litres	✓ ✓ ✓ ✓	M1 M1 A1 U1	Don't penalise a more accurate approximation. Or equivalent. Areas of 26, 53·5, 50·5, 38, 15 Award for up to 1 error in reading scale. CAO.

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4353/02

W16-4353-02

MATHEMATICS (UNITISED SCHEME)

UNIT 3: Calculator-Allowed Mathematics

HIGHER TIER

A.M. MONDAY, 18 January 2016

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

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 **4**.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**3**	
3.	**4**	
4.	**8**	
5.	**5**	
6.	**3**	
7.	**3**	
8.	**6**	
9.	**5**	
10.	**4**	
11.	**4**	
12.	**6**	
13.	**4**	
14.	**3**	
15.	**8**	
16.	**8**	
17.	**3**	
18.	**3**	
19.	**5**	
Total	**90**	

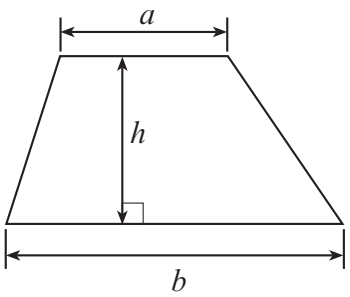
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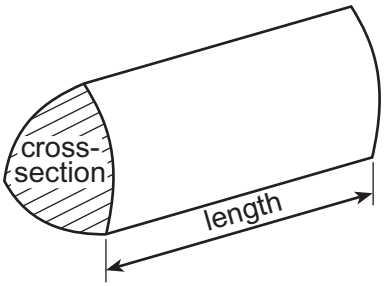
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Formula List

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

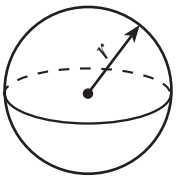


Volume of prism = area of cross-section × length



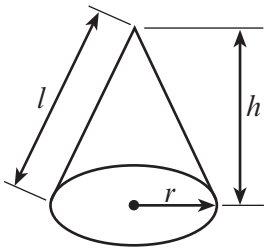
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

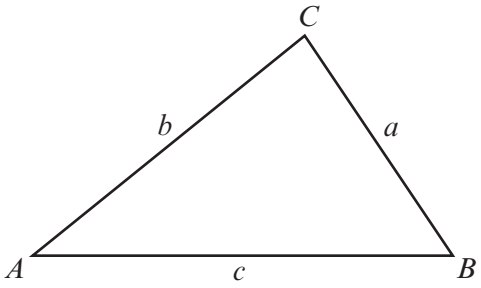


In any triangle ABC

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

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

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1. *(a)* Evaluate $\frac{10{\cdot}3 - 6{\cdot}4}{2{\cdot}9 \times 0{\cdot}8}$. Give your answer correct to 1 decimal place. [2]

(b) Factorise $12ab + 20a$. [2]

(c) Solve the equation $\frac{5}{x} = 15$. [1]

5

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2. William and Rushan earned £45 by washing cars.
They agreed to share the money in the ratio of the time they each spent washing cars.
William washed cars from 10:15 a.m. to 11:45 a.m.
Rushan washed cars from 1:45 p.m. to 4:45 p.m.
How much did each person receive? [3]

William receives £ ..... Rushan receives £ .....

3

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Turn over.

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3. Using a ruler and a pair of compasses, construct an accurate diagram of the triangle shown below.
You must show all your construction lines.
One line has already been drawn for you. [4]

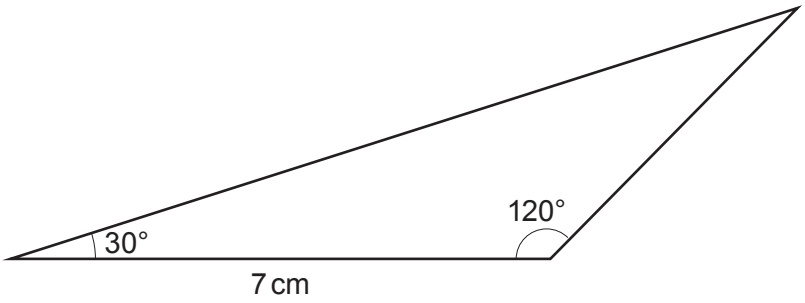


Diagram not drawn to scale

4

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

Cellan buys a season ticket each year to watch Swardiff Rovers football club play all their home matches.
The season ticket payment options for next year are given below.

- Normal price is £510
- Pay before the end of January and get a discount of $\frac{1}{12}$ off the normal price
- If you pay by credit card, a charge of 1·6% will be added

Cellan decides to pay before the end of January to get the discount.
He pays using his credit card.
How much less than the normal price does he pay?
You must show your working. [8]

8

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5. The diagram shows a regular pentagon joined to a quadrilateral.

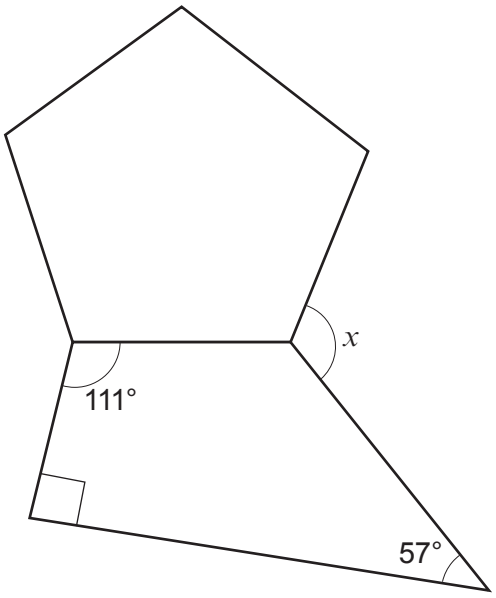


Diagram not drawn to scale

Calculate the size of angle x. [5]

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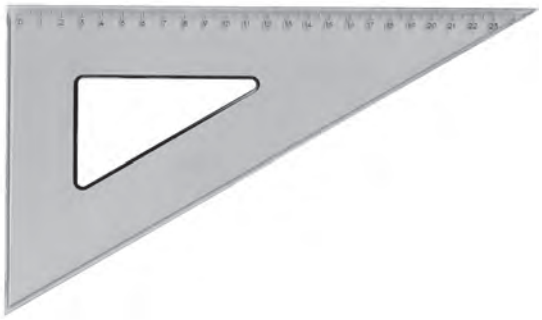
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6. Solve the equation $8y - 3 = 2(2y + 8)$. [3]

3

7. Elwyn is a carpenter.
He normally uses a tool called a try square to measure angles of 90°.



One day, Elwyn forgets to pack his try square.
In his van, Elwyn has three wooden rods of length 8 cm, 15 cm and 17 cm.
Show, using calculations, that he can create an angle of 90° by joining the ends of these rods to form a triangle. [3]

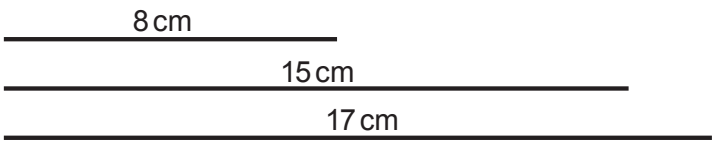


Diagram not drawn to scale

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8. An office manager recorded the number of photocopies made by her staff every day in September. The table below shows a summary of her results.

Number of photocopies per day	Number of days
0 – 99	4
100 – 199	9
200 – 299	14
300 – 399	1
400 – 499	2

(a) Calculate an estimate of the mean number of photocopies made per day in September. [4]

(b) Complete the following statement:

"My answer is only an estimate because I have assumed .....

....."

[1]

(c) Describe a more accurate method the office manager could have used to calculate the mean number of photocopies made per day in September. [1]

6

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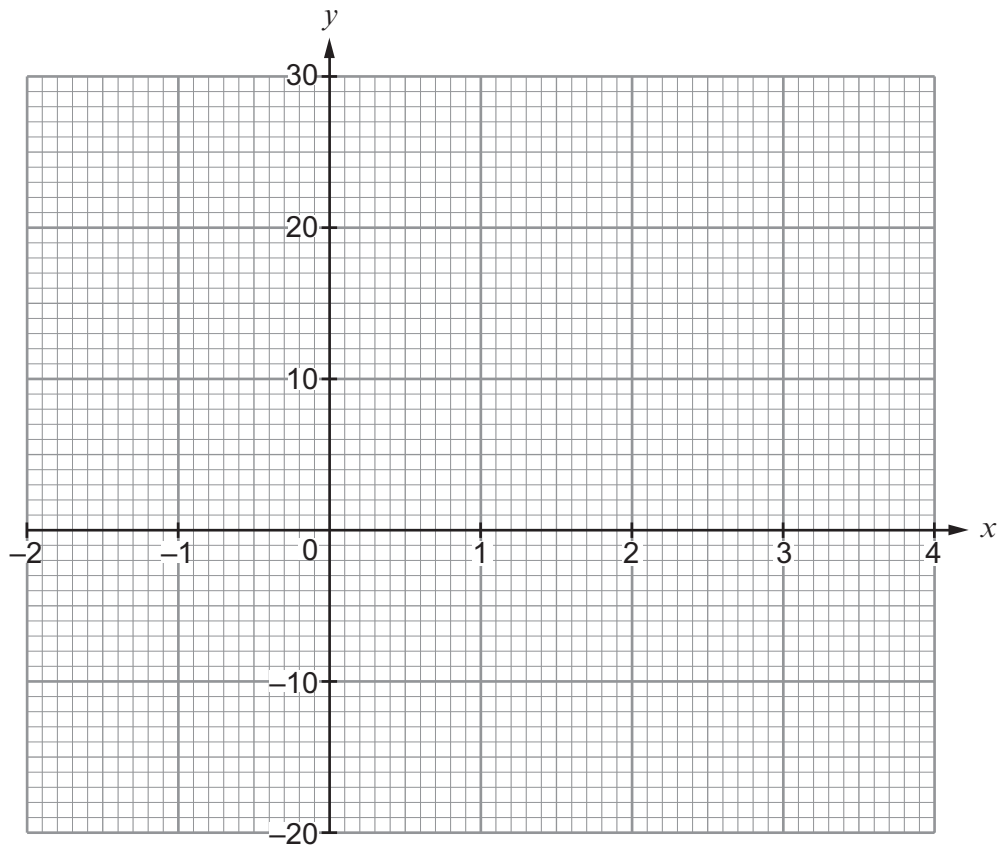
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9. *(a)* Complete the table below that shows some of the values of $y = 2x^2 - 5x + 1$ for values of x from –2 to 4. [2]

x	–2	–1	0	1	2	3	4
$y = 2x^2 - 5x + 1$	19	.....	1	–2	.....	4	13

(b) On the graph paper below, draw the graph of $y = 2x^2 - 5x + 1$ for values of x from −2 to 4. [2]



(c) Use your graph to solve the equation $2x^2 - 5x + 1 = 0$. [1]

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10. A square overlaps a circle to form the shape shown below.
The radius of the circle and the sides of the square each measure 3 cm.
The centre of the circle, *O*, coincides with a vertex of the square.

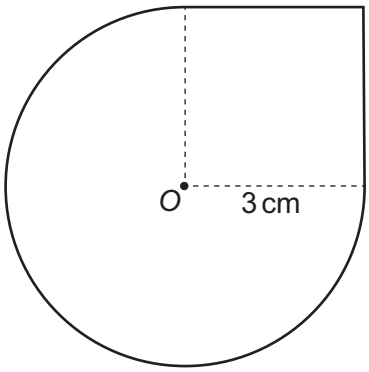


Diagram not drawn to scale

Calculate the area of the shape that has been formed. [4]

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11. Anne is standing a horizontal distance of 150 m away from the base of a vertical tower.

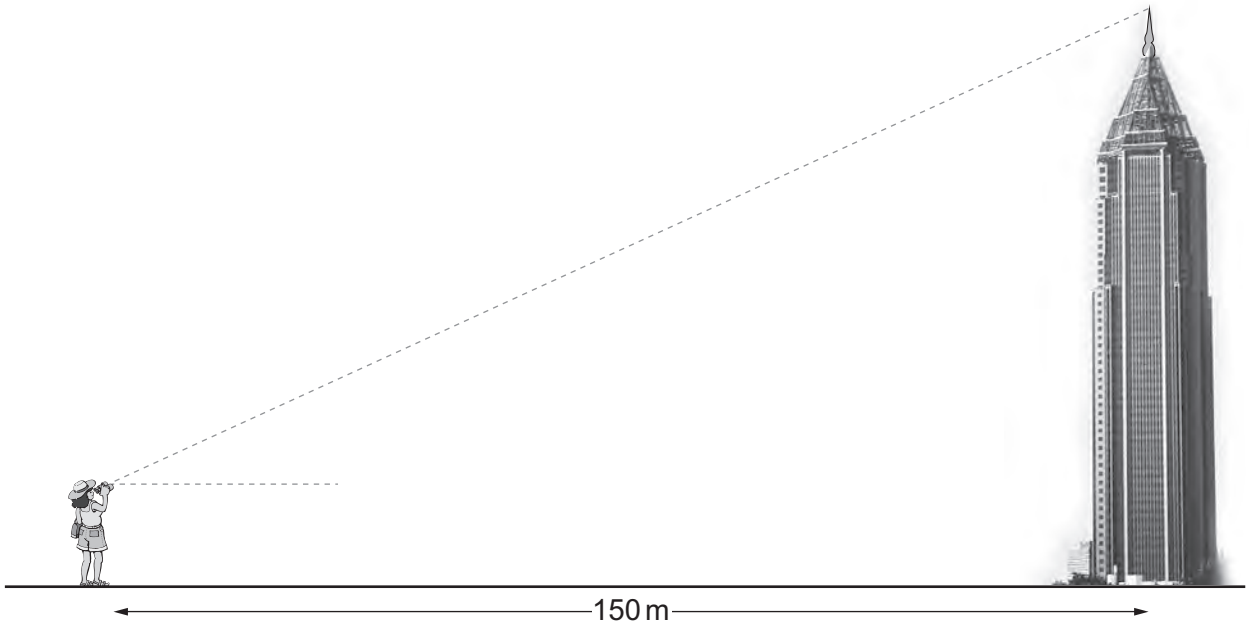


Diagram not drawn to scale

When she views the top of the tower through a pair of binoculars, the angle of elevation of the top of the tower is 39°.
The binoculars are held 1·7 m above the ground.
Calculate the vertical height of the tower. [4]

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12. *(a)* Calculate $(3{\cdot}7 \times 10^2) + (4{\cdot}1 \times 10^4)$. Give your answer in standard form. [2]

(b) An estimate of the number of cells in a human body can be found by dividing the average volume of a human body by the average volume of a human cell.

	Average value
Volume of a human body	$0{\cdot}07\,m^3$
Volume of a human cell	$6{\cdot}8 \times 10^{-10}\,cm^3$

Use the above information to calculate an estimate of the number of cells in a human body.
Give your answer in standard form, correct to 3 significant figures. [4]

6

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13. Solve the equation $\frac{2x+3}{4} - \frac{7x}{10} = \frac{4}{5}$. [4]

4

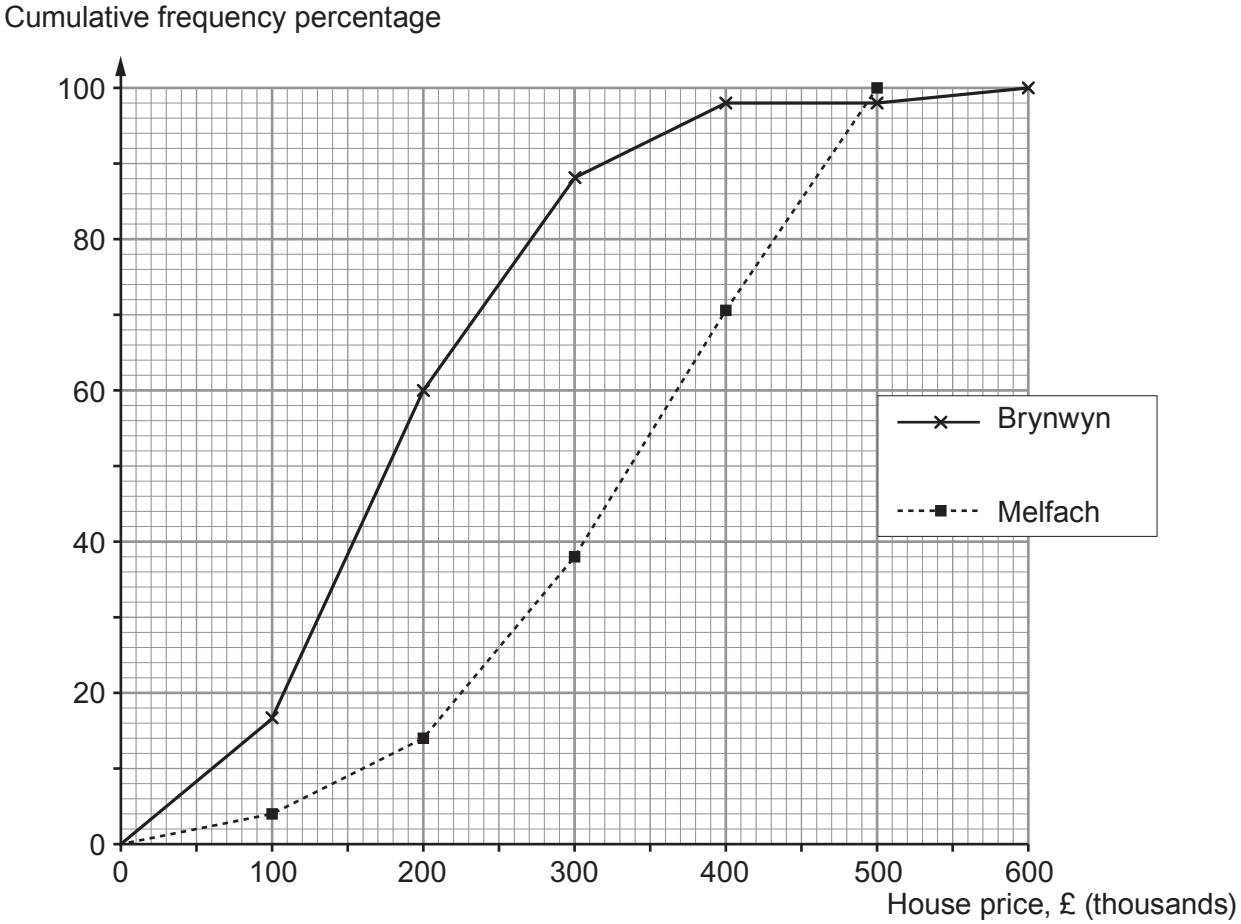
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14. The cumulative frequency diagram shows the house prices in two villages, Brynwyn and Melfach, in December 2015.
The cumulative frequencies have been calculated as **percentages** of the total number of houses in each village.



(a) Which village has the higher median house price?
Give a reason for your answer. [1]

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(b) What percentage of houses in Melfach cost less than £200 000? [1]

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(c) Explain why it is not possible to use the diagram to decide which village has more houses costing less than £200 000. [1]

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15. *(a)* Factorise the expression $x^2 + 8x - 20$, and hence solve the equation $x^2 + 8x - 20 = 0$. [3]

(b) A stone is thrown from the top of a cliff. After t seconds, its height above sea level, h, is given by the formula $h = 70 + 4t - 5t^2$.

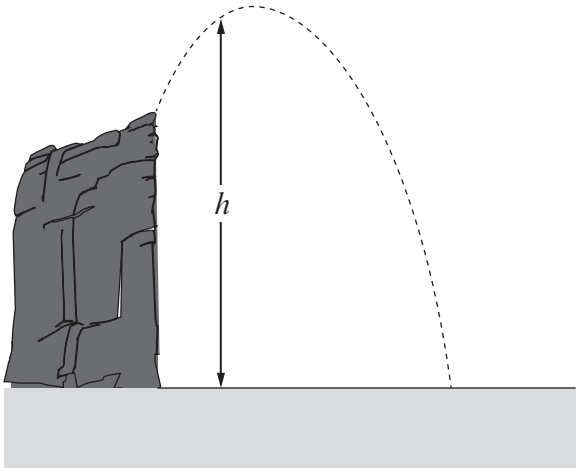


Diagram not drawn to scale

Find the value of t when the stone hits the sea.
Give your answer correct to 2 decimal places. [5]

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16. *(a)* Calculate the length *BC* in the triangle below. [3]

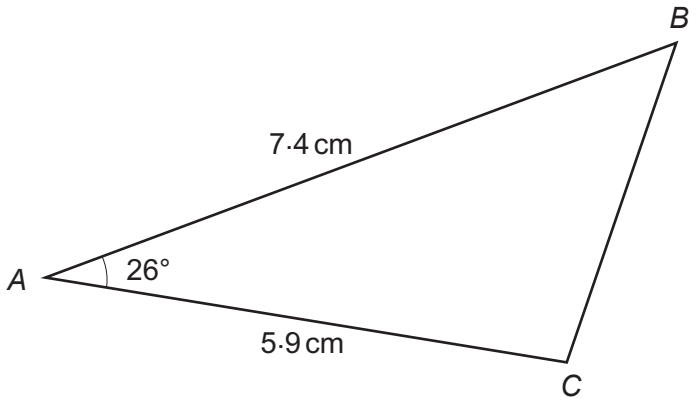


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(b) Calculate the area of the triangle below. [5]

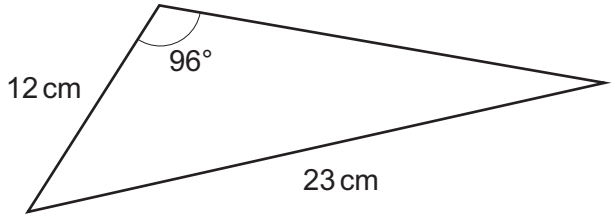


Diagram not drawn to scale

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17. The following grouped frequency table shows the heights, in centimetres, of pupils in a Year 7 class.

Height (cm)	Frequency	Frequency density
$100 < h \leqslant 110$	4	0·4
$110 < h \leqslant 115$	9	
$115 < h \leqslant 120$	13	
$120 < h \leqslant 130$	5	
$130 < h \leqslant 150$	4	

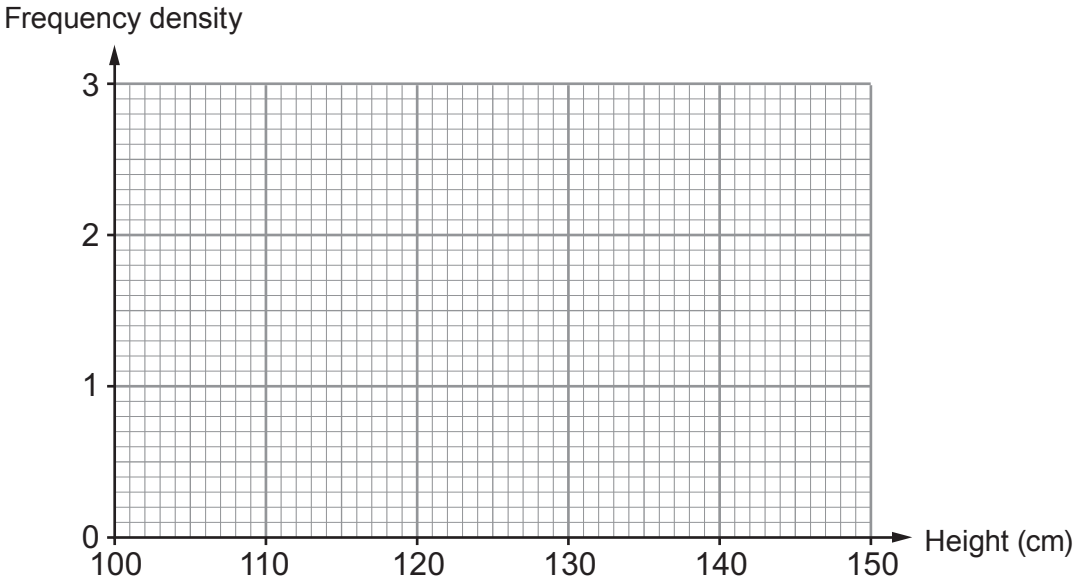
Complete the frequency density column in the table, and draw a histogram to show the distribution of the heights of the pupils. [3]

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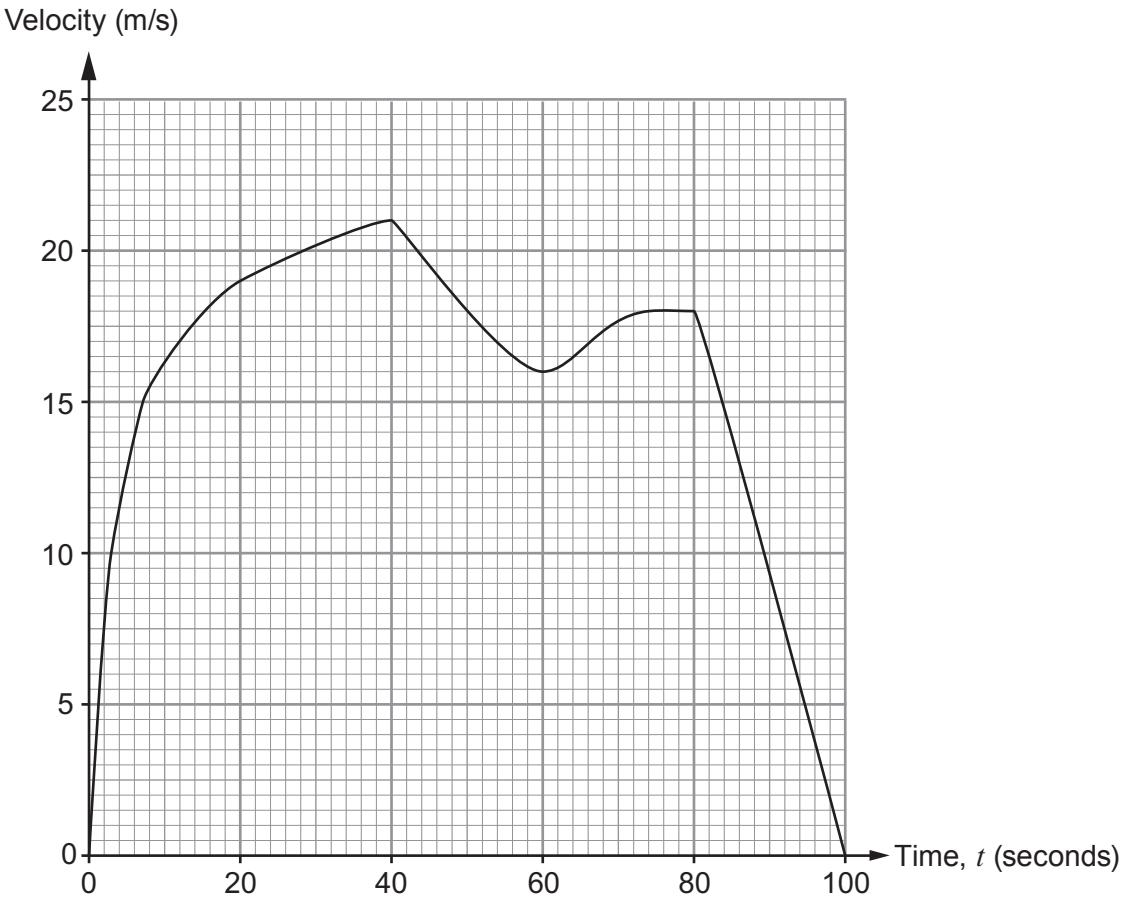
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18. This velocity-time graph is for a short car journey, starting at time $t = 0$.



By using the ordinates $t = 0$, $t = 20$, $t = 40$, $t = 60$, $t = 80$ and $t = 100$, calculate an estimate of the distance travelled by the car during this journey. [3]

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19. A frustum of a cone is the shape that is left when a small cone is cut from a larger cone. The frustum shown has a top face of diameter 20 cm and a bottom face of diameter 30 cm. The height of the frustum is 40 cm.

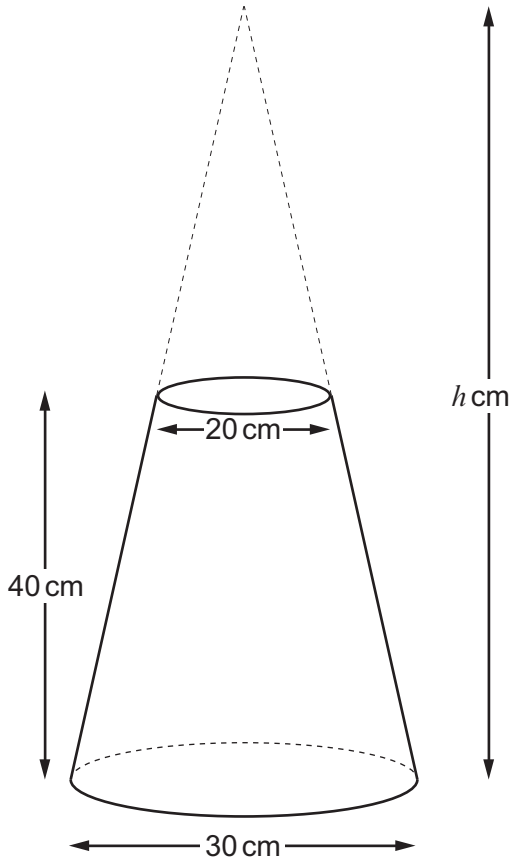


Diagram not drawn to scale

(a) Calculate the height, h, of the large cone. [3]

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(b) Calculate the volume of the frustum. [2]

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END OF PAPER

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GCSE MARKING SCHEME

JANUARY 2016

MATHEMATICS UNITISED - UNIT 3
HIGHER TIER
4353/02

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INTRODUCTION

This marking scheme was used by WJEC for the 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

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Unitised Unit 3 – Jan 2016 Final 31.1.16 Higher Tier Mark scheme		
1. (a) 1·7 (b) 4a(3b + 5) (c) 5/15 or 1/3 or 0·33(333….)	B2 B2 B1 5	B1 for 1·6(810….) B1 for 4a(3b….) or 4a(…+ 5) or correct partial factorisation. Mark final answer. Do not accept 0·3.
2. (Ratio =) 1:2 or equivalent. (1 part =) 45 ÷ 3 William £15 Rushan £30	B1 M1 A1 3	Allow 2:1 or equivalent FT the sum of their ratio. CAO An answer of 30, 15 gets B1M1A0
3. Suitable arcs for 30° angle. Line drawn at 30°. Suitable arcs for 120° (60° from the right side of the vertex). Line drawn at 120°.	M1 A1 M1 A1 4	 Use overlay. Allow ±2°. Use overlay. Allow ±2°. Penalise –1 for incomplete triangle if all marks are gained. *Alternative method:* *Candidates may use the fact that the triangle is isosceles for the 2nd M1A1.*
4. (1/12 × 510) 42·5(0) OR (0·016 × 510) 8·16 510 – 42·5(0) OR 510 + 8·16 = (£)467·5(0) OR = (£)518·16 1·016 × 467·5(0) OR (11/12) × 518·16 (Cost of season ticket =) (£)474·98 (Saving =) (£)35·02 QWC: Look for • correct units used i.e. £, p • spelling in at least 1 statement/sentence • clarity of text explanations QWC2: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer QWC1: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer	B1 M1 A1 M1 A1 B1 QWC 2 8	 (11/12) × 510 OR 1·016 × 510 gains B1M1. FT 'their 467·50' OR 'their 518·16'. FT provided at least one M1 awarded. QWC2 Presents material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.
5. (Internal angle of the regular pentagon =) (3 × 180) ÷ 5 = 108(°) (4th angle in the quadrilateral =) 360 – (90 + 111 + 57) = 102(°) (x =) (360 – 108 – 102) = 150(°)	M1 A1 M1 A1 B1 5	*Alternative method:* *M1 for (exterior angle of pentagon =) 360 ÷ 5* *A1 for 72(°)* *M1 for (4th angle in the quadrilateral =) 360 – (90 + 111 + 57)* *A1 for 102(°)* *A1 for (78 + 72) =150(°).* FT provided at least one of the previous M1 marks awarded, and x<180.
6. $8y - 3 = 4y + 16$ $8y - 4y = 16 + 3$ $y = 4\frac{3}{4}$ OR 4·75 OR 19/4	B1 B1 B1 3	FT until 2nd error. Mark final answer.

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Unitised Unit 3 – Jan 2016 Final 31.1.16 Higher Tier Mark scheme		
7. Squaring at least 2 lengths $8^2 + 15^2$ (= 64 + 225 = 289) $17^2 = 289$ OR $\sqrt{289} = 17$ (and conclusion)	B1 M1 A1 3	Accept equivalent methods. *Alternative method:* *B1 for squaring at least 2 lengths* *M1 for cos(angle) = $(15^2+8^2-17^2)/(2\times15\times8)$* *A1 for angle = 90°*
8. (a) Sight of the mid-points 49·5, 149·5, 249·5, 349·5, 449·5. 49·5×4 + 149·5×9 + 249·5×14 + 349·5×1 + 449·5×2 (=198 + 1345·5 + 3493 + 349·5 + 899) (=6285) 6285 ÷ 30 = 209·5 (b) valid assumption e.g. '…every data item lies at the mid-point of each group.' OR '…the data is evenly distributed across each group.' OR '… the same number of copies made each day' (c) valid description e.g. 'She could have calculated accurate means using the actual data she recorded.' OR 'She could have used smaller class intervals.'	B1 M1 m1 A1 E1 E1 6	 FT their mid-points from within or at the bounds of the groups. FT '*their 6285*'. Accept 210 from correct working. An answer of 209·5 found from using mid-points of 50, 150, … and subtracting 0·5 gains full marks. Accept '…how many copies were made each day'
9. (a) 8, −1 (b) At least 6 points plotted accurately Smooth curve drawn connecting all 7 correct points. (c) (x =) 0·2 AND 2·3	B2 P1 C1 B1 5	B1 for each value of *y*. FT '*their 8*' and '*their −1*'. FT their graph provided there are 2 solutions.
10. (Area of square =) 3^2 (= 9) (cm^2) $\frac{3}{4} \times \pi \times 3^2$ = 21 to 21·22(cm^2) (Total area =) 30 to 30·22 (cm^2)	B1 M1 A1 B1 4	 FT 'their 21…' + 9 provided $\pi \times 3^2$ used in their calculation.
11. 150 × tan39(°) = 121(·467…) (m) (Height of tower =) 123(·167…) (m)	M2 A1 A1 4	M1 for tan39(°) = h/150 Allow M1 for incorrect placement of the angle of elevation leading to h = 150 × tan51(°) CAO FT from M1 (for adding 1·7 onto 'their 121(·467…)'
12. (a) $4{\cdot}137 \times 10^4$ (b) Correct conversion to common units. $0{\cdot}07 \div (6{\cdot}8\times10^{-16})$ OR $(7\times10^4) \div (6{\cdot}8\times10^{-10})$ or equivalent. = $1{\cdot}03\times10^{14}$	B2 B1 M1 A2 6	B1 for 41370 or $41{\cdot}37\times10^3$ or $413{\cdot}7\times10^2$ or 4137×10 or premature rounding written correctly in standard form Accept use of 7 instead of 6·8 for B1M1 only. FT with incorrect place value provided conversion attempted. A1 for $1{\cdot}0(29411\ldots)\times10^{14}$ or correct number but not in standard form. SC1 for $1{\cdot}0(29411\ldots)\times10^8$. SC2 for $1{\cdot}03\times10^8$.
13. Method of working with all 3 terms to clear the 2 fractions. Correctly expanding brackets and collecting like terms i.e. ($10x + 15 - 14x = 16$ leading to) $15 - 4x = 16$ or equivalent. $x = -1/4$ or $-0{\cdot}25$	M2 A1 A1 4	e.g. multiplying each term by a multiple of 20. M1 for appropriate working for 2 of the 3 terms. Clearing implies denominator of 1. FT provided at least M1 awarded. FT until 2nd error. Mark their final answer. *If no marks awarded SC1 for sight of (15−4x)/20 or equivalent.*

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Unitised Unit 3 – Jan 2016 Final 31.1.16 Higher Tier Mark scheme		
14. (a) Valid reason e.g 'Melfach's median is higher than Brynwyn's', with correct values given or implied, or an indication on the graph. OR 'Melfach's graph is to the right of Brynwyn's' (b) 14(%) (c) Valid reason e.g. 'The cumulative frequencies are percentages' OR 'We don't know how many houses there were altogether in each village' OR '60% of the houses in Brynwyn may be less than 14% of the houses in Melfach' OR 'It doesn't show the number of houses'	E1 B1 E1 3	Accept sight of medians for both villages (£175,000-£180,000 and £335,000-£340,000). If percentages quoted they need to be correct.
15. (a) $(x + 10)(x – 2)$ $x = -10$ AND $x = 2$ (b) $0 = 70 + 4t – 5t^2$ (t =) $\frac{-4 \pm \sqrt{4^2 - 4 \times -5 \times 70}}{2 \times -5}$ or $\frac{4 \pm \sqrt{(-4)^2 - 4 \times 5 \times -70}}{2 \times 5}$ (t =) $\frac{-4 \pm \sqrt{1416}}{-10}$ or $\frac{4 \pm \sqrt{1416}}{10}$ 4·16 (seconds)	B2 B1 B1 M1 A1 A2 8	B1 for $(x \ldots 10)(x \ldots 2)$ Strict FT their brackets provided previous B1 awarded. May be implied in their working. Allow 1 slip in substitution. CAO CAO. A1 for (t =) −3·36 and 4·16 (seconds) OR A1 for 4·1(6297…) OR 4·2 with or without the negative value.
16. (a) (BC^2 =) $7·4^2 + 5·9^2 - 2×7·4×5·9×\cos 26(°)$ BC^2 = 11·0(873…) or (BC =) √11·0(873…) (BC =) 3·3(297…) (cm) (b) (angle =) $\sin^{-1}(\frac{\sin 96}{23} \times 12)$ Angle = 31(·2572…) (°) (Area =) ½×12×23×sin52·7(427…) (Area =) 109·8(377…) (cm^2)	M1 A1 A1 M2 A1 M1 A1 8	M1 for $\frac{\sin angle}{12} = \frac{\sin 96}{23}$ FT provided the sine or cosine rule attempted for previous M1. *Alternative method* *M1 for ½×18·4(0712…)×23×sin31·2(572…)* Allow answers in the range 109·77 to 110·21 that come from premature rounding of the angle.
17. Frequency densities of 1·8, 2·6, 0·5, 0·2 Histogram of their frequency densities drawn.	M2 A1 3	M1 for any 2 or 3 correct. Provided at least M1 awarded.
18. Split into 5 areas and attempt to sum. (Distance =) ½×20(0 + 2×19 + 2×21 + 2×16 + 2×18 + 0) = 1480 (m)	M1 M1 A1 3	Or equivalent. (Areas of 190, 400, 370, 340, 180). Award for up to 1 error in reading scale. CAO.
19. (a) $\frac{h}{h-40} = \frac{30}{20}$ or equivalent . 20h = 30(h – 40) or equivalent. Height of large cone = 120 (cm) (b) (Volume =) ⅓ × π × ($120×15^2 - 80×10^2$) = 19886 to 19905 (cm^3)	M1 m1 A1 M1 A1 5	Award M1m1 for 40 ≡ ⅓ h. FT 'their 120'.

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4353/02

S15-4353-02

MATHEMATICS (UNITISED SCHEME)

UNIT 3: Calculator-Allowed Mathematics

HIGHER TIER

A.M. MONDAY, 8 June 2015

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a 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.

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 continuation page at the back of the booklet, taking care to number the question(s) correctly.

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.	**3**	
3.	**6**	
4.	**2**	
5.	**3**	
6.	**3**	
7.	**4**	
8.	**7**	
9.	**7**	
10.	**4**	
11.	**3**	
12.	**3**	
13.	**6**	
14.	**3**	
15.	**8**	
16.	**3**	
17.	**3**	
18.	**3**	
19.	**7**	
20.	**6**	
Total	**90**	

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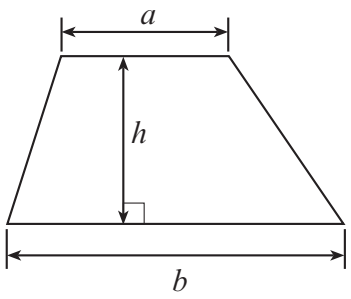
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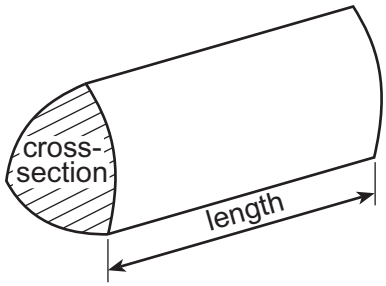
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Formula List

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

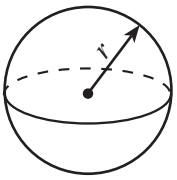


Volume of prism = area of cross-section × length



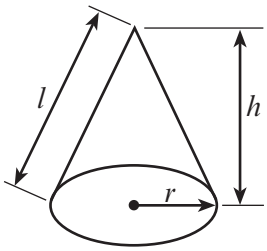
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

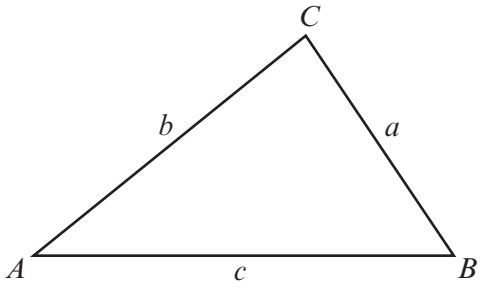


In any triangle ABC

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

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

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1. *(a)* Factorise $10x - 15$. [1]

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(b) Given that $p = 1\frac{1}{2}$, $r = -4$ and $t = 5$, evaluate the expression $pr - t^2$. [2]

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(c) Solve the equation $8x - 77 = 2x - 5$. [3]

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2. Calculate the area of the triangle.
State the units of your answer. [3]

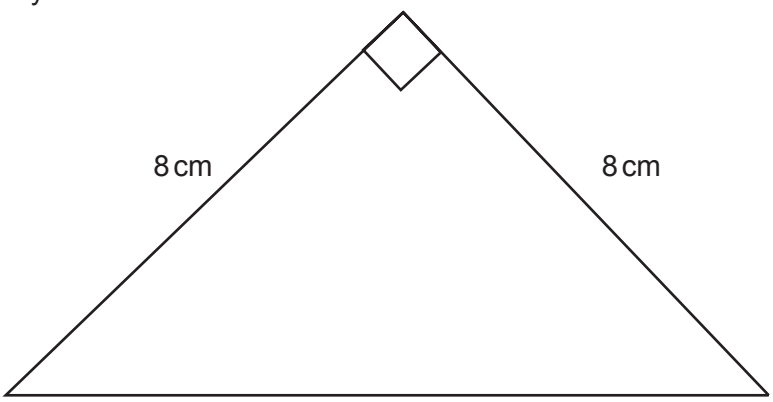


Diagram not drawn to scale

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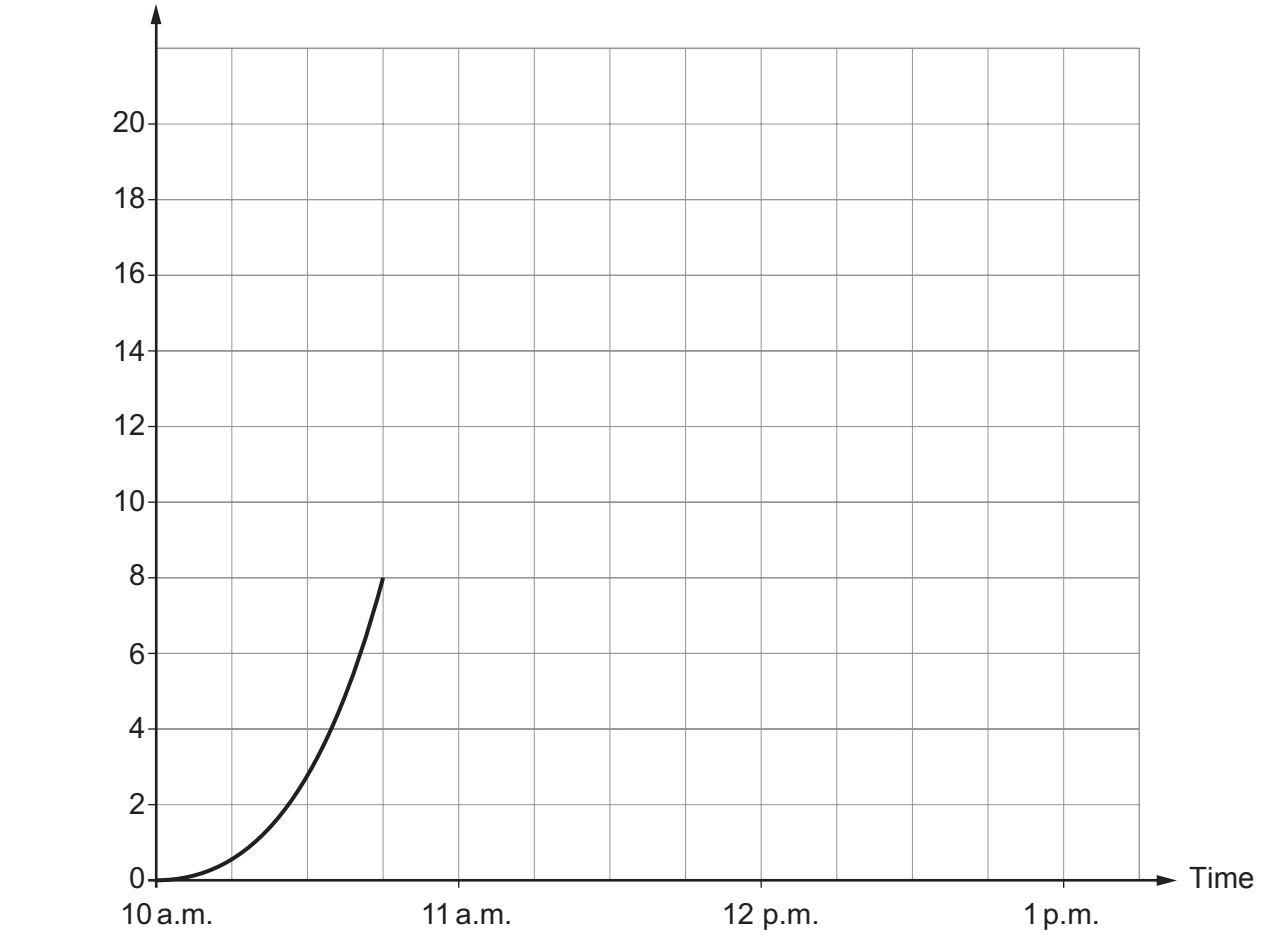
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3. John travels 20 miles to his friend's house. He begins his journey at 10 a.m.
The first part of his journey is shown on the travel graph below.



(a) Describe how John's speed changes over the first part of his journey. [1]

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(b) John splits the remainder of the 20 mile journey into two equal sections.
He has a 15 minute stop for a break between the two sections.
He travels at the same constant speed for both sections.
John arrives at his friend's house at 1 p.m.
Draw the remainder of the journey on the travel graph. [3]

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(c) What was John's average speed for the entire 20 mile journey? [2]

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4. Evaluate $\sqrt{\frac{5{\cdot}3 \times 7{\cdot}4}{6{\cdot}1 - 2{\cdot}7}}$. Give your answer correct to 2 decimal places. [2]

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5. Rishal gets paid every month.

He spends $\frac{1}{3}$ of his pay on rent and puts $\frac{1}{5}$ of his pay into savings.

What fraction of his pay does Rishal then have left? [3]

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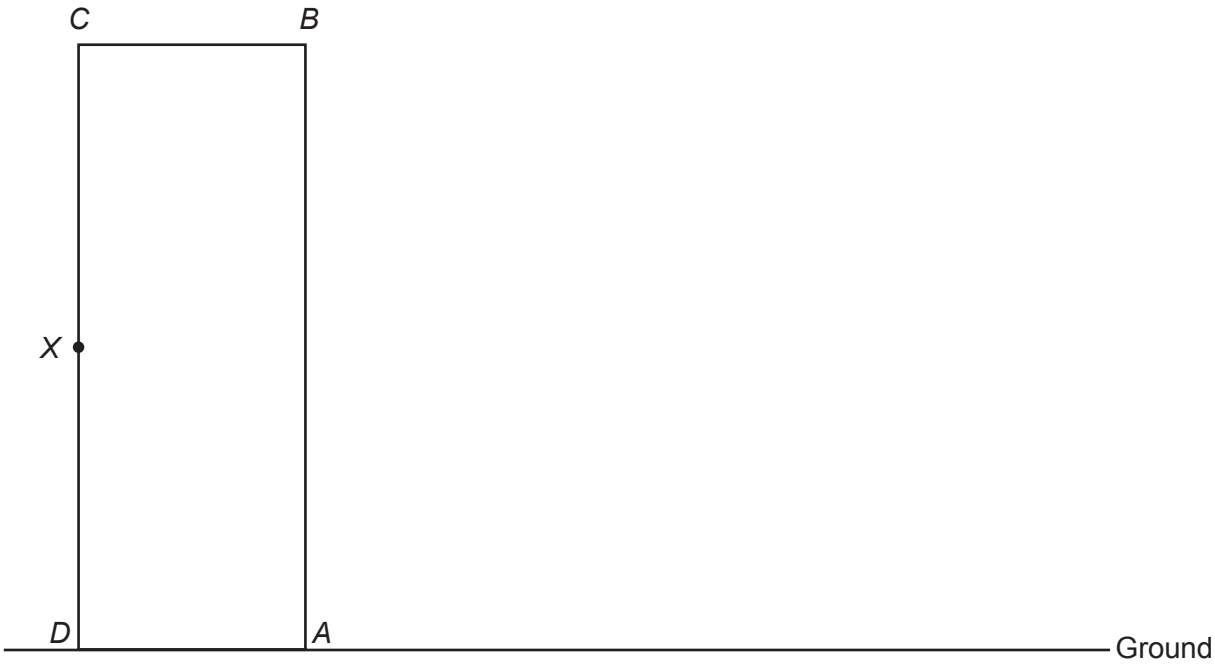
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6. *ABCD* represents a rectangular side of a box.
X is the midpoint of the edge *CD*.
The box is rotated clockwise about point *A* until *B* comes into contact with the ground.
Accurately draw the new position of *ABCD* and the locus of the point *X* as the box rotates about *A*. [3]



7. A packet contains cake mixture weighing 385 g.
The mixture is made up of only flour, sugar and raisins. The weight of the flour is twice the weight of the sugar, and the weight of the sugar is twice the weight of the raisins.
Calculate the weight of flour, sugar and raisins in the packet. [4]

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Flour: ..... g Sugar: ..... g Raisins: ..... g

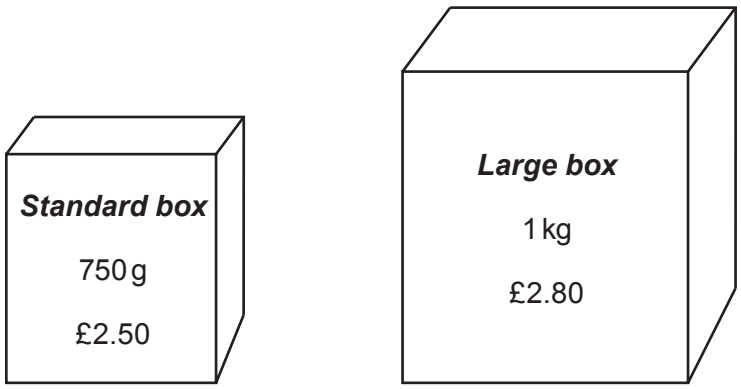
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8. *You will be assessed on the quality of your written communication in this question.*

A supermarket sells the same type of breakfast cereal in 2 different-sized boxes.
The weight and **usual** price of each box are shown below.



Diagrams not drawn to scale

This week the price of a standard box is reduced by 18%.
Which box is the best value for money this week?
Show all your working. [7]

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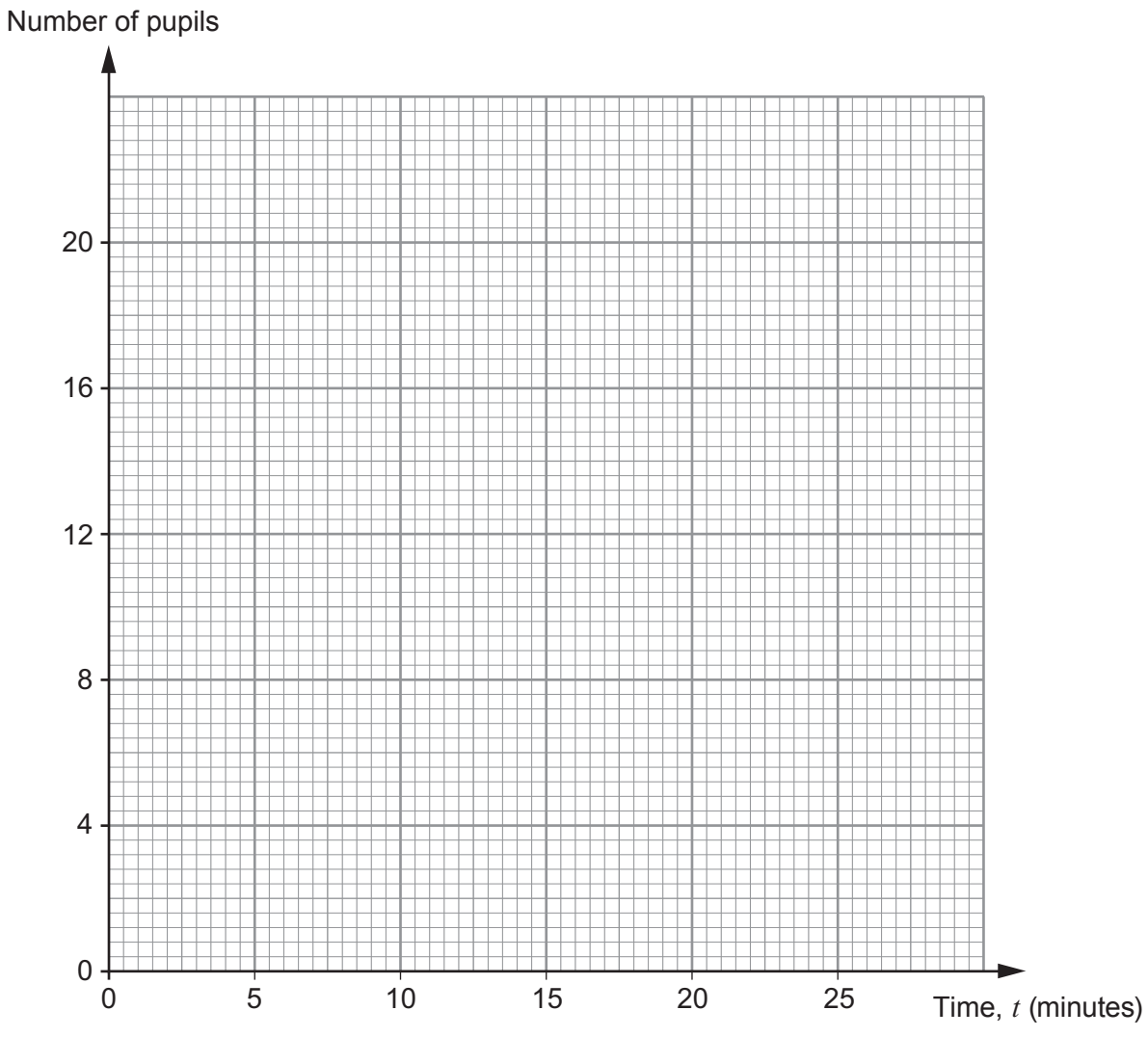
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9. A group of pupils was timed in completing a maths test. The results are shown in the grouped frequency table below.

Time, t (minutes)	Number of pupils
$0 < t \leqslant 5$	19
$5 < t \leqslant 10$	17
$10 < t \leqslant 15$	10
$15 < t \leqslant 20$	5
$20 < t \leqslant 25$	2

(a) Draw a grouped frequency diagram to illustrate these results. [2]



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(b) Calculate an estimate of the mean time taken to complete the test. [4]

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(c) Write down the modal group. [1]

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10.

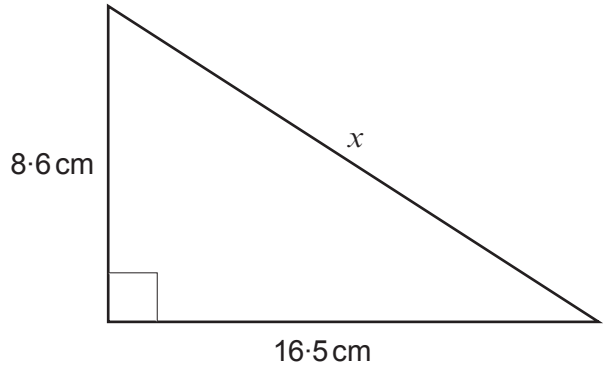


Diagram not drawn to scale

(a) Gwen is asked to calculate the length x in the triangle above.

Her answer is 14·1 cm.

Without calculating x, explain why Gwen's answer cannot be correct. [1]

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(b) Calculate the length x. [3]

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11. Factorise the expression $x^2 + 11x + 24$, and hence solve the equation $x^2 + 11x + 24 = 0$. [3]

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12. The Millennium Stadium can seat 72 500 people.
The population of Wales would fill the Millennium Stadium forty-two times.

Use this information to calculate the population of Wales.
Give your answer in standard form correct to 3 significant figures. [3]

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13.

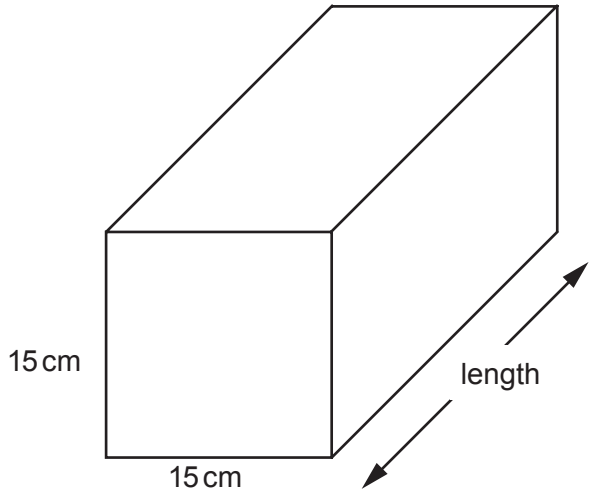


Diagram not drawn to scale

The solid block shown above is made from a metal that has a density of 2·7 g/cm^3.
The volume of the solid block is 40 500 cm^3.

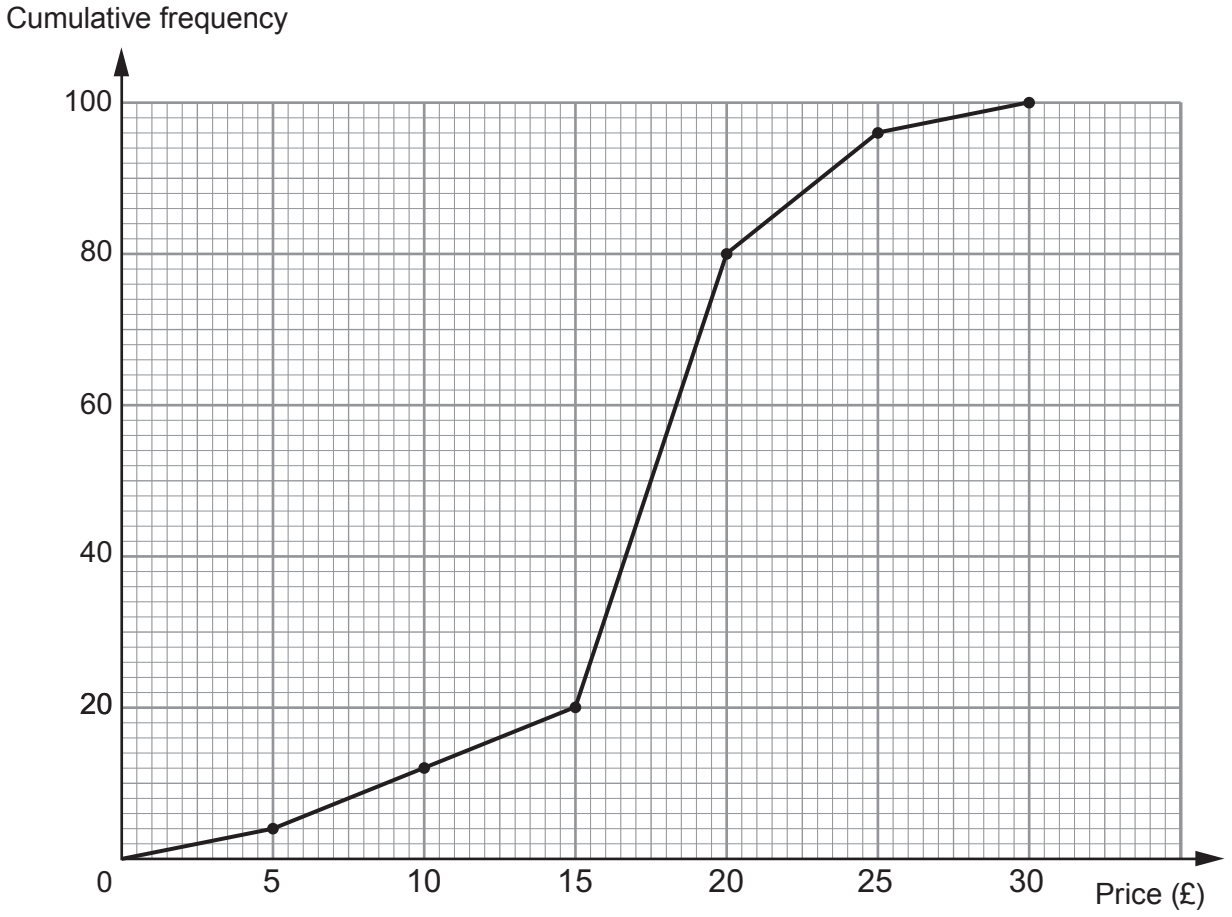
A hole is drilled through the entire length of the block.
The hole has a cross-sectional area of 25 cm^2.
Calculate the mass of the block that remains. [6]

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14. The cumulative frequency diagram shows the prices of 100 items in a shop.



(a) Write down an estimate for the median price of these items. [1]

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(b) Calculate an estimate for the interquartile range of these items. [2]

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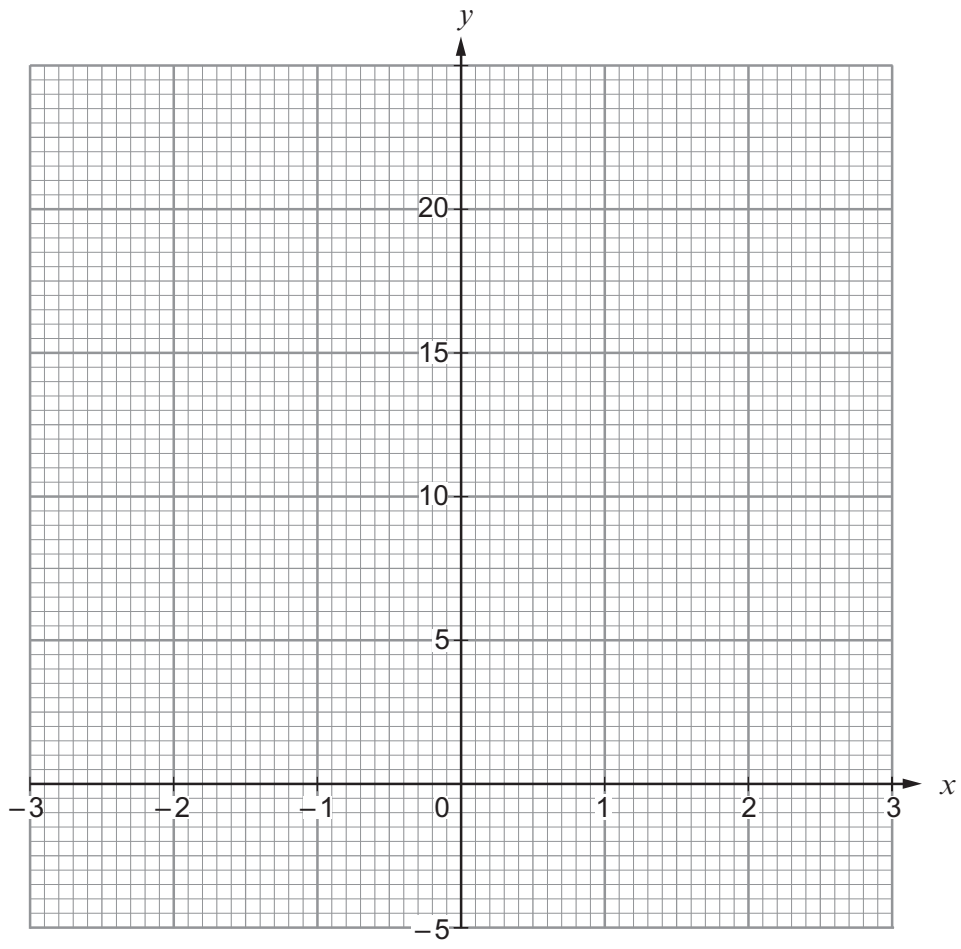
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15. *(a)* On the graph paper below, draw the graph of $y = 2x^2 - x - 3$ for values of x from -3 to 3. [4]



(b) Use your graph to write down the solutions of the equation $2x^2 - x - 3 = 0$. [1]

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(c) By drawing an appropriate straight line on the same set of axes, use your graph to solve the equation $2x^2 - 7 = 0$. [3]

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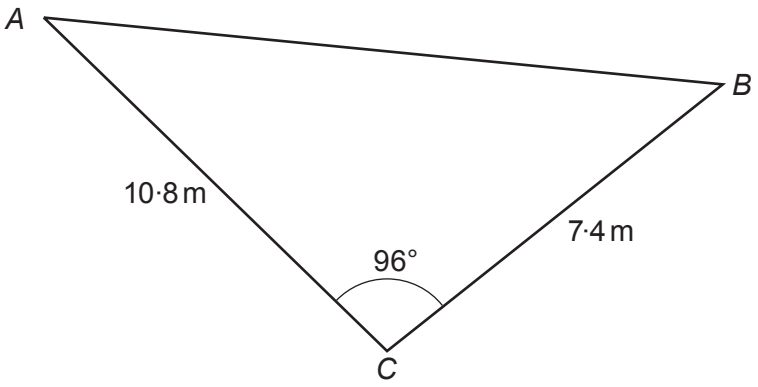


Diagram not drawn to scale

Calculate the length of the side *AB*. [3]

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17. Use the quadratic formula to solve the equation $12x^2 - 27x - 2 = 0$, giving your solutions correct to 2 decimal places. [3]

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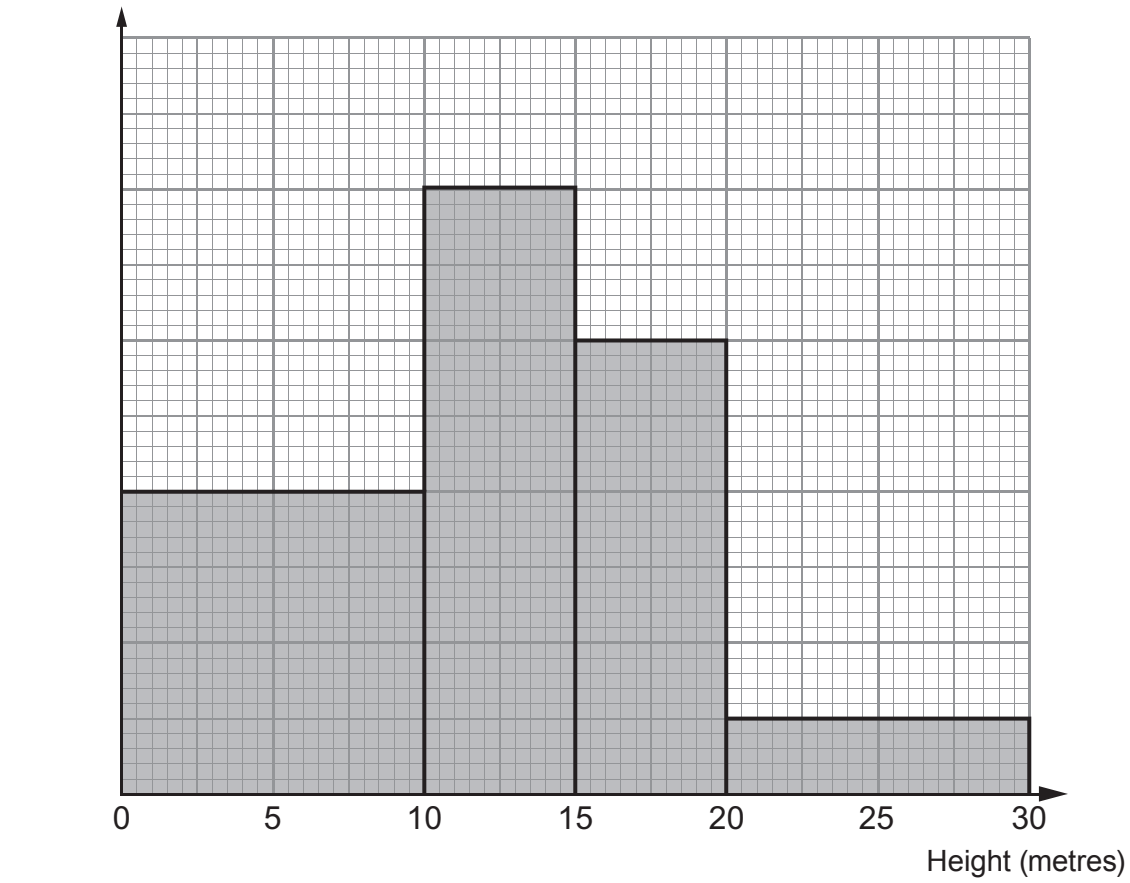
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18. This histogram shows the distribution of heights, in metres, of 240 trees in a wood.



How many trees were between 10 and 15 metres in height? [3]

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19.

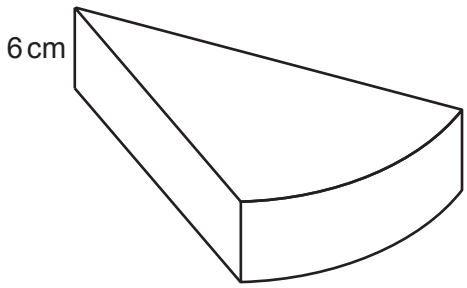


Diagram not drawn to scale

The shape above is $\frac{1}{12}$ of a solid cylinder of radius 15 cm and height 6 cm.

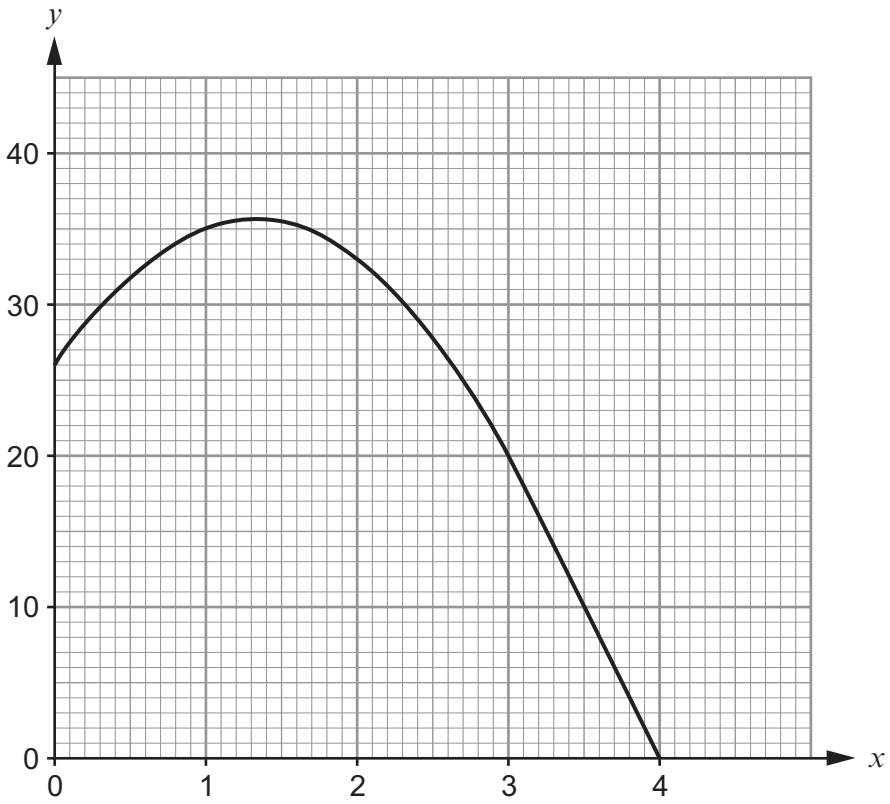
Calculate the total surface area of this shape. [7]

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20. The graph of $y = f(x)$ between $x = 0$ and $x = 4$ is shown below.



(a) Estimate the gradient of the curve at $x = 2$. [3]

(b) Use the trapezium rule with ordinates $x = 0$, $x = 1$, $x = 2$, $x = 3$ and $x = 4$ to estimate the area bounded by the curve $y = f(x)$, the x-axis and the y-axis. [3]

END OF PAPER

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

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GCSE MARKING SCHEME

MATHEMATICS - UNITISED

SUMMER 2015

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2015 examination in GCSE MATHEMATICS - UNITISED. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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2015 June UNIT 3 (calculatorallowed) Foundation Tier	✓	Mark	Comments
Ribbon Marked 1(a) marked with 1(b) and 1(c) 1. (a) (£) 18·75 (£) 1·78 (£) 8(·00) (Total =) (£) 28·53	 ✓ ✓ ✓ ✓	 B1 B1 B1 B1 4	 FT 'their three costs'.
1 (b) (number of complete £5 spent=) 5 (5×100=) 500		B1 B1 2	FT 'their total' for both B1s.
1 (c) 40 – (£)28.53 (£) 11·47		M1 A1 2	FT 'their' total for M1 A1
2(a) 32000		B1 1	
2(b) 62.8		B1 1	
3. Evidence of counting squares 24-28 inclusive (cm^2)		M1 A1 2	
4. (32−18)÷2 7(cm)		M1 A1 2	Or equivalent.
5. Use of 1000m = 1km (2000÷400=) 5 (laps)		B1 B1 2	
Ribbon Marked 6(a) 6(b), 6(c), 6(d), 6(e) and 6(f) 6 (a) 6 (students ate no fruit or veg)		 B1 1	
6 (b) 6+4+6+7+9+10+8 =50		M1 A1 2	An attempt to add at least six vertical heights of bars. FT 'their 6' or allow one other slip in reading from scale CAO
6 (c) 18/50 or equivalent		B2 2	Or equivalent. FT 'their 50' B1 for 18 as a numerator (but denominator not 'their 50') or B1 for an attempt to add 10/'their 50' + 8/'their 50'.
6 (d) 120 /360 or equivalent		B1 1	Allow 120°±2. Accept equivalent fraction. ISW.
6 (e) 36 – 1/3 of 36 24		M1 A1 2	FT 'their fraction' in (d) for M1 A1 24/36 M1 A0
6 (f) A correct comment with reference to both sets of data or that makes specific reference to just one.		E1 1	"Two sets of results give different conclusions" "The school results shows the statement wrong but the sports centre results show the statement correct".

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2015 June UNIT 3 (calculatorallowed) Foundation Tier	✓	Mark	Comments
7. $a = 10$ $b = 5$ b×b (area =) 25 (cm^2)	✓ ✓ ✓ ✓	B1 B1 M1 A1 4	 FT 15 – 'their *a'* FT for M1 and A1,'their b×b' provided at least one B1 awarded.
8. Extras used (150 − 120 =) 30 (mins) or (490 − 400 =) 90 (texts) <u>Cost of Bill</u> Ext mins×(£)0·35 + Ext texts×(£)0·12+(£)15(·00) Total cost = £36·30 <u>New contract</u> (240 mins 800 texts cost) £30 He should accept the new contract. Look for • Spelling in at least one statement or sentence • Clarity of text explanations • Consistent use of £ and p • Correct use of mathematical symbols, QWC2: Candidates will be expected to • Present work clearly, with words explaining process and steps AND • Make few, if any, mistakes in mathematical form, spelling, punctuation and grammar in their final answer. QWC1 : Candidates will be expected to • Present work clearly, with words explaining process or steps OR • Make few, if any, mistakes in mathematical form, spelling, punctuation and grammar in their final answer.	 ✓ ✓ ✓ ✓ ✓ ✓ ✓	 B1 M1 A1 B1 E1 QWC2 7	 For either "extra" amount used FT 'their' extra mins and texts but not from 150 mins or 490 texts. CAO FT 'their £36.30'. The bill would have been cheaper by £6.30 QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR Evident weakness in organisation of material but using acceptable mathematical form, with few, if any, errors in spelling, punctuation and grammar. QWC0 Evident weakness in organisation of material, and errors in use of mathematical form, spelling, punctuation and grammar.
9. Use of 1000g=1kg to convert units 6750 ÷450 or 6.75÷0·45(0) (=15) or equivalent 15 × 20 + 25 (=325) 325 (mins) 5 hours 25 minutes	✓ ✓ ✓ ✓ ✓	B1 M1 m1 A1 B1 5	 FT error in conversion if consistent units FT 'their 15' CAO For correct conversion to hours and minutes. FT 'their 325'provided equivalent difficulty

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2015 June UNIT 3 (calculatorallowed) Foundation Tier	✓	Mark	Comments
10.(a) $2x = 16$ $x = 8$		B1 B1 2	FT one error Accept embedded answer
10.(b) $42 = 4\times3 + 6C$ $6C = 30$ $C = 5$		B1 B1 B1 3	Correct substitution FT until second error. Accept embedded answer
11. 1 /4+1/8 = 3/8 1− (1/4 + 1/8) = 5/8 5/8 is (£)100 so 1/8 is (£) 20 (Total amount=)(£)160	✓ ✓ ✓ ✓	B1 B1 M1 A1 4	Accept decimal equivalent. B2 for 5/8. FT 'their 3/8' but not 2/12. Alternative 100÷5×8 Look for trial and improvement methods. Award M1 for at least two trials that demonstrate some improvement.
12 (a) 360 – (45 + 90 + 62) 163(°)		M1 A1 2	
12 (b) 360(°)		B1 1	Accept reference to the sum equals 360(°)
13 (a) 30 (minutes)		B1 1	Accept ½ hour or half an hour.
13 (b) 50 (miles)		B1 1	
Ribbon marked 13 (c) and 13 (d) 13 (c)horizontal line from (11:30, 80) to (13:00 ,80) Line with negative gradient to (15:00 , 0)		B1 B1 2	
13 (d) 80 ÷ 2 40(mph)		M1 A1 2	FT 'their line' from part c if line with negative gradient.
14. ½×8×8 = 32 cm^2		M1 A1 U1 3	
15. (Ratio =) 4:2:1 or equivalent (1 part =) 385 ÷ (4+2+1) Flour 220(g) Sugar 110(g) Raisins 55(g)	✓ ✓ ✓ ✓	B1 M1 A2 4	A1 for two correct amounts OR for all three correct but incorrectly designated. *Alternative method using trial and improvement:* *B4 for correct amounts (B3 for 2 correct).* *B2 for two trials using correct proportions working towards the correct amounts.* *B1 for one trial using correct proportions.* *SC1 for Flour 154, Sugar 154, Raisins 77 from use of the ratio (2:2:1)*
16**. Use overlay.** Correct size and position of ABCD. Arc drawn of radius AX centre A. Arc ending on 'their new CD'		B1 M1 A1 3	Allow ± 2mm on the length of the sides and ± 2° on the 90° angles.

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2015 June UNIT 3 (calculatorallowed) Foundation Tier	✓	Mark	Comments
17(a) **Use overlay** Correct grouped frequency diagram.		B2 2	B1 for any 3 correct heights of bars. B0 if a frequency polygon has been drawn, with or without a frequency diagram. Penalise -1 for any other ambiguous lines.
17.(b) **to be viewed with table** Sight of the mid-points 2·5, 7·5, 12·5, 17·5, 22·5 $2·5\times19 + 7·5\times17 + 12·5\times10 + 17·5\times5 + 22·5\times2$ (47·5 +127·5 + 125 + 87·5 + 45 = 432·5) $432·5 \div 53$ = 8·1(60…) or 8· 2 (minutes) or 8 min 9.6 sec	✓ ✓ ✓ ✓	B1 M1 m1 A1 4	 FT their mid-points from within or at the bounds of the groups. FT 'their 432.5' Accept 8 (minutes) from correct working
17.(c) $0 < t \leq 5$ (minutes)		B1 1	Allow any unambiguous reference to the group eg 0 − 5.
18.(a) Valid explanation eg.'x is the hypotenuse so it should be longer than 16.5' or 'x should be the longest side'		E1 1	'x is the hypotenuse' is not sufficient.
18.(b) $(x^2 =) 8·6^2 + 16·5^2$ $x^2 = 346·21$ OR $(x =) \sqrt{346·21}$ $(x =)18·6(067…$cm)		M1 A1 A1 3	 Accept 19 from correct working
TOTAL MARKS		80	

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UNIT 3 - HIGHER TIER

Unitised Unit 3 – June 2015 Higher Tier	✓		Comments
1.(a) 5(2x – 3)		B1	
1.(b) −31		B2	B1 for −6 + … OR … −25 OR B1 for 1½×−4 – 5^2.
1.(c) 8x – 2x = −5 + 77 6x = 72 x = 12		B1 B1 B1	FT until 2nd error.
2. ½×8×8 = 32 cm^2		M1 A1 U1	
3. (a) 'His speed increases' or 'He accelerates'. (b) **To be viewed with graph. Use Overlay.** 1st section: 6 miles travelled in 1 hour. Straight line drawn to (11:45, 14). Horizontal line of 1 square drawn from end of 1st line. 2nd section: Straight line - 6 miles travelled in 1 hour.		E1 B1 B1 B1	E0 for a description of the journey e.g. he travels 3 miles in 30 min, then 5 miles in the next 30 min. If no marks awarded, allow SC1 for journey finishing at (1:00, 20) provided an attempt made at all 3 parts of the journey. Ignore any additional lines.
3.(c) 20 ÷ 3 OR 20 ÷ 180 = 6⅔ (mph) or equivalent = 0·1(111…) (miles/min)		M1 A1	 Accept 6·66, 6·67 and 6·7 but not 6·6. Allow M1 for 20 ÷ 2·75 leading to A1 for 7·2727… Allow M1 for 20 ÷ 165 leading to A1 for 0·1212…
4. 3·40		B2	B1 for 3·3(9636…) or 3·4
5. Sight of $\frac{8}{15}$ or equivalent (fraction remaining =) $1 - (\frac{1}{3} + \frac{1}{5})$ or equivalent) (fraction remaining =) $\frac{7}{15}$ or equivalent		B1 M1 A1	 CAO. *Alternative method:* *B1 for the correct calculation of the addition of 2 fractional amounts.* *M1 for the subtraction of this total from the amount.* *A1 for a correct fraction.*
6. Use Overlay. Correct size and position of ABCD. Arc drawn of radius AX, centre A. Arc ending on 'their new CD'		 B1 M1 A1	 Allow ±2mm on the length of the sides and ±2º on the 90º angles.
7. (Ratio =) 4:2:1 or equivalent (1 part =) 385 ÷ (4+2+1) Flour 220(g) Sugar 110(g) Raisins 55(g)	✓ ✓ ✓ ✓	B1 M1 A2	 A1 for two correct amounts OR all 3 correct but incorrectly designated. *Alternative method using trial and improvement:* *B4 for correct amounts (B3 for 2 correct).* *B2 for two trials using correct proportions working towards the correct amounts.* *B1 for one trial using correct proportions.* *SC1 for Flour 154, Sugar 154, Raisins 77 from use of the ratio (2:2:1)*

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Unitised Unit 3 – June 2015 Higher Tier	✓		**Comments**
8. (Sale price of standard box =) 2.50 – (0·18×2.50) OR 0·82×2.50	✓	M1	
(= £) 2.05	✓	A1	
Perform calculations that allow comparison.			
e.g. Standard box Large box			
205÷750 280÷1000	✓	M1	FT 'their £2.05'including £2.50 used.
= 0.273…(p per gram) = 0.28 (p per gram)	✓	A1	*(Or 365.85g/£ and 357.14g/£)*
			Alternative method: Price of 1kg worth of 750g box or vice versa
			M1 for 2.05 × 4/3 OR 2.80 × ¾
			A1 for (£)2.73… OR (£)2.10
Statement implying that the standard box is better value.	✓	A1	FT *their* values provided M1 awarded.
QWC: Look for • correct units used i.e. kg, g, £, p • spelling in at least 1 statement/sentence • clarity of text explanations QWC2: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer QWC1: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer	✓ ✓	QWC 2	QWC2 Presents material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.
9. (a) **Use Overlay.** Correct grouped frequency diagram.		B2	B1 for any 3 correct heights of bars. B0 if a frequency polygon has been drawn, with or without a frequency diagram. Penalise −1 for any other ambiguous lines.
9. (b) **To be viewed with table.** Sight of the mid-points 2·5, 7·5, 12·5, 17·5, 22·5	✓	B1	
2·5×19 + 7·5×17 + 12·5×10 + 17·5×5 + 22·5×2 (47·5 + 127·5 + 125 + 87·5 + 45 = 432·5)	✓	M1	FT their mid-points from within or at the bounds of the groups.
432·5 ÷ 53	✓	m1	
= 8·1(60…) or 8· 2 (minutes) or 8 min 9·6 sec	✓	A1	FT 'their 432·5' Accept 8 (minutes) from correct working.
9. (c) $0 < t \leq 5$ (minutes)		B1	Allow e.g. 0 – 5.
10. (a) Valid explanation e.g. 'x is the hypotenuse so it should be longer than 16·5' or 'x should be the longest side'.		E1	'x is the hypotenuse' is not sufficient.
10. (b) $(x^2 =) 8{\cdot}6^2 + 16{\cdot}5^2$		M1	
$x^2 = 346{\cdot}21$ OR $(x =) \sqrt{346{\cdot}21}$		A1	
$(x =) 18{\cdot}6(067\ldots$ cm)		A1	Accept 19 from correct working.
11. (x + 8)(x + 3)		B2	B1 for (x…8)(x…3)
x= −8 AND x = −3		B1	Strict FT their brackets provided previous B1 awarded. Final B0 for solutions obtained using the formula.
12. $3{\cdot}05 \times 10^6$		B3	B2 for $3{\cdot}045 \times 10^6$ OR $3{\cdot}04 \times 10^6$ OR 3 050 000 or equivalent. B1 for 3 045 000 or equivalent. If no marks awarded, SC1 for $1{\cdot}73 \times 10^3$.
13. (length of block =) 40 500/(15×15)	✓	M1	
= 180(cm)	✓	A1	
(Volume of hole =) 25 × 180	✓	M1	FT 'their 180'.
= 4500(cm^3)	✓	A1	
(Mass of block remaining =) 2·7×(40500−4500)	✓	M1	FT 'their 4500' provided it is a volume.
= 97 200 (g) or equivalent	✓	A1	Mark final answer. Accept rounded answers provided previous M1 awarded *Alternative method:* *B1 for (Mass of whole block =) 40 500×2·7 (109 350(g))* *M1 for (length of block =) 40 500/(15×15)* *A1 for 180 (cm)* *M1 for (Mass of hole =) 25 × 180 × 2·7 FT 'their 180'* *A1 for 12 150 (g)* *A1 for 97 200 (g) FT 'their 109 350'.*

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Unitised Unit 3 – June 2015 Higher Tier	✓		Comments
14.(a) (£)17·5(0)		B1	
14.(b) (19·5 to 19·75) – (15·25 to 15·5) = (£)4 to (£)4·50 inclusive		M1 A1	
15. Ribbon marked. To be viewed with graph. Use Overlay. (a) Correct calculation of at least 6 coordinates. Plotting at least 4 points correctly. Correct curve through all 7 correct points. (b) (x =) –1 and 1·5 (c) Rearranging equation to $2x^2 - x - 3 = -x + 4$ Line $y = -x + 4$ drawn Solutions of approximately −1·9 and 1·9		B2 P1 C1 B1 M1 A1 A1	B1 for correct calculation of at least 4 coordinates. FT their curve provided there are at least 2 solutions. Implied by sight of (y =) $-x + 4$. FT their curve. Solutions alone gain no marks.
16. $(AB^2 =) 10{\cdot}8^2 + 7{\cdot}4^2 - 2\times10{\cdot}8\times7{\cdot}4\times\cos96^\circ$ $AB^2 = 188.107\ldots$ OR (AB =) $\sqrt{188.107\ldots}$ (AB =) 13·7(152…m)		M1 A1 A1	
17. (x =) $\frac{27 \pm \sqrt{(-27)^2 - 4\times12\times-2}}{2\times12}$ (x =) $\frac{27 \pm \sqrt{825}}{24}$ x = −0·07 AND x = 2·32		M1 A1 A1	Allow one slip in substitution. CAO. CAO.
18. To be viewed with graph. Idea that each large block is equivalent to frequency of 20 OR each block on the y-axis is a frequency density of 4 OR 4/12 of 240 80 (trees)		M2 A1	M1 for $12 \times (x \times 5) = 240$
19. (Area of sector of circle =) $\frac{1}{12} \times \pi \times 15^2$ = 58·875 to 58·9125 (cm^2) (Length of circular arc =) $\frac{1}{12} \times 2 \times \pi \times 15$ = 7·85 to 7·855 (cm) (Area of curved surface =) 47·1 to 47·13 (cm^2) (Total surface area =) 2×58·875 + 47·1 + 2×(15×6) = 344·85 to 345 (cm^2)	✓ ✓ ✓ ✓ ✓ ✓ ✓	M1 A1 M1 A1 A1 M1 A1	30/360 could be seen instead of 1/12. (Or 75π/4). Sight of 117·75 to 117·825 implies. (Or 5π/2) (Or 15π). FT 6 × 'their 7·85'. FT provided both M1s awarded. (Or 180 + 105π/2).
20. (a), (b) To be viewed with graph. (a) Tangent drawn. Idea of increase in *y*/increase in *x*. Gradient from a reasonable tangent. (b) Split into 4 areas and attempt to sum (Area =) ½×1(26 + 2×35 + 2×33 + 2×20 + 0) = 101 (units^2)		S1 M1 A1 M1 M1 A1	Ignore signs for M1 only. About −7. Or equivalent. Award for up to 1 error in reading scale. CAO

x	−3	−2	−1	0	1	2	3
$y = 2x^2 - x - 3$	18	7	0	−3	−2	3	12

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4353/02

W15-4353-02

MATHEMATICS (UNITISED SCHEME)
UNIT 3: Calculator-Allowed Mathematics
HIGHER TIER

A.M. MONDAY, 19 January 2015

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**3**	
2.	**2**	
3.	**7**	
4.	**3**	
5.	**4**	
6.	**3**	
7.	**6**	
8.	**6**	
9.	**8**	
10.	**3**	
11.	**5**	
12.	**3**	
13.	**3**	
14.	**7**	
15.	**4**	
16.	**6**	
17.	**3**	
18.	**4**	
19.	**3**	
20.	**7**	
Total	**90**	

4353
020001

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

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.

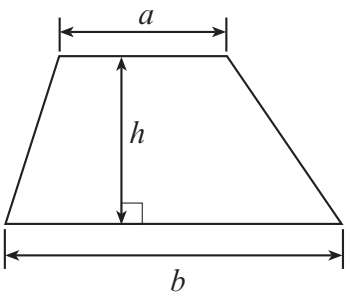
You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **8**.

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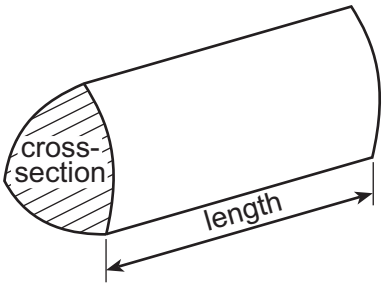
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Formula List

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

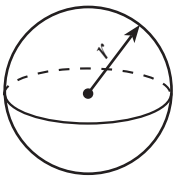


Volume of prism = area of cross-section × length



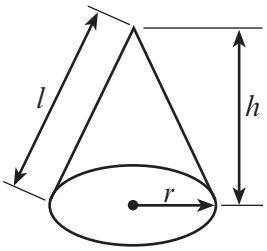
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

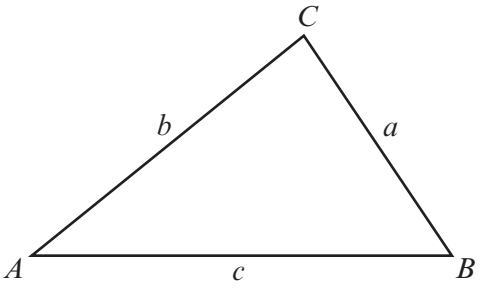


In any triangle ABC

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

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

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1. Evaluate $\frac{x^3}{5y+z}$ when $x = 3$, $y = 1{\cdot}8$ and $z = 9$.

Write your answer as a decimal. [3]

2. Share 252 kg in the ratio 5 : 1. [2]

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Turn over.

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3. *(a)* Factorise the expression $x^2 - 9x$. [1]

(b) Solve the equation $3(x - 7) = 21$. [3]

(c) Solve the equation $9y - 2 = 5y + 12$. [3]

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4. Ifan is sitting in his parents' car as they travel on the motorway.
The car is travelling at a steady speed of 90 km/h.
Using his watch, Ifan measures the time it takes to travel between two bridges.
The time taken is 10 seconds.

How far apart are the two bridges?
Give your answer in metres. [3]

.....

.....

.....

.....

.....

.....

.....

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5. A solution to the equation $5x^3 - 2x - 60 = 0$ lies between 2 and 3.
Use the method of trial and improvement to find this solution correct to 1 decimal place. [4]

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6. Calculate the length x in the triangle below. [3]

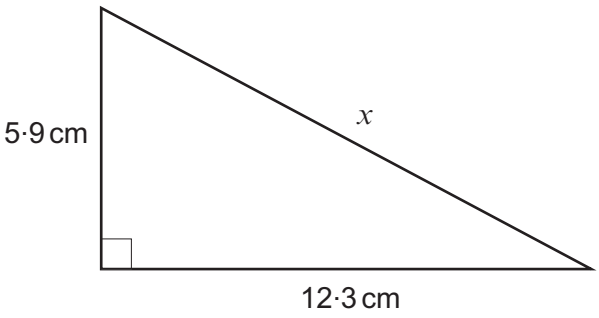


Diagram not drawn to scale

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Turn over.

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7. Four grey regular polygons join together as shown in the diagram.

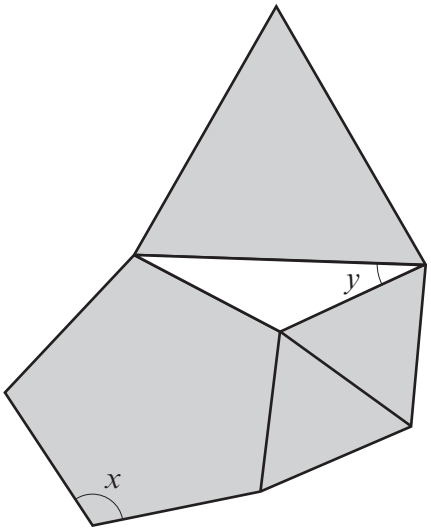


Diagram not drawn to scale

(a) Calculate the size of angle x. [2]

(b) Calculate the size of angle y. [4]

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

A company has a large semicircle as part of its logo.
The company plans to paint the logo onto one of the walls of its headquarters.
One tin of paint covers 15 m^2.

Calculate the number of tins of paint that the company needs to buy to paint a semicircle of radius 6·3 m onto the wall. [6]

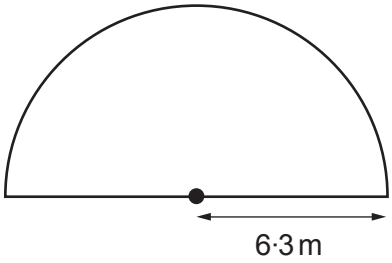


Diagram not drawn to scale

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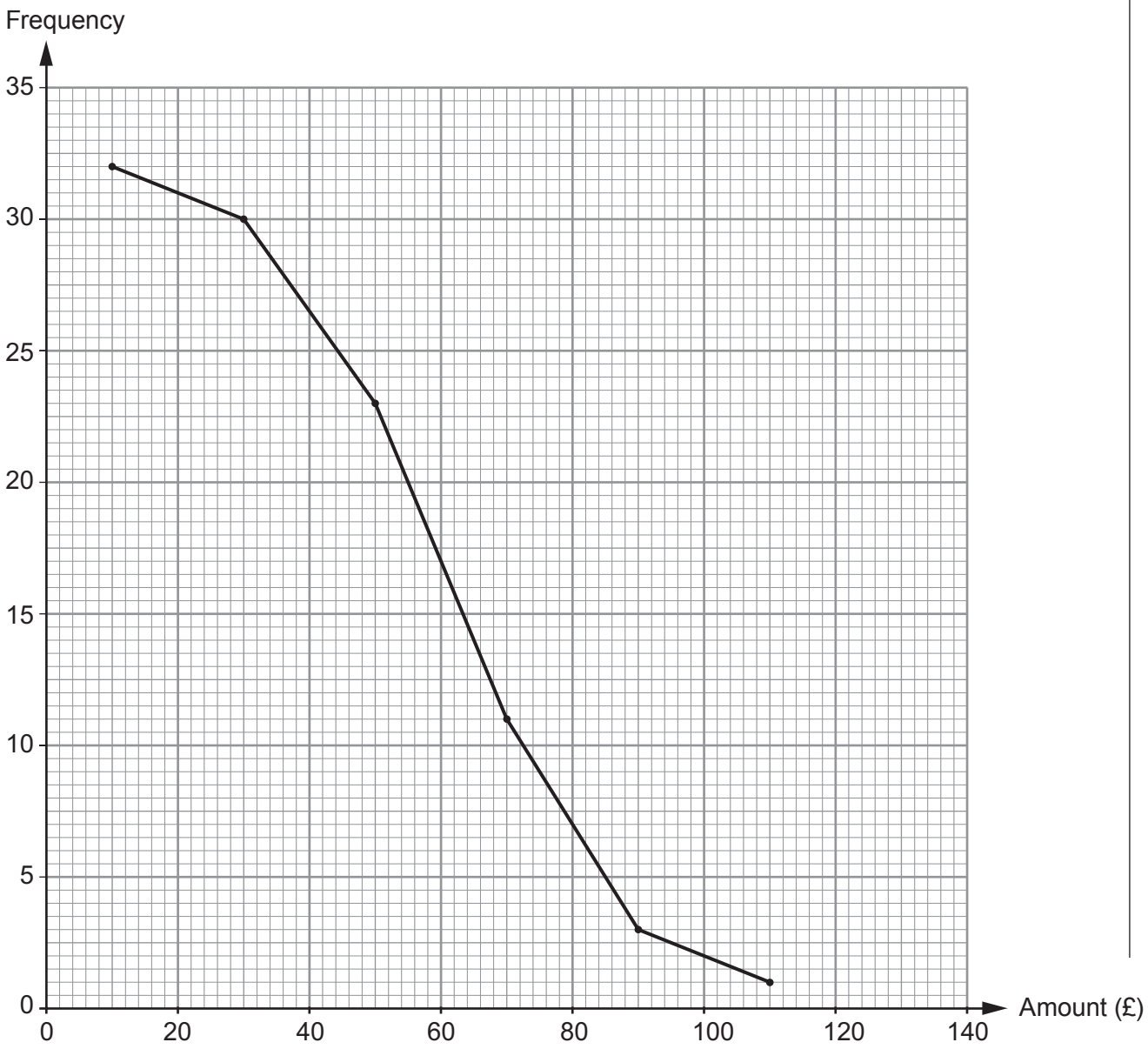
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9. The frequency polygon below shows the amount of money that 100 customers spent in a supermarket on a Monday morning.



(a) For the Monday morning, complete the following table, and hence calculate an estimate of the mean amount spent per customer. [5]

Amount, s (£)	Mid-point	Frequency
$0 < s \leqslant 20$		
$20 < s \leqslant 40$		
$40 < s \leqslant 60$		
$60 < s \leqslant 80$		
$80 < s \leqslant 100$		
$100 < s \leqslant 120$		

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(b) The amount of money that **another 100 customers** spent in the same supermarket on a **Saturday afternoon** is shown below.

Amount, s (£)	Frequency
$0 < s \leqslant 20$	5
$20 < s \leqslant 40$	19
$40 < s \leqslant 60$	34
$60 < s \leqslant 80$	12
$80 < s \leqslant 100$	12
$100 < s \leqslant 120$	10
$120 < s \leqslant 140$	8

On the **same graph paper**, draw a frequency polygon to show the amount of money that the customers spent on the Saturday afternoon. [2]

(c) Use the two frequency polygons to make one comparison between the amount spent on Monday morning and the amount spent on Saturday afternoon. [1]

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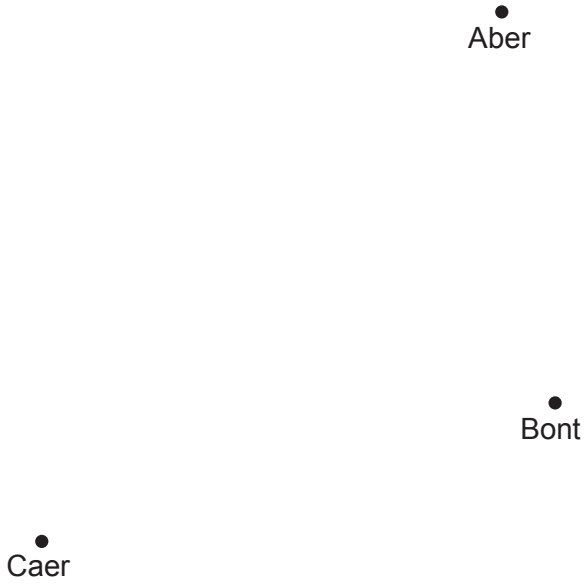
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10. Leah is drawing a map of her local area. She has accurately plotted the positions of the villages of Caer, Aber and Bont on the map below.
Leah now wants to plot the position of her house.
Her house is the same distance from Aber as it is from Bont.
According to the scale she is using, it needs to be plotted 6 cm from Caer.
Find the two possible positions of Leah's house, and mark each with a cross. [3]



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11. *(a)* Find the value of $\frac{3{\cdot}6 \times 10^7}{6 \times 10^4}$.

Give your answer in standard form. [2]

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(b) The mass of an atom of hydrogen is $1{\cdot}66 \times 10^{-24}$ g.
The mass of an atom of oxygen is $2{\cdot}66 \times 10^{-23}$ g.
A molecule of water consists of two atoms of hydrogen and one atom of oxygen.

Calculate the mass of a molecule of water.
Give your answer in standard form, correct to 3 significant figures. [3]

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12. Factorise $x^2 + 12x - 45$, and hence solve the equation $x^2 + 12x - 45 = 0$. [3]

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13. The diagram shows a square-based pyramid.
The length of each side of the base is 5 cm and the perpendicular height is 9 cm.

Calculate the volume of this pyramid.
State the units of your answer. [3]

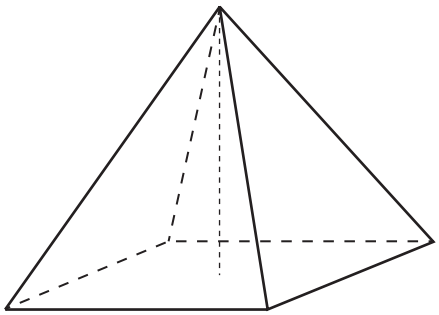


Diagram not drawn to scale

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14. Mrs Loydon teaches a primary school class.
During one school week, her maths lessons are based on learning the '2 times table'.
She decides to measure the time taken for pupils in her class to say the '2 times table' at the start and at the end of the school week.

The grouped frequency table below shows her results at the start of the week.

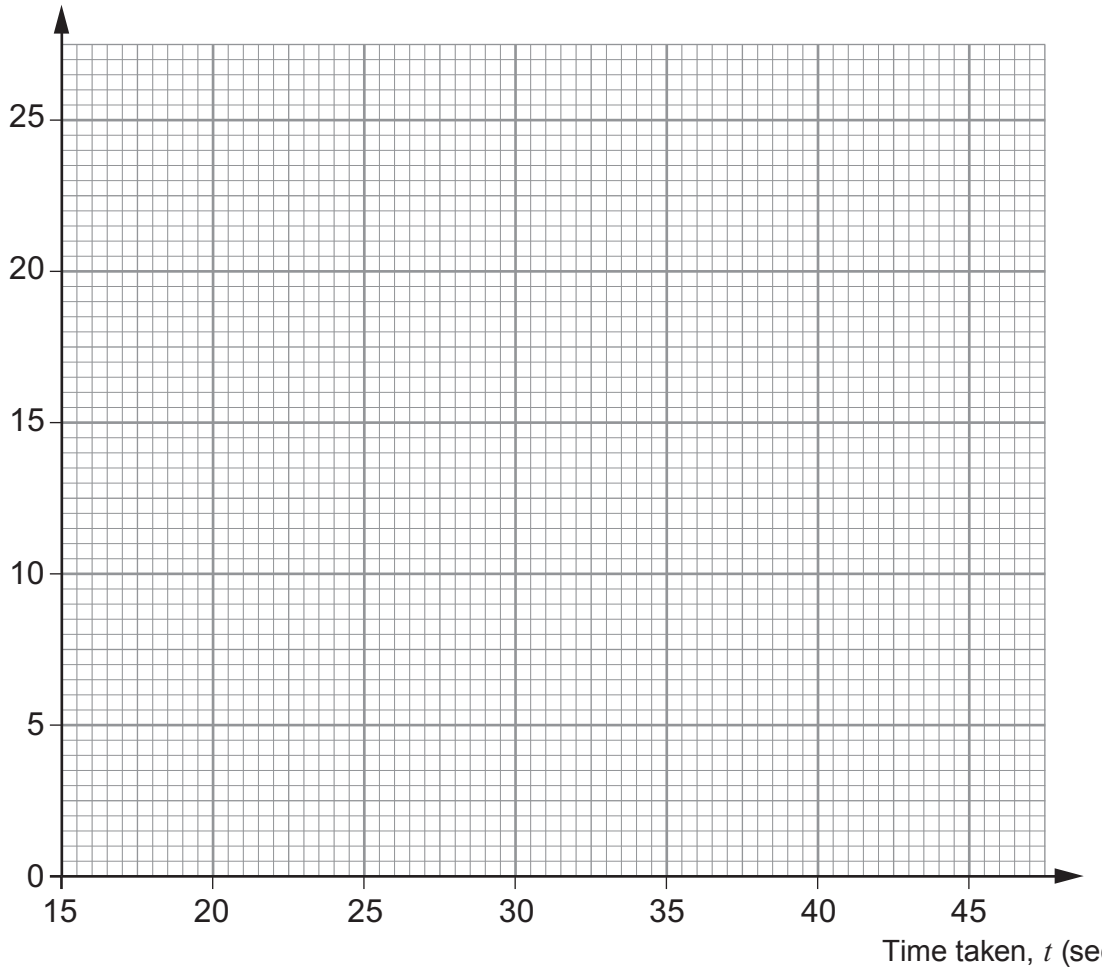
Time taken, t (seconds)	$15 < t \leqslant 20$	$20 < t \leqslant 25$	$25 < t \leqslant 30$	$30 < t \leqslant 35$	$35 < t \leqslant 40$	$40 < t \leqslant 45$
Frequency	3	4	8	6	2	1

(a) Complete the table below. [1]

Time taken, t (seconds)	$\leqslant 15$	$\leqslant 20$	$\leqslant 25$	$\leqslant 30$	$\leqslant 35$	$\leqslant 40$	$\leqslant 45$
Cumulative frequency	0						

(b) Draw a cumulative frequency graph of the times taken. [3]

Cumulative frequency



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(c) Use your cumulative frequency graph to estimate the median time taken at the start of the week. [1]

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(d) At the end of the week, the lower quartile of the class was 18 seconds, and the upper quartile was 26 seconds.
Mrs Loydon compares these results with those from the start of the week.
Explain, with reasons, what conclusions she can make. [2]

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15. In the diagram below, point *B* lies on the line AC, and point *E* lies on the line *AD*.
AB = 10 cm, *BC* = 2 cm and the area of triangle *ABE* = 24 cm^2.
Calculate the area of trapezium *BCDE*. [4]

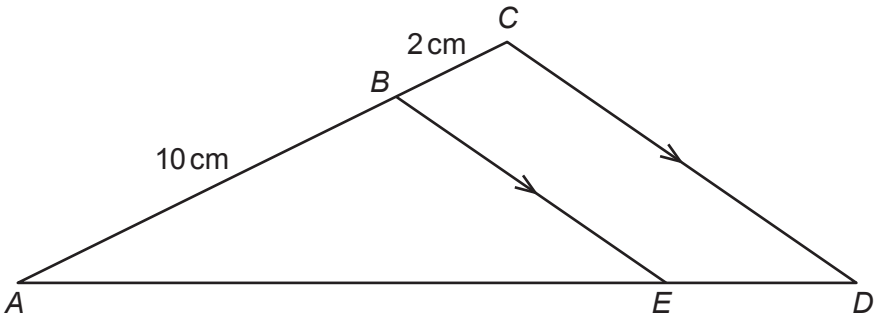


Diagram not drawn to scale

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16. It is known that c is directly proportional to the square of d, and c = 18 when d = 1·5.

(a) Find an expression for c in terms of d. [3]

(b) Calculate c when d = 2·3. [1]

(c) Calculate the possible values of d when c = 98. [2]

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17. A kite has sides of length 6 cm and 11 cm.
Two of the angles inside the kite are 130° each.

Calculate the area of the kite. [3]

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18. A cruise ship sets out from port *P*.
It sails 95 km on a bearing of 058° to its first port of call, *A*.
The following day, it sails 147 km on a bearing of 310° to its second port of call, *B*.
The day after that, it sails back to port *P* by the shortest route.

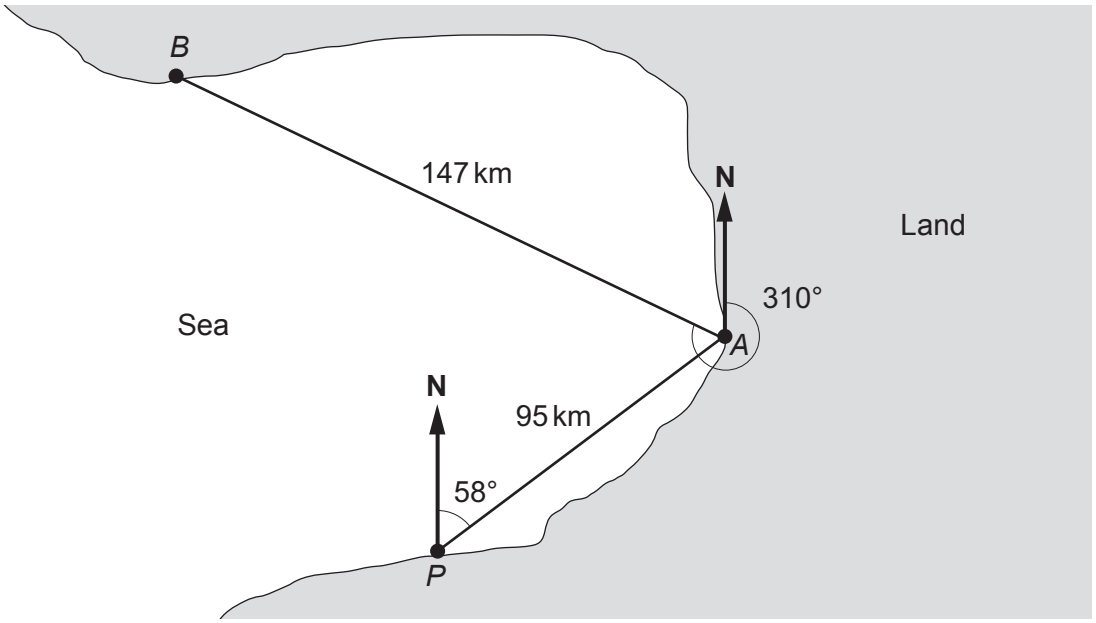
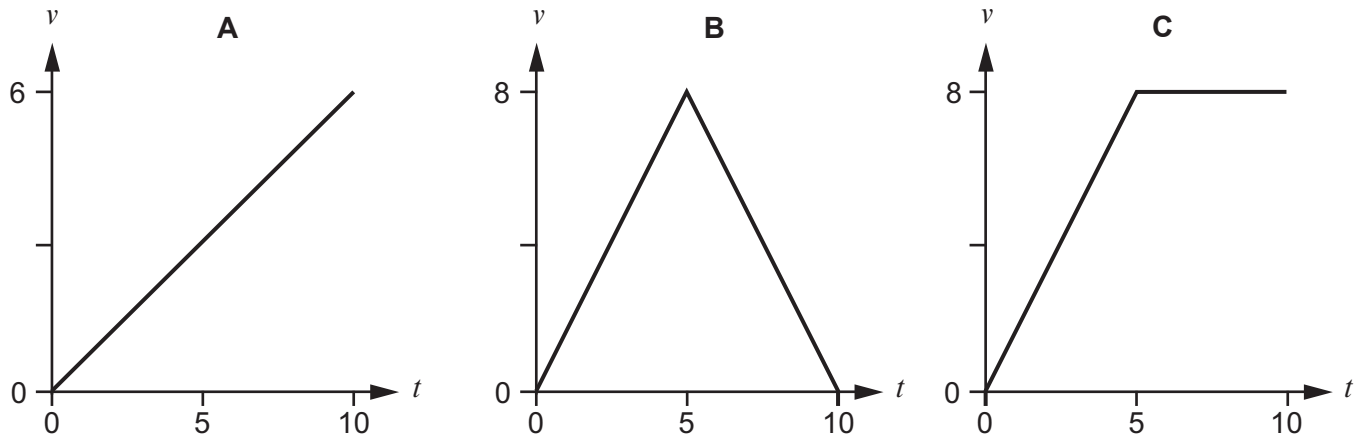


Diagram not drawn to scale

Calculate how far the cruise ship sails to travel from *B* to *P*. [4]

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19. The following graphs show 3 different journeys, where v is velocity in metres per second, and t is time in seconds.



One of these graphs shows a journey when the distance travelled in 10 seconds was 60 metres. Identify this graph and explain how you obtained your answer, showing your calculations. [3]

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20. *(a)* In the triangle below, show that x satisfies the equation $3x^2 - 6x - 2 = 0$. [3]

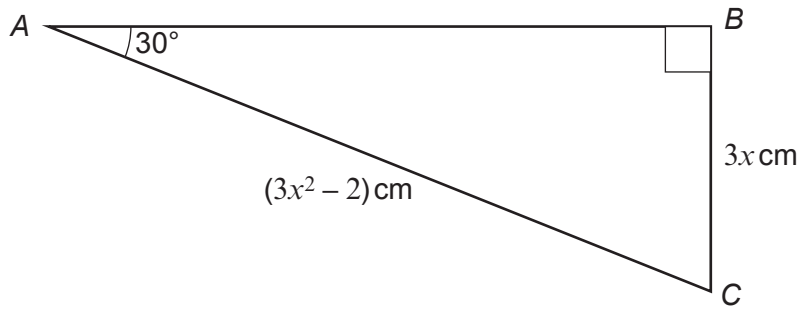


Diagram not drawn to scale

(b) Solve the equation $3x^2 - 6x - 2 = 0$ and hence find the length of *BC*, correct to 1 decimal place. [4]

END OF PAPER

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GCSE MARKING SCHEME

MATHEMATICS - UNITISED

JANUARY 2015

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2015 examination in GCSE MATHEMATICS - UNITISED. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

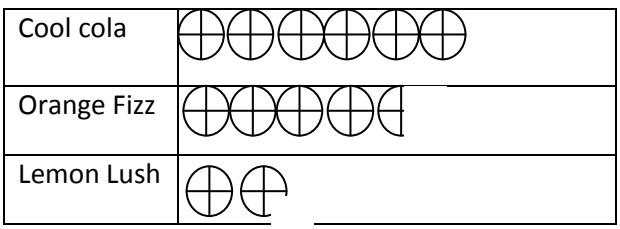
WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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UNIT 3 - FOUNDATION TIER

January 2015 **UNIT 3 (calculator allowed) Foundation**	**Mark**	**Final Mark Scheme** **Comments**
1. (a) (£)26.5(0) (£)2.97 (£)3.6(0) Total = (£)33.07 1 (b) 40−(£)33.07 (£)6.93 1 (c) Two free tickets identified (£) 10.6(0) ISW.	B1 B1 B1 B1 M1 A1 M1 A1 8	 FT if at least B1 awarded. FT candidate's total. FT 'their (£)33.07' Sc1 for ('their (£)33.07'− (£)15.9(0) =)(£)17.17 where drinks and sweets have not been considered.
2. (a) 7240	B1 1	
2. (b) 37	B1 1	
3. Evidence of counting squares 24-28 inclusive (cm^2)	M1 A1 2	
4. 5(p) and 2(p) coins	B2 2	B1 if candidate identifies 14(p) as the difference OR identifies 7(p) needs to be given.
5. (a) All letters correctly placed Regular Polygon C, E, F Irregular Polygon B,G,H Not a Polygon A, D (b) indicates B and H (c) indicates F and C	B3 B1 B1 5	B2 for six or seven shapes correctly placed. B1 for four or five shapes correctly placed. Duplication of letters counts as an error. Sc1 for three shapes correctly placed with one in each box with no shapes incorrectly placed.
6(a) (lemon lush=) 24 (b) difficult to show a part of the diagram with accuracy. e.g. the symbol needs to be easily divided into 8 pieces. . (c) One row represented in symbols consistent with the key. Two rows represented in symbols consistent with the key. Three rows represented in symbols consistent with the key.	B2 E1 B1 B1 B1 6	B1 for one can = 8 Alternative: 3/10 of 80 (=8×3)=24 e.g. the data for Tuesday's sales needs to be a multiple of 8 

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January 2015 UNIT 3 (calculator allowed) Foundation	Mark	Final Mark Scheme Comments
7. (a) Hands drawn to show twenty minutes to 5. (b)(16:40 to 19:40 Total time) 3hrs =180 min or 150 mins = 2½ hrs (180 − 150 =) 30 (mins) or (3 − 2½ =) ½ (hr). (30 ÷ 2 =)15 (min) or (½ ÷ 2 =) ¼ (hr) or	B1 B1 B1 B1 4	Hour hand <u>should</u> be between 4 and 5 but accept at 4. FT total 'their 180 mins'
8. (a) Median 58 (Thursday) (ii) Sum of the numbers (295) Sum/5 59 (iii) 42 (b) Correct interpretation of the range of daily sales of at least one of milkshakes or smoothies, in context.	B1 M1 m1 A1 B1 E1 6	B0 for Thursday without number. For attempt to add the numbers division by 5 of a number in the range 215-375 (54+38+65+58+80)/5 gets M1, m1 FT interpretation of 'their range' if in context. On average sales of milkshakes are consistent/around the same each day but smoothies' sales are more varied. E0 if no interpretation. Eg the range is smaller and the mean is the same.
9. (number of adults needed 240÷15) 16 (adults needed) (240+16=)256 (total people on the trip) 256÷50(=5.12) or equivalent 6 (buses needed) Look for • Spelling in at least one statement or sentence • Clarity of text explanations, • The use of notation (watch for the use of '=', '−' and '+' being appropriate. QWC2: Candidates will be expected to • Present work clearly, with words explaining process and steps AND • Make few, if any, mistakes in mathematical form, spelling, punctuation and grammar in their final answer. QWC1 : Candidates will be expected to • Present work clearly, with words explaining process or steps OR • Make few, if any, mistakes in mathematical form, spelling, punctuation and grammar in their final answer.	 B1 B1 M1 A1 QWC2 6	Any appropriate method that gives 16 adult places. FT 'their 256'or 240 If no marks awarded, SC1 for use of 1 adult for every 15 students. e.g. 45 students and 3 adults per bus. Award M1A1 for "240÷50 (=4.8),so 5 buses needed" only if neither B1 has been awarded. QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR Evident weakness in organisation of material but using acceptable mathematical form, with few, if any, errors in spelling, punctuation and grammar. QWC0 Evident weakness in organisation of material, and errors in use of mathematical form, spelling, punctuation and grammar.

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January 2015 UNIT 3 (calculator allowed) Foundation	Mark	Final Mark Scheme Comments
10. 5.1	B2 2	B1 for 5.0(64417504..) seen B0 for 5 alone.
11. (80×3.50 =) (£)280 (2/5 × 80=) 32 280 – 32 × 5 (£)120 120/(80 − 32) (£)2.5(0)	B1 B1 M1 A1 M1 A1 6	 FT 'their 280'and 'their 32' so long as B1 awarded. FT 'their 120'and 'their 32'
12. Intersecting construction arcs with radius 9cm and 7.5cm drawn from A and B respectively. Completed triangle with vertex at intersection of construction arcs.	M1 A1 2	Accuracy ±2mm M0 for freehand arcs or no arcs seen.
13. a = 5 Substitution of a =5 e.g. 5+3× 5+b = 23 or equivalent b=3	B1 B1 B1 3	 FT 'their a'. Implies previous B1. Look for answers in table.
14. (a) 9:30 (am) or 09:30 (b) horizontal line drawn stopping at point (10:20, 2) (c) Draw a line with positive gradient from (10:20 , 2) to (10:40 , 3) Use of distance divided by time or gradient of line. 3 (km/h)	B1 B1 B1 M1 A1 5	 FT part (b) for start of line. Ignore additional lines beyond 10:40. FT positive gradient of 'their line'. '1 km in 20 mins', without further working, earns M1 A0
15. 252 ÷ 6 (= 42) 210 (kg) AND 42 (kg)	M1 A1 2	
16. (a) 3x – 21 = 21 OR x – 7 = 21/3 3x = 42 OR x = 7 + 7 x = 14 (b) 9y – 5y = 12 + 2 4y = 14 y = 3.5	 B1 B1 B1 B1 B1 B1 6	 Accept embedded answer. FT until 2nd error. FT until 2nd error. Accept 7/2. Mark final answer.
17. a) Points plotted at mid-points of groups and straight lines connecting the points b) Appropriate comment that compares purchases made on Monday and Saturday.	B2 E1 3	B1 at least 4 points plotted and joined correctly OR for all points plotted correctly but not joined, OR consistent horizontal translation within the limits of the groups. Accept intention of straight lines. Ignore any lines outside the first and last points. E.g. "More low value purchases on a Monday morning", "More money is spent on a Saturday afternoon".

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January 2015 UNIT 3 (calculator allowed) Foundation	Mark	Final Mark Scheme Comments
18. $(x^2 =)$ $12.3^2 + 5.9^2$ $x^2 = 186.1$ OR $(x =)$ $\sqrt{186.1}$ $(x =)$ 13.6(418…cm)	M1 A1 A1 3	
19. (Area of semi-circle =) $\pi \times 6{\cdot}3^2/2$ $= 62{\cdot}3$ to $62{\cdot}4$ (m^2) (Number of tins of paint needed =) $(\pi \times 6{\cdot}3^2/2) \div 15$ = 5(tins)	M1 A1 M1 A1 4	 FT 'their area' provided π used in the calculation. Provided of equivalent difficulty.
20. Perpendicular bisector of line joining Aber and Bont drawn. Correct 2 points identified.	B1 B2 3	Use overlay with tolerances included. B1 for 1 point identified Or correct circle or arc drawn within tolerance. If no marks awarded, SC1 for complete method but outside tolerances.

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UNIT 3 - HIGHER TIER

January 2015 UNIT 3 Higher	Mark	Final Mark Scheme Comments
1. $\frac{27}{18}$ or equivalent. = 1.5	B2 B1 3	B1 for sight of 27 or 18. FT provided B1 already awarded. If no marks awarded, allow SC1 for answers of 18.72 (not used brackets) or 0.5 (used squared instead of cubed) as evidence of a correct numerator or denominator.
2. 252 ÷ 6 (= 42) 210 (kg) AND 42 (kg)	M1 A1 2	
3. (a) x(x – 9) (b) 3x – 21 = 21 OR x – 7 = 21/3 3x = 42 OR x = 7 + 7 x = 14 (c) 9y – 5y = 12 + 2 4y = 14 y = 3.5	B1 B1 B1 B1 B1 B1 B1 7	Accept embedded answer. FT until 2nd error. FT until 2nd error. Accept 7/2. Mark final answer.
4. (Distance =) $\frac{90 \times 1000}{3600} \times 10$ = 250 (m)	M2 A1 3	M1 for a distance conversion into m OR a speed conversion into 'per second' OR speed × time. CAO. Allow M1 SC1 for 0.25 **km**.
5. One correct evaluation $2 \leq x \leq 3$ 2 correct evaluations $2.25 \leq x \leq 2.4$ one either side of 0 2 correct evaluations $2.25 \leq x \leq 2.35$ one either side of 0 *If evaluations not seen, accept 'too high' or 'too low'.* $x = 2.3$	B1 B1 M1 A1 4	**x** / **$5x^3-2x-60$**: 2 / -24; 2.1 / -17.895; 2.2 / -11.16; 2.3 / -3.765; 2.4 / 4.32; 2.5 / 13.125; 2.6 / 22.68; 2.7 / 33.015; 2.8 / 44.16; 2.9 / 56.145; 3 / 69; 2.25 / -7.547; 2.26 / -6.804; 2.27 / -6.055; 2.28 / -5.298; 2.29 / -4.535; 2.3 / -3.765; 2.31 / -2.988; 2.32 / -2.204; 2.33 / -1.413; 2.34 / -0.615; 2.35 / 0.189; 2.36 / 1.001; 2.37 / 1.820; 2.38 / 2.646; 2.39 / 3.480; 2.4 / 4.320
6. $(x^2 =)\ 12.3^2 + 5.9^2$ $x^2 = 186.1$ OR $(x =)\ \sqrt{186.1}$ (x =) 13.6(418…cm)	M1 A1 A1 3	
7. (a) (Angle inside pentagon =) 540/5 = 108 (º) (b) Sight of 60 (º) as an angle in an equilateral triangle. 360 – 60 – 60 – 108 (= 132) y = (180 – 132)/2 y = 24 (º)	M1 A1 B1 M1 m1 A1 6	OR 180 – (360/5) FT 'their 108' for all remaining marks.

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January 2015 UNIT 3 Higher	Mark	Final Mark Scheme Comments
8. (Area of semi-circle =) $\pi \times 6 \cdot 3^2/2$ $= 62 \cdot 3$ to $62 \cdot 4$ (m^2) (Number of tins of paint needed =) $(\pi \times 6 \cdot 3^2/2) \div 15$ = 5 (tins) QWC: Look for • spelling in at least 1 statement/sentence • clarity of working • correct units used i.e. m^2, tins QWC2: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer QWC1: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer	M1 A1 M1 A1 QWC 2 6	 FT 'their area' provided π used in the calculation. Provided of equivalent difficulty. QWC2 Presents material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.
9. (a) Mid-points 10, 30, 50, 70, 90, 110 Frequencies 32, 30, 23, 11, 3, 1 Sum of mid-points × freq (= 3520) ÷ 100 = (£) 35.2(0) (b) Points plotted at mid-points of groups, and straight lines connecting the points. (c) Appropriate comment that compares purchases made on Monday and Saturday.	B1 B1 M1 m1 A1 B2 E1 8	 FT their mid-points and frequencies. Mid-points need to be within the limits of each group, including the limits themselves. Dividing by 100 or their total frequency. B1 at least 4 points plotted and joined correctly, OR for all points plotted correctly but not joined, OR consistent horizontal translation within the limits of the groups. Accept intention of straight lines. Ignore any lines outside the first and last points. e.g. 'More low value purchases on a Monday morning.' 'More money is spent on a Saturday afternoon.'
10. Perpendicular bisector of line joining Aber and Bont drawn. Correct 2 points identified.	B1 B2 3	Use overlay with tolerances included. B1 for 1 point identified Or correct circle or arc drawn within tolerance. If no marks awarded, SC1 for complete method but outside tolerances.
11. (a) 6×10^2 (b) $2 \times (1.66 \times 10^{-24}) + 2.66 \times 10^{-23}$ $= 2.99 \times 10^{-23}$	B2 M1 A2 5	B1 for 600 or 0.6×10^3. Or equivalent. A1 for 2.992×10^{-23} or equivalent. SC1 for a correct answer to their calculation written instandard form to 3 s.f., provided rounding required.
12. $(x + 15)(x - 3)$ $x = -15$ or $x = 3$	B2 B1 3	B1 for (x…15)(x…3). FT for their pair of brackets. Both solutions needed for this B1. B0 for solutions obtained from the quadratic formula.
13. $\frac{1}{3} \times 5^2 \times 9$ = 75 cm^3	M1 A1 U1 3	 Independent mark.
14. (a) 3, 7, 15, 21, 23, 24 (b) Idea, plotting the upper class boundary consistently with the corresponding cumulative frequency. At least 4 points plotted correctly. All points correct and joined by straight lines or a curve, including to zero. (c) A correct reading from their graph. (d) Pupils got quicker AND suitable reason e.g. "upper quartile is now less than the median from the start of the week", "both quartiles have come down in time".	B1 M1 A1 A1 B1 E2 7	 FT, for all marks, their cumulative frequencies, provided an attempt made to be cumulative. If no marks awarded, SC1 if points plotted at mid-points. M0A0A0 for bars with or without plots. Answers are likely to be in the range 27·5to 29. E1 for 'pupils got quicker' OR E1 for valid statement e.g.'the spread of marks has not changed much from start of the week.' If the quartiles from the start of the week are quoted, they need to be correct. LQ=23 to 24·5, UQ=32 to 33·5.

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January 2015 UNIT 3 Higher	Mark	Final Mark Scheme Comments
15. Use of scale factor of (12/10) or (10/12) Area ACD/24 = $(12/10)^2$ Area ACD = 24 x 1.44 = 34.56 (cm^2) Area of trapezium = 10.56 (cm^2)	B1 M1 A1 A1 4	Sight of 1.2 or 0.8333… Or equivalent. FT 'their 34.56' provided M1 awarded. *Alternative method:* *Ratio of lengths 10:12 or 5:6* *B1* *Ratio of areas 100:144 = 25:36* *B1* *Area of trapezium = 11/25 x 24* *M1* *Area = 10.56 (cm^2)* *A1*
16. (a) $c = k \times d^2$ or $c \propto d^2$ $18 = k \times 1.5^2$ $c = 8d^2$ (b) 42.3(2) (c) $98 = 8d^2$ $(d =) \pm 3.5$	B1 M1 A1 B1 M1 A1 6	 FT for their non-linear expression from (a), in (b) and (c). FT for their non-linear expression from (a) provided positive and negative roots required.
17. (Area of 1 triangle =) ½ x 6 x 11 x sin130º x 2 (Area of kite =) 50.5(58…cm^2) or 51 (cm^2)	M1 m1 A1 3	 An answer of 25(.279…) gets M1m0A0.
18. (Angle inside triangle at A =) 72º $BP^2 = 147^2 + 95^2 - 2x147x95xcos\ 72º$ BP^2 = 22003(.15535) or (BP =) √22003(.15535) (BP =) 148(.334…km)	B1 M1 A1 A1 4	 FT 'their 72º' providing it's less than 122°. FT their 22003(.15535) provided M1 awarded.
19. "Area under a v-t graph gives the distance travelled." (½ x 5 x 8) + (5 x 8) C	M1 A1 A1 3	Could be implied by their calculations. OR Distance A = ½×10×6 AND Distance B = ½×10×8.
20. (a) $(3x^2 - 2)\sin 30º = 3x$ $3x^2 - 6x - 2 = 0$ (b) $\frac{-(-6) \pm \sqrt{((-6)^2 - 4\times3\times-2)}}{2\times3}$ $\frac{6 \pm \sqrt{60}}{6}$ x = 2.29(…) or 2.3 (or x = -0.29 or -0.3) BC = 6.9 (cm)	M2 A1 M1 A1 A1 B1 7	M1 for $\sin 30º = 3x/(3x^2 - 2)$ Convincing work needed. *Alternative method:* *M2 for $6x = 3x^2 - 2$ with convincing argument for an equilateral triangle.* *A1 for $3x^2 - 6x - 2 = 0$.* Allow 1 slip in substitution for M1 only. Do not accept a part trial and improvement method. CAO. CAO. If no workings shown, SC1 for x = 2·29 or 2·3. FT their value of x, provided M1 or SC1 awarded, and BC is positive.

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4353/02

A14-4353-02

MATHEMATICS (UNITISED SCHEME)
UNIT 3: Calculator-Allowed Mathematics
HIGHER TIER

A.M. MONDAY, 10 November 2014

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**2**	
2.	**3**	
3.	**4**	
4.	**5**	
5.	**2**	
6.	**4**	
7.	**6**	
8.	**8**	
9.	**5**	
10.	**3**	
11.	**4**	
12.	**4**	
13.	**3**	
14.	**3**	
15.	**5**	
16.	**5**	
17.	**3**	
18.	**4**	
19.	**7**	
20.	**4**	
21.	**6**	
Total	**90**	

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ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

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.

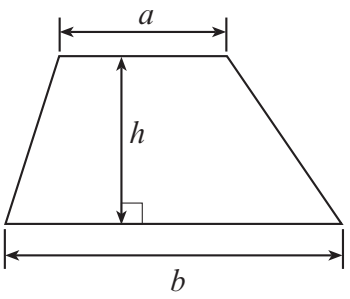
You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **7**.

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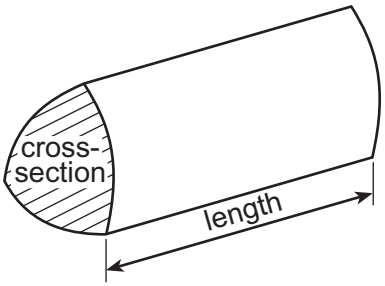
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Formula List

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

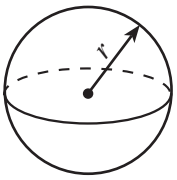


Volume of prism = area of cross-section × length



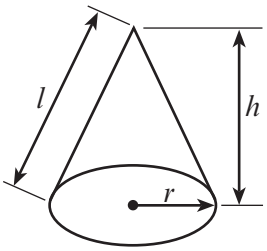
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

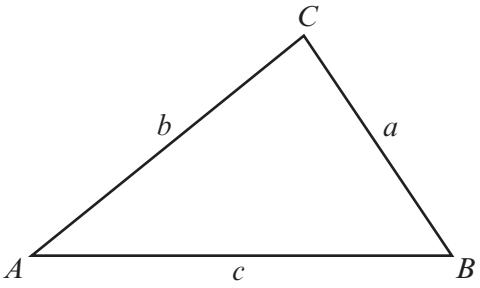


In any triangle ABC

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

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

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1. Given the formula $v = u + at$, find v when $u = -20$, $a = 9{\cdot}8$ and $t = 5$. [2]

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2. Ioan, Meinir and Gerallt share a sum of money.

Ioan receives $\frac{1}{5}$, Meinir receives $\frac{3}{10}$, and Gerallt receives $\frac{1}{2}$.

In what ratio do they share the money?
Give your ratio in its simplest form. [3]

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Ioan : Meinir : Gerallt

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Turn over.

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3. A theme park collects a large amount of data for every day that it is open.
The following table shows the data collected for six randomly selected days in August 2014.

Day	**1**	**2**	**3**	**4**	**5**	**6**
Number of visitors (thousands)	4	6	14·6	10·4	9·8	13
Weight of litter collected (tonnes)	1·6	3	6·1	3·8	4·6	5

(a) On the graph opposite, draw a scatter diagram to show this information. [2]

(b) Draw a line of best fit on your scatter diagram. [1]

(c) Use your line of best fit to estimate the weight of litter that would be collected on a day when 12 000 people visited the park. [1]

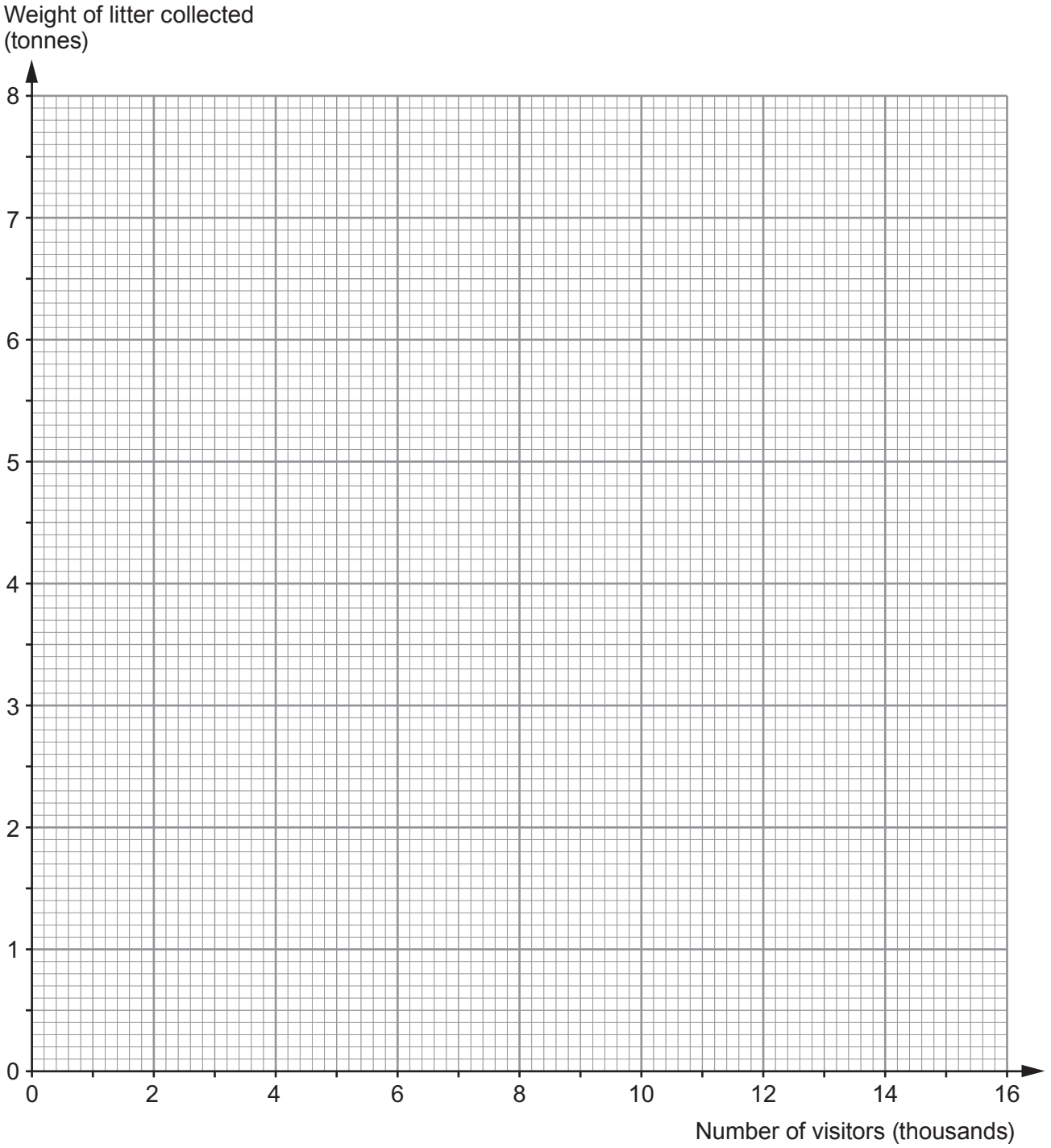
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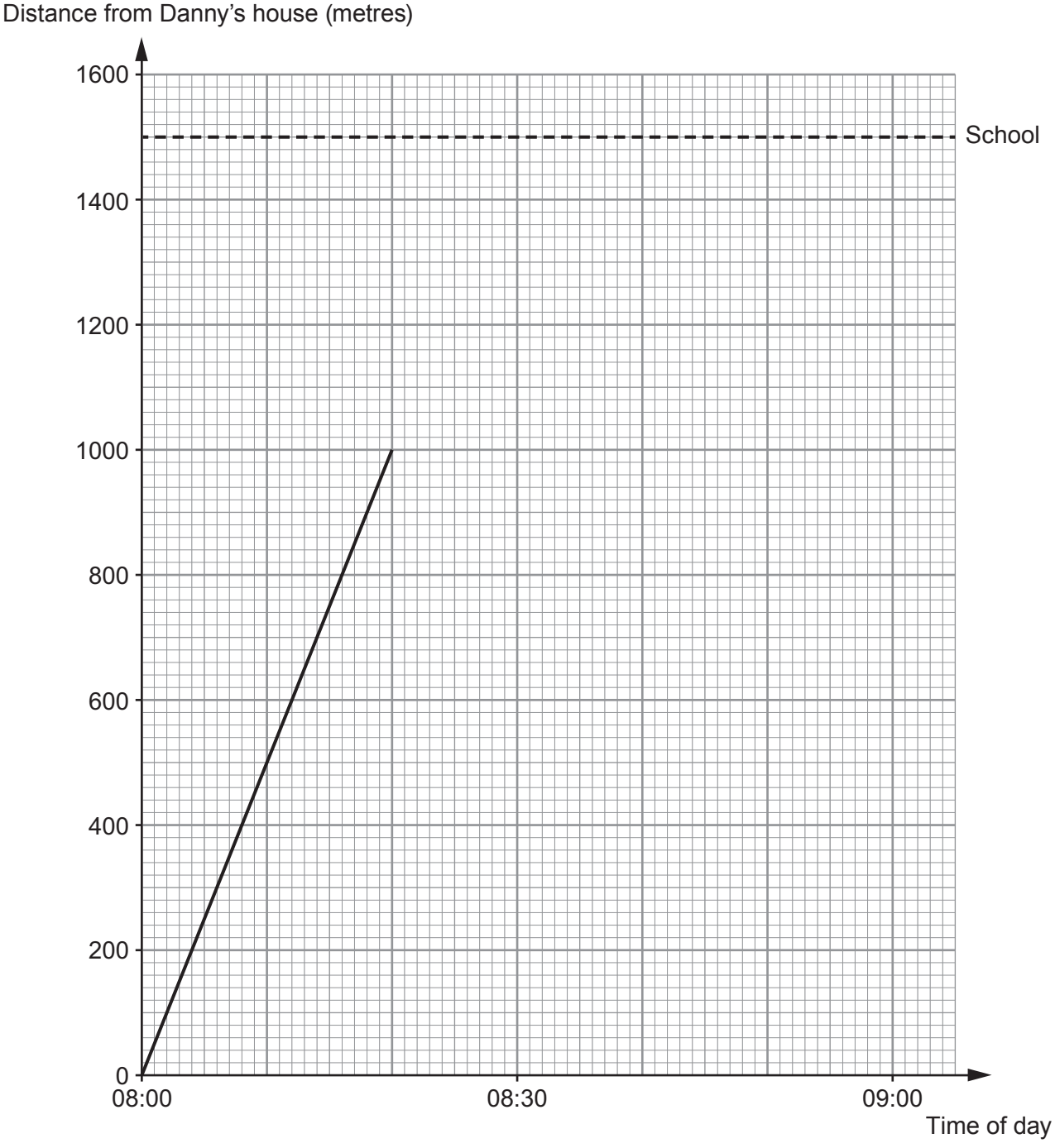
Turn over.

Examiner only

4. Danny lives 1500 m away from his school. He walks to school at the same constant speed every day starting at 08:00.
The travel graph below shows the start of his journey one day.

(a) Complete the travel graph using the following information:

- When he had travelled 1000 m he realised that he had left his dinner money in the house, so he turned around, arriving back at his home at 08:30.
- He immediately set off from home running at a steady speed, so that he ran a distance of 500 m every 5 minutes, until he reached his school. [3]



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(b) Danny arrived at school later than usual. How many minutes later than usual did Danny arrive at school? [2]

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5. Find the size of each interior angle of a regular pentagon. [2]

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6. Using a ruler and a pair of compasses, construct an accurate diagram of the quadrilateral shown below.
You must show all your construction lines.
One line has already been drawn for you. [4]

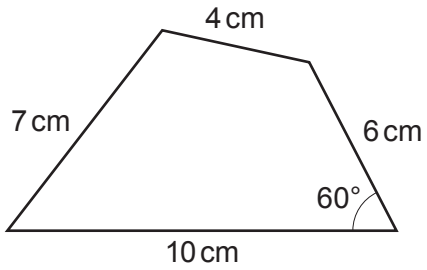


Diagram not drawn to scale

10 cm

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

A bathroom mirror is shown below. Two vertical and two horizontal overlapping wooden pieces are placed over the mirror as shown. The width of each of the wooden pieces is 2 cm.

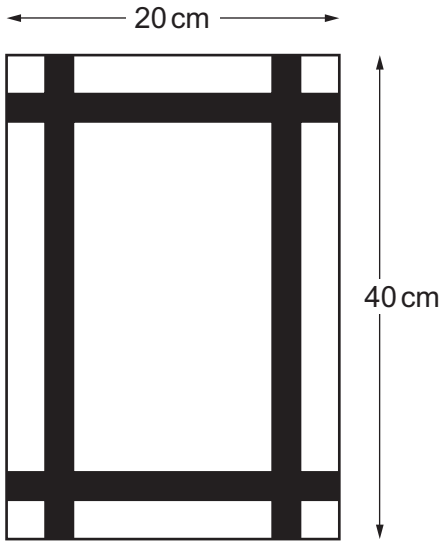


Diagram not drawn to scale

Calculate the area of the mirror that is **not** covered by the wooden pieces.
Show all your working. [6]

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8. *(a)* Solve the equation $\frac{12}{y} = 5$. [1]

(b) Solve the equation $4(2x - 5) = 3x - 5$. [3]

(c) A solution to the equation $x^3 + 10x - 20 = 0$ lies between 1·5 and 1·6.
Use the method of trial and improvement to find this solution correct to 2 decimal places. [4]

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9. A gas company uses the following information to calculate Hywel's monthly payment.

- Hywel is expected to use 18 000 units of gas this year
- For the first 2000 units of gas used, he will be charged 6·883p per unit
- For the remaining units of gas used, he will be charged 2·987p per unit
- VAT of 5% is to be charged

Calculate Hywel's **monthly** payment, correct to the nearest penny.
Show all your working. [5]

Monthly payment = £ .....

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10. The diagram below shows a ladder resting against the top of a vertical wall.
The ladder is 4·9 m long and the wall is 4 m high.
How far is the bottom of the ladder from the base of the wall? [3]

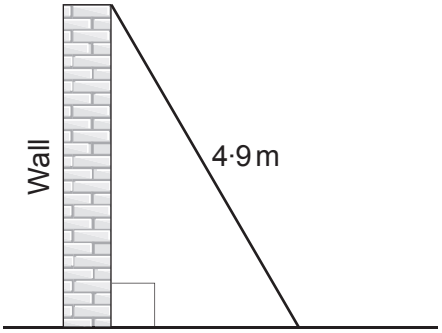


Diagram not drawn to scale

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11. A golfer hits 40 golf balls with one of his clubs.
He records the distance each ball travels. The grouped frequency table shows his results.

Distance travelled, d, in yards	Frequency
$75 < d \leqslant 80$	4
$80 < d \leqslant 85$	13
$85 < d \leqslant 90$	17
$90 < d \leqslant 95$	6

Calculate an estimate for the mean distance travelled by these balls. [4]

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12. Triangle *ABC* is isosceles with perpendicular height 12 cm and $A\hat{C}B = 72°$.

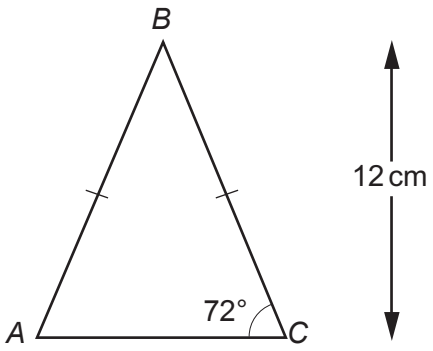


Diagram not drawn to scale

Calculate the length *AC*. [4]

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13. Our Sun is a star within a galaxy called the Milky Way.

Scientists estimate that there are about 300 billion stars in the Milky Way, and that there are about 500 billion galaxies in the Universe.
1 billion = 1000 million.
Assuming that each galaxy has the same number of stars as in the Milky Way, approximately how many stars are there in the Universe?
Give your answer in standard form. [3]

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14. *AOD* and *BOC* are two diameters of a circle, centre *O*. Two triangles are formed by joining *A* to *B* and *C* to *D*.

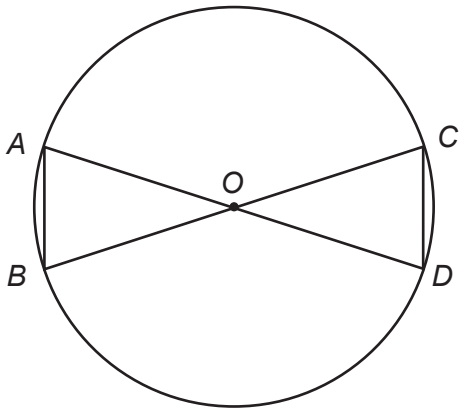


Diagram not drawn to scale

Prove that the triangles are congruent. [3]

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Turn over.

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15. *(a)* Factorise the expression $9a^3b + 6a^2$. [2]

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(b) Factorise the expression $x^2 + 8x - 20$, and hence solve the equation $x^2 + 8x - 20 = 0$. [3]

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16. A solid metal cube has sides of length 7 cm.
The cube is melted down and recast into solid spheres of radius 1·5 cm.
Calculate the maximum number of spheres that can be formed. [5]

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17.

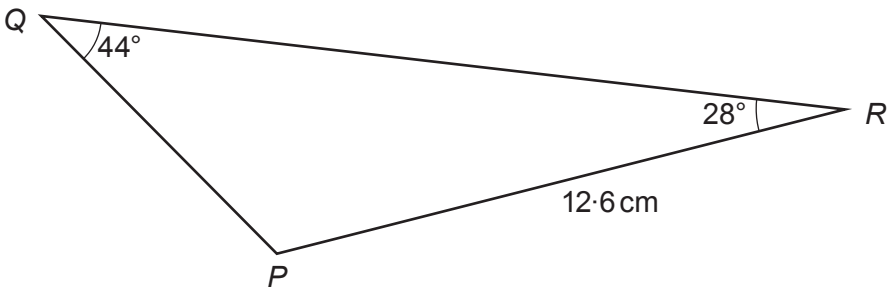


Diagram not drawn to scale

Calculate the length *PQ*. [3]

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18. The diagram shows an inverted hollow cone of height 12 cm and a volume of 3510 cm^3.
The cone contains 130 cm^3 of water.
Calculate the height of the water in the cone. [4]

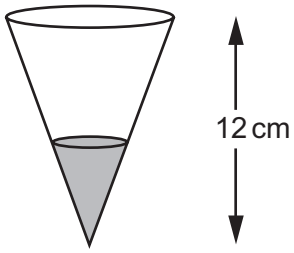


Diagram not drawn to scale

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19. *(a)* Show that the equation $\frac{5}{x-2} + \frac{4}{x+1} = 2$ can be written as $2x^2 - 11x - 1 = 0$. [4]

(b) Hence solve the equation $\frac{5}{x-2} + \frac{4}{x+1} = 2$.

Give your answers correct to 2 decimal places. [3]

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20. The heights of a group of adult males are recorded. The table below shows the results.

Height, x, in cm	Frequency	Frequency density
$160 < x \leqslant 165$	4	0·8
$165 < x \leqslant 170$	7	
$170 < x \leqslant 175$	13	
$175 < x \leqslant 180$	10	
$180 < x \leqslant 190$	.....	0·6

(a) Use the table to complete the histogram on the opposite page. [3]

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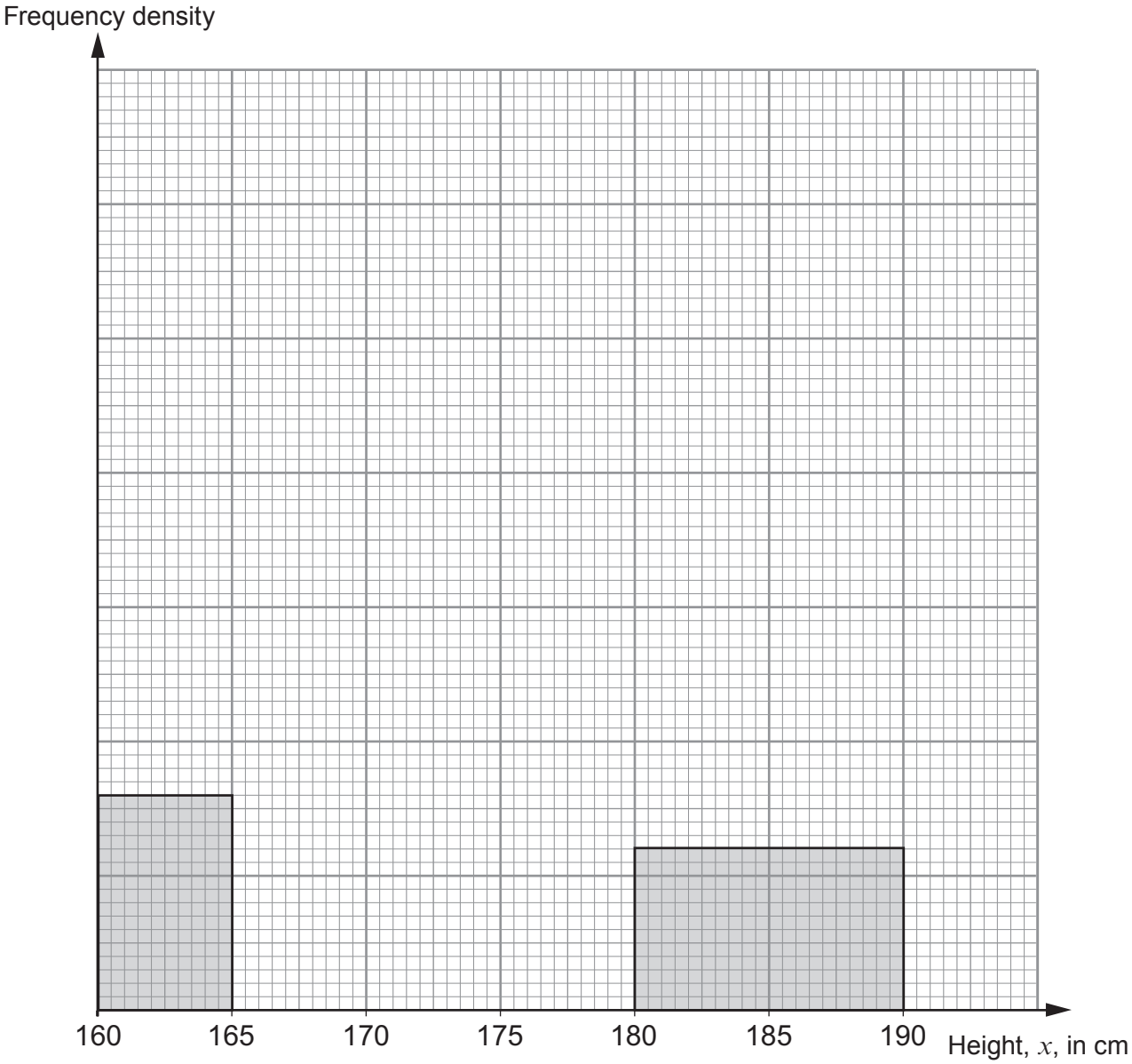
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(b) Find the number of adult males whose heights, in cm, are in the group $180 < x \leqslant 190$.

[1]

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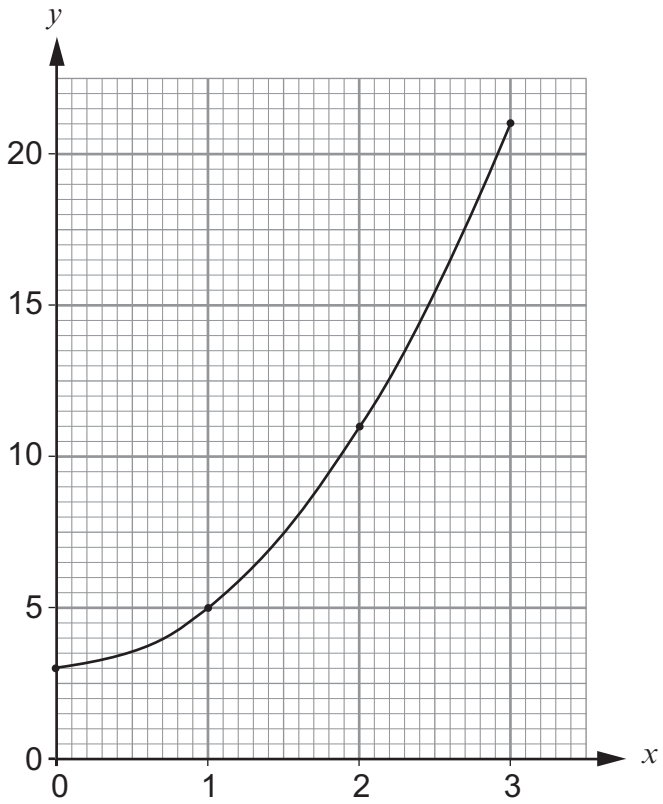
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21. The graph of $y = 2x^2 + 3$, for values of x between $x = 0$ and $x = 3$, is shown below.



(a) Estimate the gradient of the curve when $x = 1$. [3]

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(b) Use the trapezium rule with ordinates $x = 0$, $x = 1$, $x = 2$ and $x = 3$ to estimate the area bounded by the curve $y = 2x^2 + 3$, the x-axis and the lines $x = 0$ and $x = 3$. [3]

END OF PAPER

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GCSE MARKING SCHEME

MATHEMATICS - UNITISED

NOVEMBER 2014

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the November 2014 examination in GCSE MATHEMATICS - UNITISED. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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UNIT 3 - FOUNDATION TIER

GCSE Mathematics - Unitised Unit 3 (calculator allowed) Foundation Tier November 2014	Mark	Final Mark Scheme Comments
1. (a) (£)8·5(0) (£)23·85 (£) 9·98 (£)42·33 (b) (£)7·67 (c) 6×1·99 (£) 11·94	B1 B1 B1 B1 B1 B1 B1 7	 FT candidate's values, provided equivalent difficulty FT 50 – 'their 42·33'. Or equivalent SC1 for (9×1·99=)(£)17·91
2. (a) 53000 (b) 67 (c) 37·8	B1 B1 B1 3	
3. 42− (38−12) 16	M1 A1 2	Or equivalent
4. (6435-5793)= 642 (units used) 642 ×15(p) (£)96·3(0) or 9630(p)	B1 M1 A1 3	 FT 'their 642' from working If given, £ and/or p must be correct
5 Evidence of counting squares 48-52 (squares) 240-260 (m^2)	M1 A1 B1 3	 F.T. 5× 'their number of squares'
6. (a) A and L OR F and J (b) H and C	B1 B1 2	
7. (a) (i) any correct combination using 5, 3, 12 and 20. (ii) any correct combination (b) (i) 11 (ii) 4×9÷(3−1) (c) −10 + −5 (d) −4 × −6	B1 B1 B1 B1 B1 B1 6	5+3 = 20 −12 12+5=20 − 3 12+3 = 20 −5 Accept answers in boxes or on lines 20 ÷ 5 = 12 ÷ 3 or 5 ÷ 3 = 20 ÷ 12 (incl reciprocals) Accept answers in boxes or on lines A pair of brackets inserted correctly around subtraction. Extra brackets accepted if correct. Eg. (4×9)÷(3−1) Select the two negative numbers. In any order

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GCSE Mathematics - Unitised Unit 3 (calculator allowed) Foundation Tier November 2014	Mark	Final Mark Scheme Comments
8. Choosing a combination of 4 and 6 to make 16. 4, 4, 4, 4 or 6, 6, 4 Correct costing for one combination (£) 12 or (£) 11.6(0) (£) 11·6(0) and a convincing argument that 6, 6, 4 is cheapest OR both costings evaluated with a final answer of (£) 11·6(0)	B1 B1 B1	**Alternative method** Cost of 1 bottle from 6-bottle pack = (£)4·30÷6 = (£)0·71(6). Cost of 1 bottle from 4-bottle pack = (£)0·75. B1 for both. B1 for "Buy 2 6-bottle packs + 1 4 6-bottle pack". B1 for correct total price (£) 11·6(0)
Look for • Spelling • Clarity of text explanations, • Consistent and correct use of £ or p signs. QWC2: Candidates will be expected to • Present work clearly, with words explaining process and steps AND • Make few, if any, mistakes in mathematical form, spelling, punctuation and grammar in their final answer. QWC1 : Candidates will be expected to • Present work clearly, with words explaining process or steps OR • Make few, if any, mistakes in mathematical form, spelling, punctuation and grammar in their final answer.	QWC 2 5	QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR Evident weakness in organisation of material but using acceptable mathematical form, with few, if any, errors in spelling, punctuation and grammar. QWC0 Evident weakness in organisation of material, and errors in use of mathematical form, spelling, punctuation and grammar.
9. A: 12 ('sides') (36÷12=) 3(cm) (Perimeter B= 10×3) 30 (cm)	B1 B1 B1 3	Attempt to find the side length of a square. FT candidate's number of 'sides' on perimeter A. No FT for 36÷5 FT 10 × times 'their 3' If no marks awarded, SC1 for B has perimeter of 10 'sides'.
10. (a) 18 (b) 120=45+5*Y* 5*Y*=75 *Y*=15	B1 B1 B1 B1 4	Correct substitution Isolating the Y. Accept 5*Y*=120−45 F.T if aY=b (a≠1)

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GCSE Mathematics - Unitised Unit 3 (calculator allowed) Foundation Tier November 2014	Mark	Final Mark Scheme Comments
11.(a) 39	B1	
(b) D 5, C 9, B 6, A 4	B2	B1 for any two/three correct frequencies If frequencies score zero then B1 for all correct tallies.
(c) 21 to 30 or C	B1	FT from their frequencies
(d) **Use overlay** 3 or 4 angles correct and correctly labelled	B4	Ft from their frequencies
	OR	
3 or 4 angles correct, labels not fully correct 2 angles correct and correctly labelled. 2 angles correct, labels not fully correct. 1 angle correct and correctly labelled.	B3 B3 B2 B1	If only B1 is scored for the diagram, and all the angles given correctly, then cancel the B1 and award M1, A1. If B0 scored for the diagram, check the angles and the method to see if the M1 and the A1 can be awarded. (1 is) 15° gets M1.
OR <u>If 0 or 1 for the diagram or no diagram</u> 360/24 Angles are 75, 135, 90, and 60.	OR M1 A1 8	Or SC1 for all correct percentages. 20·8, 37·5, 25, 16·7
12. 3 (or 4) arcs and the bisector of the angle drawn.	B2 2	B1 for the first arc crossing both lines (or two equal radius arcs crossing both lines) **and** an attempt at the next stage in the construction.
13. (a) 45×32×30 43200 cm^3 (b) use of 1 litre = 1000 cm^3 (eg 43L = 43000 cm^3) (43litres is less than the volume of the tank) The water will not overflow	M1 A1 U1 M1 A1 5	Or equivalent Accept ml May be implied but not stated explicitly. Eg. 200 cm^3 space left. FT candidate's volume of tank provided M1 awarded in part (a).
14. 2/8 is 48(pupils) or ¼ is 48(pupils) 48×4 or equivalent 192	B1 M1 A1 3	
15. 180 – (360/5) OR ((5-2) x 180) / 5 108 (°)	M1 A1 2	Or equivalent
16. Area of one rectangle correctly evaluated (e.g. whole mirror) Area of two or more different white or black rectangles correctly evaluated A complete method of subtracting or adding areas e.g. 800 – (2×20×2 + 2×40×2 – 4×2×2) mirror wooden strips overlap = 576(cm^2)	B1 B1 M1 A1 4	*Possible calculation for the white pieces:* *4 corner pieces 4×2×2 (assuming squares)* *2 long rectangles 2×12×2* *2 tall rectangles 2×32×2* *Centre piece 12×32* *Or B1B1M1A1 for 36*×16=576(cm^2) CAO
17 (a) All points plotted correctly. (b) Appropriate straight line of best fit drawn with some values above and below the line. (c) from their line of best fit ± 0·05 (tonnes).	B2 B1 B1 4	B1 for 3, 4 or 5 points plotted correctly, not joined, or B1 for all points plotted correctly but joined. Mark intention. FT from their line. B0 if no line drawn.

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GCSE Mathematics - Unitised Unit 3 (calculator allowed) Foundation Tier November 2014	Mark	Final Mark Scheme Comments
18. Line or curve drawn from end of existing line to (08:30,0). Straight line drawn from (08:30,0) to (08:45, 15:00).	B1 B2 3	 FT their first line. B1 for straight line drawn from (08:30,0) with correct gradient (500m every 5min) but not finishing at (08:45 , 15: 00) , OR B1 for straight line finishing at the school with correct gradient but not starting immediately after the first line.
19. One correct evaluation $1{\cdot}5 \le x \le 1{\cdot}6$ 2 correct evaluations $1{\cdot}585 \le x \le 1{\cdot}6$ one either side of 0 2 correct evaluations $1{\cdot}585 \le x \le 1{\cdot}595$ one either side of 0 *If evaluations not seen, accept 'too high' or 'too low'.* $x = 1{\cdot}59$	B1 B1 M1 A1 4	x $x^3 + 10x - 20$ x $x^3 + 10x - 20$ 1·5 -1·625 1·591 -0·063 1·51 -1·457 1.592 -0.045 1·52 -1·288 1.593 -0.028 1·53 -1·118 1·594 -0·010 1·54 -0·948 1·595 0·008 1·55 -0·776 1·596 0·025 1·56 -0·604 1·597 0·043 1·57 -0·430 1·598 0·061 1·58 -0·256 1·599 0·078 1·59 -0·080 1·6 0·096 The second B1 can be gained by calculating one value that is too low in the range 1·585 to 1·6 AND stating clearly that 1·6 will be too high.
20. (Distance^2 =) $4{\cdot}9^2 - 4^2$ Distance^2 = 8·01 OR (Distance =) $\sqrt{8.01}$ (Distance =) 2·8(30…) (m)	M1 A1 A1 3	
21. Sight of the mid-points 77·5, 82·5, 87·5, 92·5 77·5×4 + 82·5×13 + 87·5×17 + 92·5×6 (=3425) (310 + 1072·5 + 1487·5 + 555) ÷ 40 = 85(·625) (yards)	B1 M1 m1 A1 4	 FT their mid-points from within or at the bounds of the groups

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UNIT 3 - HIGHER TIER

GCSE Mathematics - Unitised Unit 3 Higher Tier November 2014	Mark	Final Mark Scheme
1. −20 + 9.8×5 = 29	M1 A1 2	
2. All three amounts correct in comparable form e.g. 20%, 30%, 50%, OR 0.2, 0.3, 0.5 or equivalent 2:3:5	 B2 B1 3	Allow fractions of a sum of money. B1 for any 2 amounts correct in comparable form.
3. (a) All points plotted correctly. (b) Appropriate straight line of best fit drawn with some values above and below the line. (c) from their line of best fit ± 0.05 (tonnes).	B2 B1 B1 4	B1 for 3, 4 or 5 points plotted correctly, not joined, or B1 for all points plotted correctly but joined. Mark intention. FT from their line. B0 if no line drawn.
4. (a) Line or curve drawn from end of existing line to (08:30,0). Straight line drawn from (08:30, 0) to (08:45, 15:00). (b) 08:45 – 08:30 = 15 (min)	B1 B2 M1 A1 5	 FT their first line. B1 for straight line drawn from (08:30,0) with correct gradient. (500m every 5min) but not finishing at (08:45, 15:00), OR B1 for straight line finishing at the school with correct gradient but not starting immediately after the first line. FT 'their 08:45'.
5. 180 – (360/5) OR ((5-2) x 180) / 5 108 (º)	M1 A1 2	Or equivalent.
6. Suitable arcs drawn for 60° angle. 60° angle drawn with line 6cm long. Correct arcs drawn from the ends of the 10cm and 6cm lines. Lines of length 7cm and 4cm joining to complete the quadrilateral.	M1 A1 B1 B1 4	Allow ± 2º for the 60º angle, ±2mm for all lengths. Only award this B1 for the quadrilateral shown.
7.Area of one rectangle correctly evaluated (e.g. whole mirror) Area of two or more different white or black rectangles correctly evaluated A complete method of subtracting or adding areas e.g. 800 – (2×20×2 + 2×40×2 – 4×2×2) mirror wooden strips overlap = 576(cm^2) QWC: Look for • correct units used i.e. cm^2 • correct use of mathematical notation e.g. +, −,=. • spelling in at least 1 statement/sentence • clarity of text explanations QWC2: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer QWC1: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer	B1 B1 M1 A1 QWC 2 6	*Possible calculation for the white pieces:* *4 corner pieces 4×2×2 (assuming squares)* *2 long rectangles 2×12×2* *2 tall rectangles 2×32×2* *Centre piece 12×32* *OR B1B1M1A1 for 36×16 = 576(cm^2)* CAO QWC2 Presents material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.

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GCSE Mathematics - Unitised Unit 3 Higher Tier November 2014	Mark	Final Mark Scheme
8. (a) 2.4 or 2⅖ (b) $8x - 20 = 3x - 5$ $5x = 15$ $x = 3$ (c) One correct evaluation $1.5 \leq x \leq 1.6$ 2 correct evaluations $1.585 \leq x \leq 1.6$ one either side of 0 2 correct evaluations $1.585 \leq x \leq 1.595$ one either side of 0 *If evaluations not seen, accept 'too high' or 'too low'.* $x = 1.59$	B1 B1 B1 B1 B1 B1 M1 A1 8	FT until 2nd error. x $x^3 + 10x - 20$ x $x^3 + 10x - 20$ 1.5 -1.625 1.591 -0.063 1.51 -1.457 1.592 -0.045 1.52 -1.288 1.593 -0.028 1.53 -1.118 1.594 -0.010 1.54 -0.948 1.595 0.008 1.55 -0.776 1.596 0.025 1.56 -0.604 1.597 0.043 1.57 -0.430 1.598 0.061 1.58 -0.256 1.599 0.078 1.59 -0.080 1.6 0.096 The 2nd B1 can be gained by calculating a value that is too low in the range 1·585 to 1·6 AND stating clearly that 1·6 will be too high.
9. (First 2000 units cost) 13766(p) OR (£)137.66 (Remaining 16000 units cost) 47792(p) OR (£)477.92 1.05×61558 OR 1.05×615.58 (Total cost including VAT =) 64635.9(p) OR (£) 646.359 Monthly payment = £ 53.86	B1 B1 M1 A1 A1 5	 FT provided at least B1 awarded and both amounts considered. Accept rounded or truncated answer, to nearest penny. Must be correct to nearest penny.
10. (Distance^2 =) $4.9^2 - 4^2$ Distance^2 = 8.01 OR (Distance =) $\sqrt{8.01}$ (Distance =) 2.8(30…) (m)	M1 A1 A1 3	
11. Sight of the mid-points 77.5, 82.5, 87.5, 92.5 $77.5 \times 4 + 82.5 \times 13 + 87.5 \times 17 + 92.5 \times 6$ (=3425) (310 + 1072.5 + 1487.5 + 555) ÷ 40 = 85(.625) (yards)	B1 M1 m1 A1 4	FT their mid-points from within or at the bounds of the groups.
12. $12/\tan 72°$ = 3.8(990…) AC = 7.79(80…) OR 7.8	M2 A1 A1 4	M1 for $\tan 72° = 12/x$ Only accept 8 from correct working
13. Correct numerical representation of the numbers involved e.g. 500,000,000,000 or 5×10^{11} or 500×10^9 Multiplication using the correct numbers $= 1.5 \times 10^{23}$	B1 M1 A1 3	Accept correct representation of one of the numbers. If no marks gained, SC1 for an answer expressed in standard form following through from their consistent representation of each number.
14. OA=OC (or OA=OD) and OB=OD (or OB=OC) (all radii) AND angle AOB = angle COD (vertically opposite angles) (Therefore the triangles are congruent) SAS	M2 A1 3	M1 for one correct statement. These may be seen on the diagram. *One alternative method: M2 angle BAO = angle DCO and angle ABO = angle CDO (angles in the same segment) AND AO = OC (both radii). M1 for 1 pair of equal angles and equal radii. A1 for triangles are congruent (AAS).*
15. (a) $3a^2(3ab + 2)$ (b) $(x + 10)(x - 2)$ $x = -10$ AND $x = 2$	B2 M2 A1 5	B1 for $3a^2(3ab + \ldots)$ OR $3a^2(\ldots + 2)$ OR for correct partial factorisation. M1 for $(x \ldots 10)(x \ldots 2)$ FT their brackets, providing M1 awarded
16. (Volume of cube =) 343 (cm^3) (Volume of a sphere =) $4/3 \times \pi \times 1.5^3$ = 14.13 to 14.14 (cm^3) (Maximum number of spheres =) 343/14.1… = 24	B1 M1 A1 M1 A1 5	Accept sight of 343 in working. FT their values provided first M1 awarded. FT provided rounding required.

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GCSE Mathematics - Unitised Unit 3 Higher Tier November 2014	Mark	Final Mark Scheme
17. (PQ =) (12.6/sin44) × sin28 (PQ =) 8.5(154…) (cm)	M2 A1 3	M1 for PQ/sin28 = 12.6/sin44 or equivalent
18. Volume scale factor = 3510/130 = 27 Length scale factor = 3 Height of water = 12/3 = 4 (cm)	M1 A1 M1 A1 4	FT cube root of their 27 provided M1 awarded. *Alternative:* *M2 for $h^3=12^3\times130/3510$. M1 for $(h/12)^3= 130/3510$ or equivalent.* *m1 for* $h = \sqrt[3]{12^3 \times \frac{130}{3510}}$ *. A1 for 4(cm).*
19. (a) 5(x + 1) + 4(x – 2) as numerator AND (x – 2)(x + 1) as denominator OR multiply throughout by (x – 2) and (x + 1) 5(x + 1) + 4(x – 2) = 2(x – 2)(x + 1) $0 = 2x^2 - 11x - 1$ (b) $x = \frac{11\pm\sqrt{(-11)^2-4\times2\times(-1)}}{2\times2}$ $x = \frac{11 \pm \sqrt{129}}{4}$ x = 5.59 and x = -0.09 (Answers to 2 d.p.)	M2 A1 A1 M1 A1 A1 7	Brackets required or implied later. M1 for either correct numerator or denominator, or multiply throughout with 1 error. convincing Allow one error, in sign or substitution, but not in the formula CAO CAO
20. (a) Uniform scale on the vertical axis starting at 0 in blocks of 0.5. Appropriate width bars of height 1.4, 2.6, 2. (b) 6	B1 B2 B1 4	 FT their scale for all remaining marks provided not frequencies used. B1 for 2 correct bars or B1for sight of correct frequency densities stated.
21. a) Tangent drawn at x = 1. Idea of increase in *y*/increase in *x*. Gradient from a reasonable tangent. (b) Split into 3 areas and attempt to sum (Area =) ½×1(3 + 2×5 + 2×11 + 21) = 28 (units^2)	S1 M1 A1 M1 M1 A1 6	*Alternative method: M1 for (dy/dx) = 4x* *A1 for 4×1* *A1 for 4* Or equivalent. Award for up to 1 error in reading scale. CAO

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4353/02

MATHEMATICS (UNITISED SCHEME)
UNIT 3: Calculator-Allowed Mathematics
HIGHER TIER

A.M. TUESDAY, 17 June 2014

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a 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.

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 continuation page at the back of the booklet, taking care to number the question(s) correctly.

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 **3**.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**9**	
2.	**3**	
3.	**7**	
4.	**8**	
5.	**4**	
6.	**2**	
7.	**4**	
8.	**3**	
9.	**2**	
10.	**4**	
11.	**6**	
12.	**4**	
13.	**4**	
14.	**7**	
15.	**2**	
16.	**3**	
17.	**7**	
18.	**7**	
19.	**4**	
Total	**90**	

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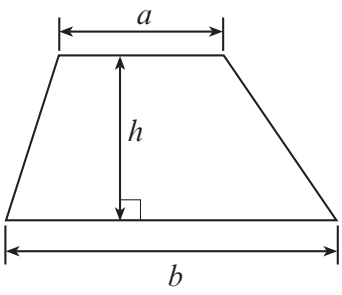
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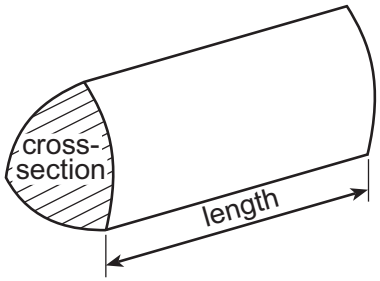
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Formula List

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

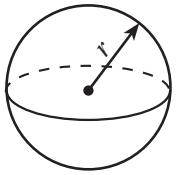


Volume of prism = area of cross-section × length



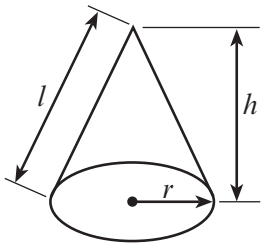
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

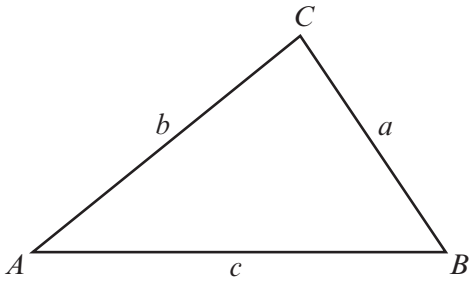


In any triangle ABC

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

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

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1. *(a)* Evaluate $\frac{\sqrt[3]{90}}{10{\cdot}5 - 7{\cdot}74}$. Give your answer correct to 2 decimal places. [2]

(b) Factorise the expression $18 - 9y$. [1]

(c) Given the formula $H = 3R + 2S$, find H when $R = 1\frac{1}{3}$ and $S = -1{\cdot}8$. [2]

(d) Solve the equation $\frac{3}{a} = 10$. [1]

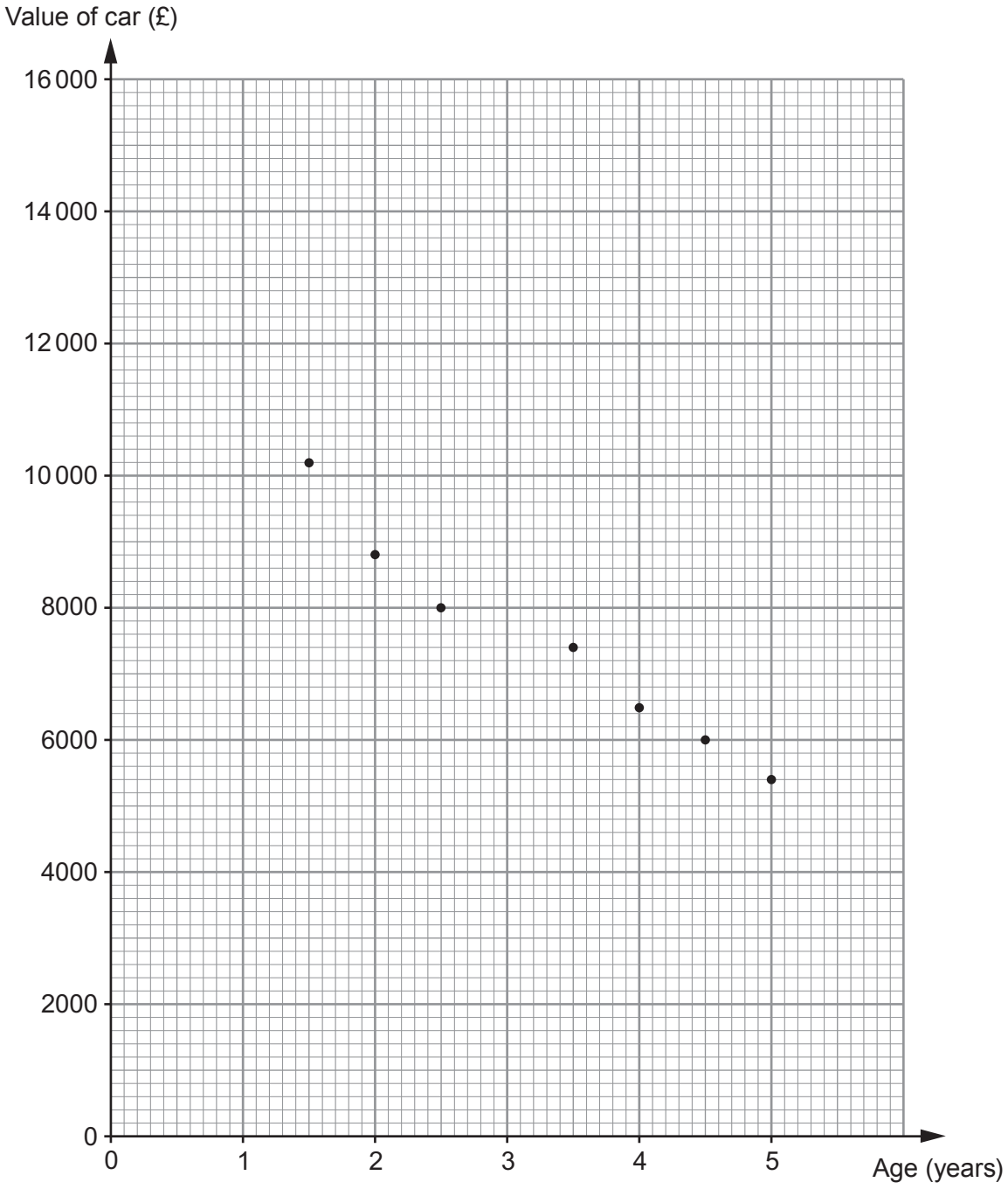
(e) Solve the equation $3(x - 2) = x + 2$. [3]

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2. The scatter diagram shows the values and ages of cars of a particular model.



(a) Write down the value of the oldest car. [1]

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(b) Draw, by eye, a line of best fit on the scatter diagram. [1]

(c) Use your line of best fit to estimate the value of a 3-year-old car of this model. [1]

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

Mr Jones pays for his gas by 12 **equal** monthly payments.
Each monthly payment is worked out using the following information.

- Mr Jones uses 15 000 units of gas in a year.
- The cost of gas is 4.028 pence per unit used.
- There is a fixed charge of £6.98 **per month**.
- There is a discount of £48 per year.

Calculate Mr Jones's **monthly payment**. [7]
You must show all your working.

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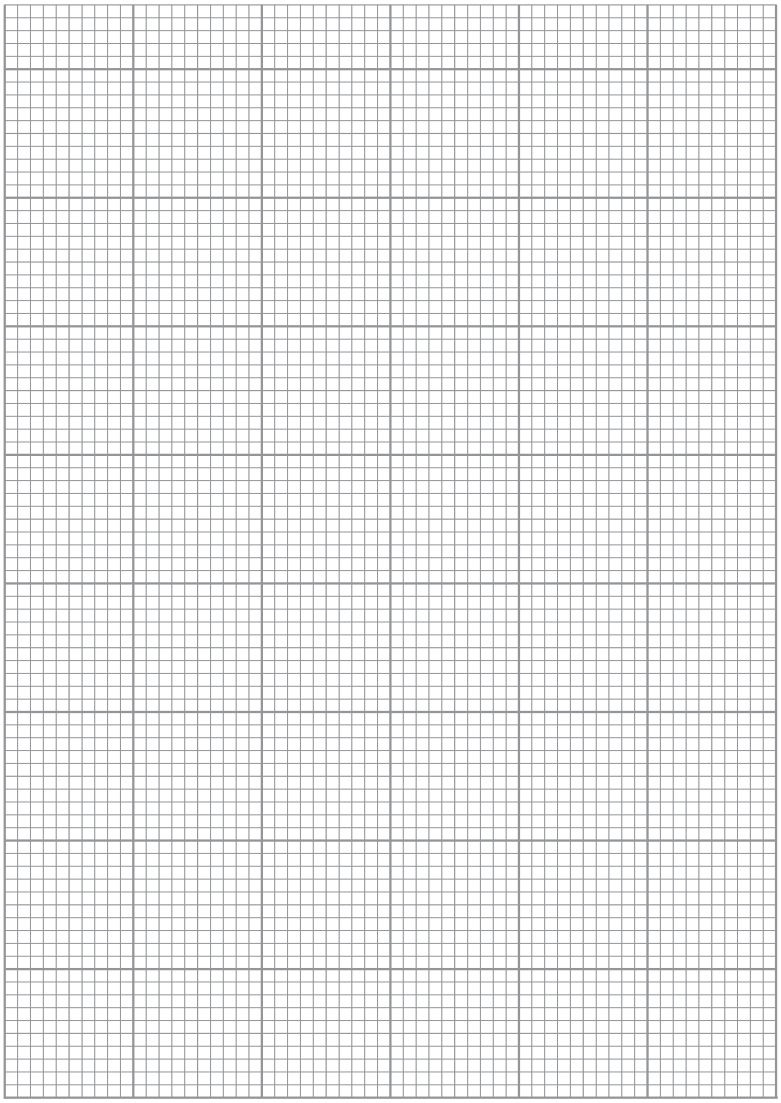
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4. A survey of 240 primary school pupils was carried out to find the amount of time they spent each week doing their homework.
Here are the results of the survey.

Time taken, t, in hours	Number of pupils
$0 < t \leqslant 1$	80
$1 < t \leqslant 2$	60
$2 < t \leqslant 3$	52
$3 < t \leqslant 4$	32
$4 < t \leqslant 5$	16

(a) Draw a grouped frequency diagram of the data. [3]



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(b) Calculate an estimate of the mean time that pupils spent each week doing their homework. [4]

(c) Write down the class interval that contains the median. [1]

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5. Two brothers, Gethin and David, share a sum of money in the ratio 2 : 7.
David gets £30 more than Gethin. Calculate how much money the brothers share. [4]

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6. The diagram below shows part of a regular polygon.
Calculate the number of sides of this regular polygon. [2]

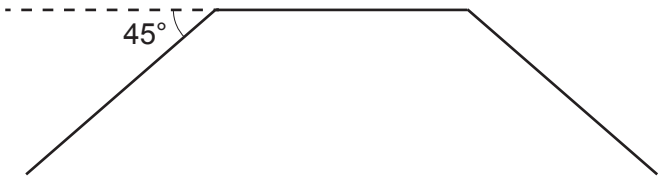


Diagram not drawn to scale

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7. In a speedboat race, competitors travel 8·5 km south from the start to buoy *A*. Then they travel 7 km east to buoy *B* and then travel directly back to the start. Calculate the total distance that the competitors travel in the race. [4]

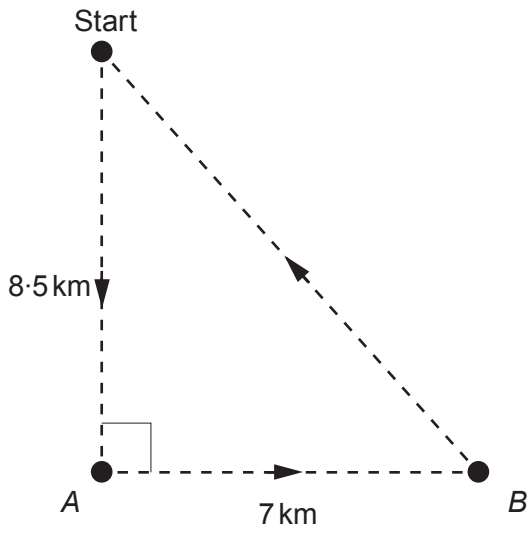


Diagram not drawn to scale

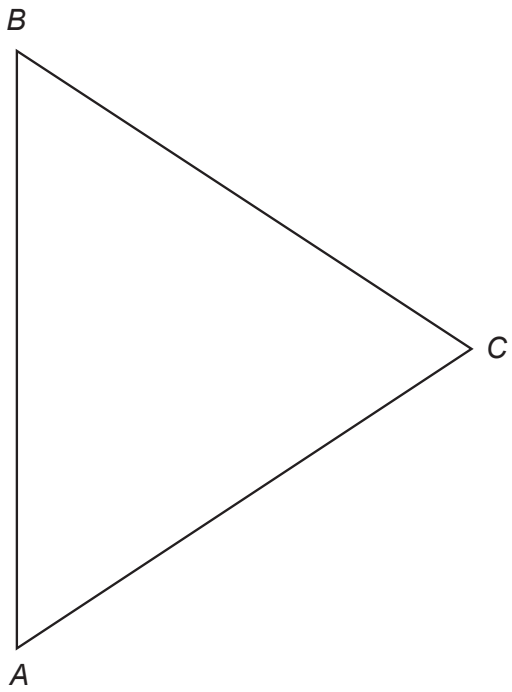
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8. Shade the region, inside the triangle below, that satisfies both of the following conditions:

- it is less than 5 cm from *AC,* and
- it is less than 4 cm from *B*. [3]



9. Find the value of $(9{\cdot}2 \times 10^5) - (3 \times 10^4)$. Give your answer in standard form. [2]

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10.

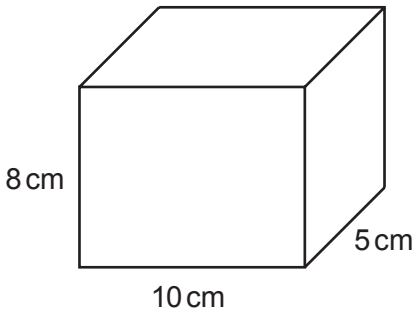


Diagram not drawn to scale

A cuboid made of metal has dimensions 10 cm, 8 cm and 5 cm. The mass of the cuboid is 1·1 kg. Calculate the density of the metal. State the units of your answer. [4]

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11. In a survey at a factory, 200 workers were asked to state their weekly earnings. The results of the survey are summarised in the table below.

Weekly earnings, s, in £	Frequency
$0 < s \leqslant 100$	18
$100 < s \leqslant 200$	22
$200 < s \leqslant 300$	60
$300 < s \leqslant 400$	84
$400 < s \leqslant 500$	16

(a) Complete the table below. [1]

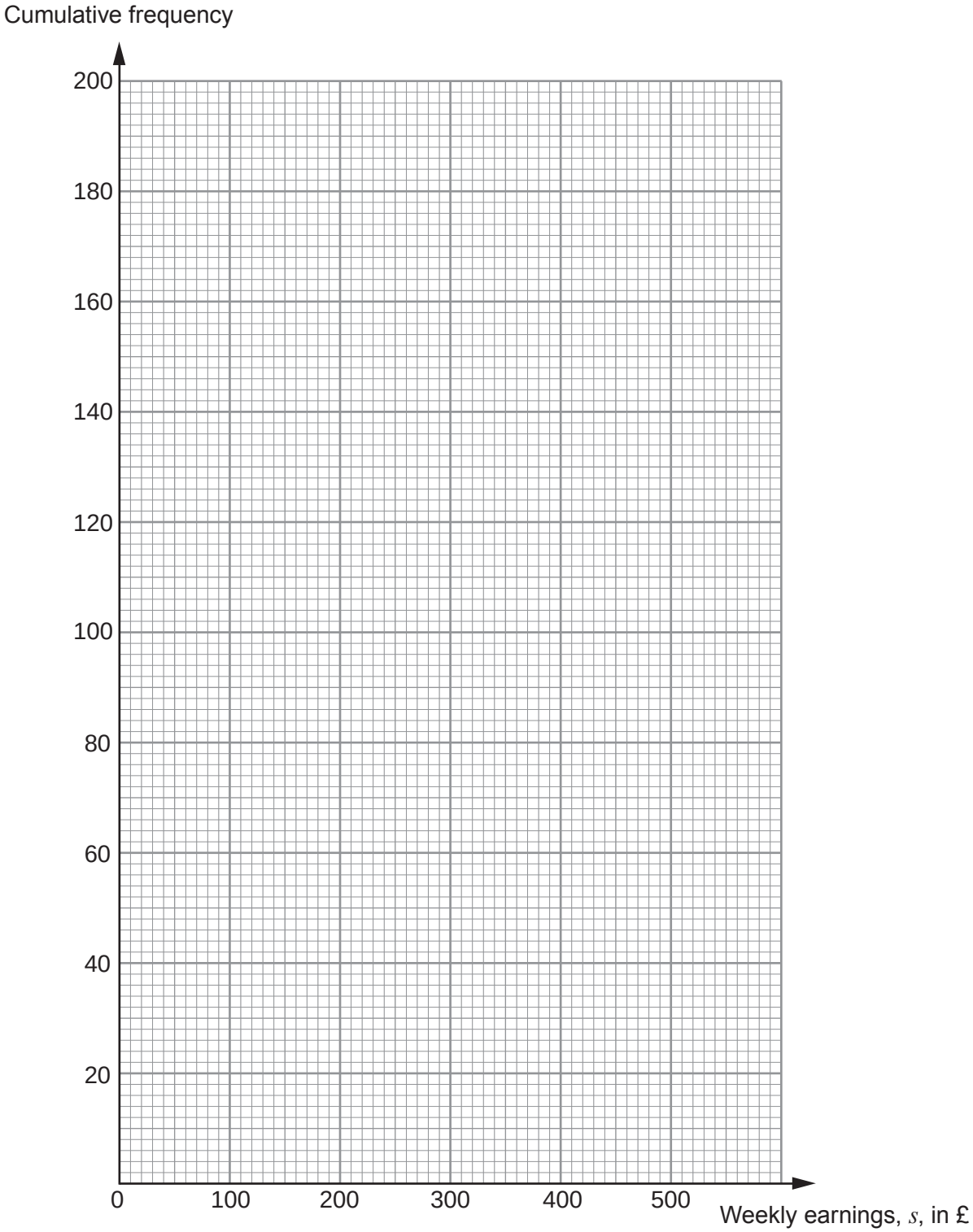
Weekly earnings, s, in £	$\leqslant 0$	$\leqslant 100$	$\leqslant 200$	$\leqslant 300$	$\leqslant 400$	$\leqslant 500$
Cumulative frequency	0					

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(b) Draw a cumulative frequency graph showing the earnings of the 200 workers. [3]



(c) Estimate the number of workers whose weekly earnings were more than £250. [2]

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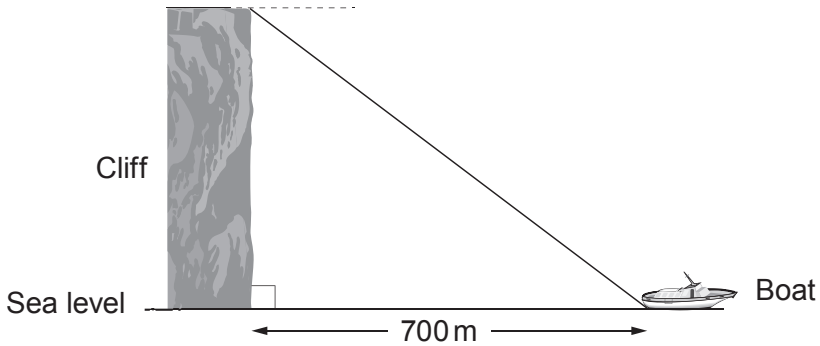
12. Solve the equation $\frac{12x-1}{5} - \frac{x}{2} = -4$. [4]

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13. From the top of a vertical cliff, the angle of depression of a sailing boat is 15°.
If the sailing boat is 700 m from the base of the cliff, calculate the height of the cliff above sea level. [4]



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14. *(a)* Use the graph paper on the opposite page to draw the graph of $y = x^2 - 2x$ for values of x from –2 to 4. [3]

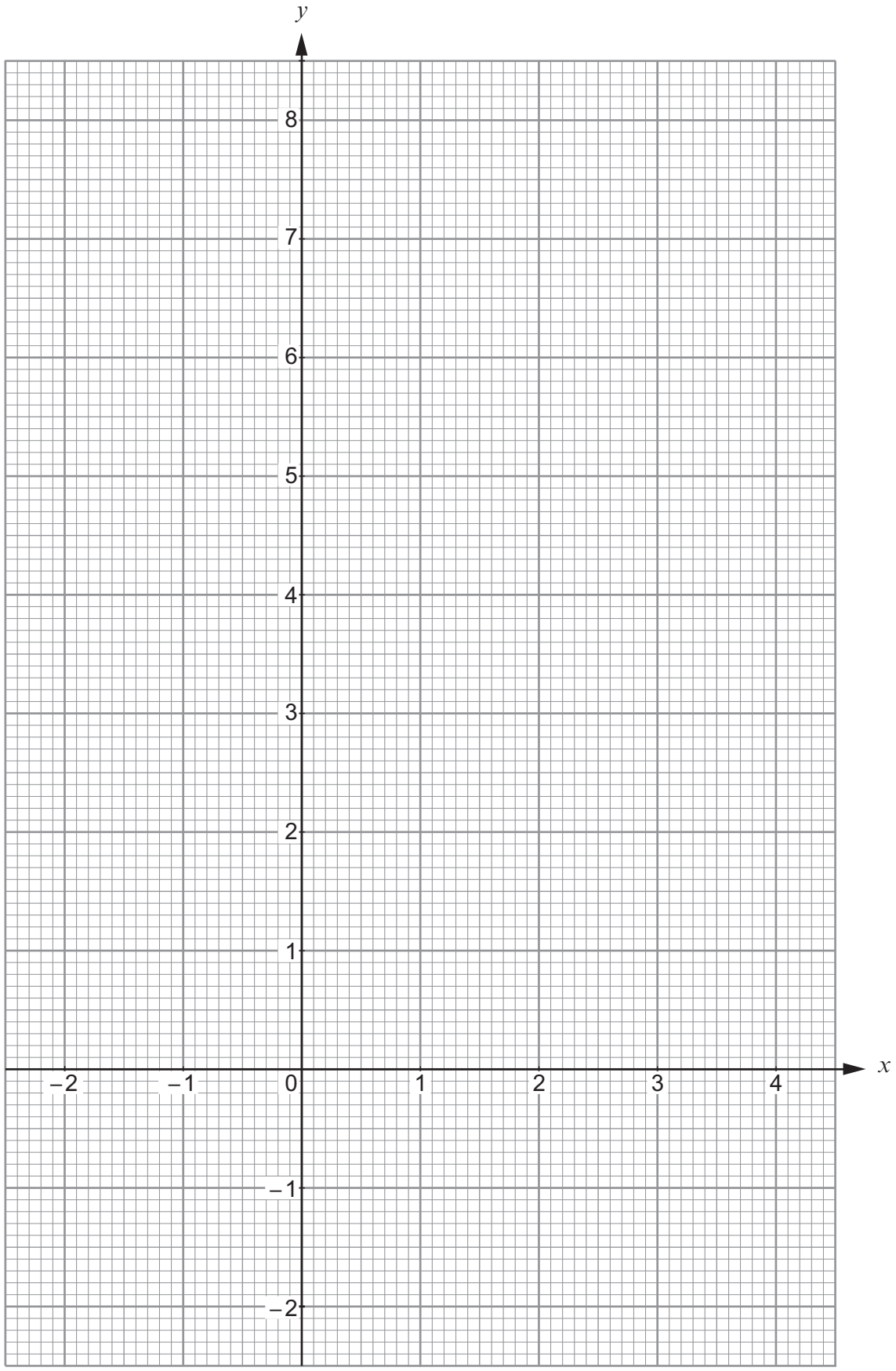
(b) Solve the equation $x^2 - 2x = 0$. [1]

(c) **Use your graph** to solve the equation $x^2 - 3x - 1 = 0$. [3]

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15. In a shot put event, competitors throw the shot from the throwing circle into a landing area. The landing area is part of a sector of a circle of radius 25 m, with its centre at the centre point of the throwing circle. The sector angle is 35°.
A diagram of the throwing circle and landing area is shown below.

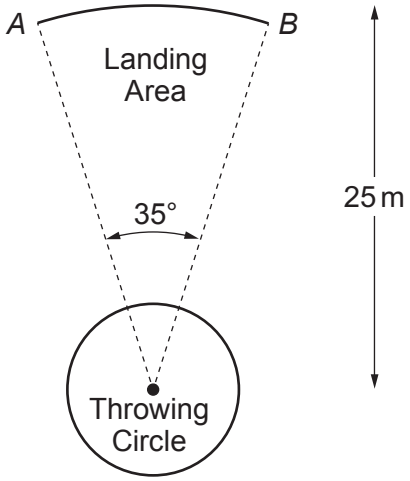


Diagram not drawn to scale

Calculate the length of the arc *AB*. [2]

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16. Given that p is inversely proportional to r^2, and that $p = 6$ when $r = 3$, find an expression for p in terms of r. [3]

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17. The triangle below has an area of 10 cm^2.
Calculate the value of x. [7]

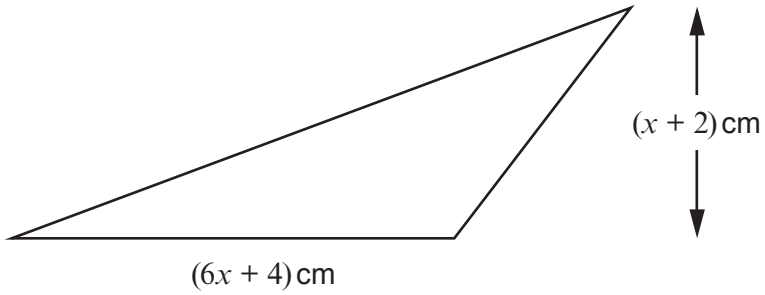


Diagram not drawn to scale

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18. A gardening tool made of steel has been manufactured by attaching two triangular pieces onto a piece in the shape of a parallelogram.
Using the information given in the diagram, calculate the size of $B\hat{F}C$. [7]

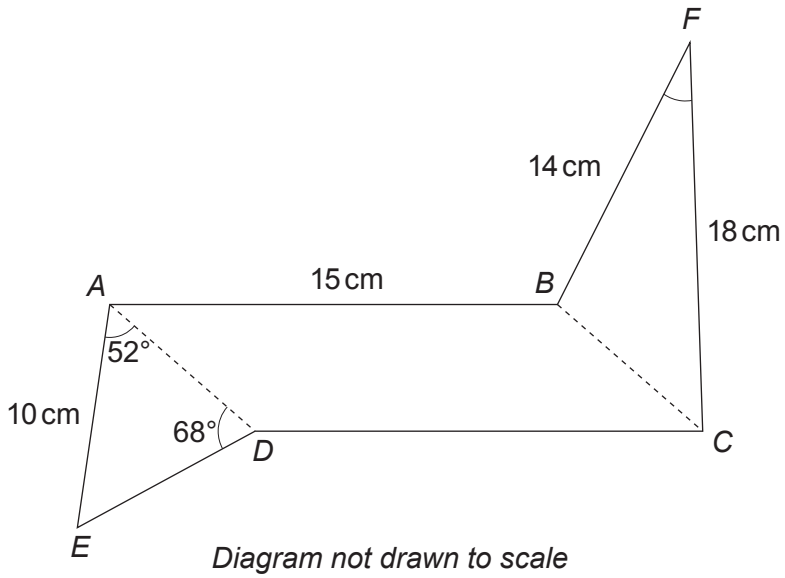


Diagram not drawn to scale

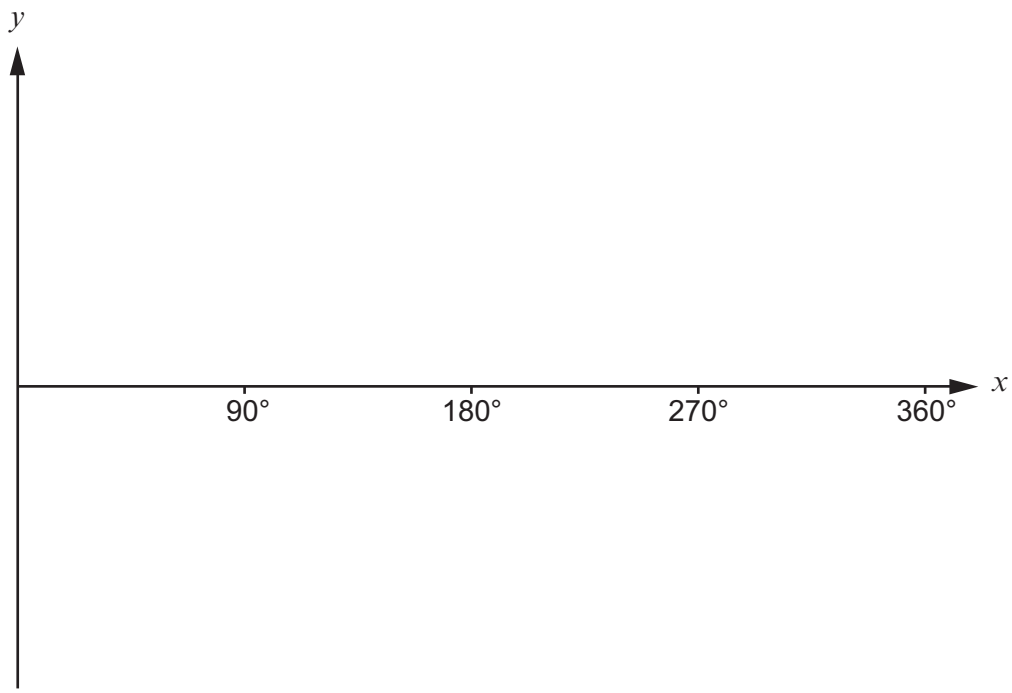
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Turn over.

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19. *(a)* On the axes below, sketch the graph of $y = \tan x$, for values of x from 0° to 360°. [2]



(b) Find all the solutions of the following equation in the range 0° to 360°. [2]

$$\tan x = -2$$

.....

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END OF PAPER

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

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GCSE MARKING SCHEME

MATHEMATICS - UNITISED

SUMMER 2014

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2014 examination in GCSE MATHEMATICS - UNITISED. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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Unit 1 - Higher Tier	4
Unit 2 - Foundation Tier	7
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Unit 3 - Foundation Tier	12
Unit 3 - Higher Tier	15

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UNIT 3 - FOUNDATION TIER

June 2014 UNIT 3 (calculator allowed) Foundation Tier	✓	Mark	Comments
1. **Ribbon marking for 1(a) and 1(b)** (a) (£)96 (£)34.2(0) (£)14.8(0) Total = 96 + 34.2(0) + 14.8(0)=(£)145 (b) 0.05×(£)145 or equivalent (£) 7.25	 ✓ ✓ ✓ ✓ 	 B1 B1 B1 B1 M1 A1 6	 FT candidate's values. FT 'their total'. (£) 152.25 gets M1 A1
2. (a) 457.8		B1 1	
2. (b) 458		B1 1	
2. (c) 500		B1 1	
3. 14		B2 2	B1 for sight of 32 or (–) 18
4. (a) E (is congruent to A)		B1	
4. (b) B and F (similar but not congruent)		B1	
4. (c) C (has half the area of shape E)		B1	
Ribbon marking for 4(d)(i) and 4(d)(ii) 4. (d) (i) 12 (cm) (ii)D (has the same perimeter as shape F)		 B1 B1 5	
5. **Ribbon marking for 5(a) and 5(b)** (a)Yellow = 4 Blue = 6 and Green = 6 (b) Both axes labelled, eg Frequency or number along vertical axis, Red, Yellow, Blue, Green along horizontal axis **and** uniform scale for frequency axis starting at 0. Four bars at correct heights and equal widths.	 ✓ ✓ ✓ ✓	 B1 B1 B2 B2 6	 FT their yellow provided whole number Or suitable code e.g. R, Y, B, G. F.T. their table values. B1 for any 2 or 3 correct bars on F.T.

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June 2014 UNIT 3 (calculator allowed) Foundation Tier	✓	Mark	Comments
6. (number of packets=)(£)15 ÷ 0.89 (=16.853932..)	✓	M1	1500 ÷ 89 or appropriate method.
16 (packets can be purchased)	✓	A1	
(Change=)(£)15 - 16 × (£) 0.89 or 1500(p)−16×89(p)	✓	M1	FT number of packets of biscuits
(£)0.76 or 76(p)	✓	A1	A0 for £76 or 0·76p
Look for • Spelling • Clarity of text explanations, • Consistent use of £ or p signs.	✓ ✓	QWC	QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar.
QWC2: Candidates will be expected to • Present work clearly, with words explaining process and steps AND • Make few, if any, mistakes in mathematical form, spelling, punctuation and grammar in their final answer.			QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR Evident weakness in organisation of material but using acceptable mathematical form, with few, if any, errors in spelling, punctuation and grammar.
QWC1 : Candidates will be expected to • Present work clearly, with words explaining process or steps OR • Make few, if any, mistakes in mathematical form, spelling, punctuation and grammar in their final answer.			QWC0 Evident weakness in organisation of material, and errors in use of mathematical form, spelling, punctuation and grammar.
		6	
7. Circle with AB as diameter		B1 1	Intention of circle accepted.
8. (a) (i) identify warmest and coldest (42°C and −39°C) and intention to subtract.		M1	M0 A0 for 42−39=3 M1A0 for −39−42=-81
81 (°C)		A1	M1A0 for 42− −39=3
8. (a) (ii) order data (−39, −5, 0, 1, 11, 11, 42) (median) 1 (°C)		M1 A1 4	Allow M1 for data ordered with one omitted. CAO
8. **8b(i) and 8b(ii) ribbon marked 8b(i) to be viewed with table below**			
(b) (i) Sum of numbers (126)	✓	M1	For an attempt to add the numbers
Sum/12	✓	m1	For a division by 12. FT one slip. (1+4+2+7+11+16+17+21+19+10+7+11)/12 gets M1 m1
	✓	A1	CAO
(mean=) 10·5 (°C)	✓	B1	
(range = 21 – 1=) 20		B2	B1 for a numerical comparison of mean and range with correct interpretation of one of mean or range.
(ii) A correct statement, in context, involving meanand range with interpretation.		6	

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June 2014 UNIT 3 (calculator allowed) Foundation Tier	✓	Mark	Comments
9. **Use overlay** (a) Angle $YX\hat{Z} = 98^{\circ}$ Angle $XY\hat{Z} = 40^{\circ}$ Completed triangle		B1 B1 B1 3	Allow ± 2° Allow ± 2° Only if at least one angle correct. **Complete reflection of the triangle gets B2**
9. **Use overlay** (b) Appropriate arcs above and below the given line with perpendicular bisector correctly constructed.		B2 2	B1 for at least two correct arcs.
10. Finding *A*: $A = 9$ Finding *B*: $2B=14$ $B=7$ Finding C: $C+8= 9+7+3$ or equivalent $C=11$	✓ ✓ ✓ ✓	B1 B1 B1 B1 B1 5	Seen or implied. Correct answer need not be on written on answer line. Seen or implied. F.T their *A* and *B*
11. $25\times24\times20$ (cm^3) OR $25\times24\times20\div1000$ (litres) $\div1500$ (cm^3) $\div1{\cdot}5$(litres) 8 (jugs)		M1 m1 A1 3	Or correct volume in units. Consistent units CAO
12. (a) $3x= 21$ $x = 7$		B1 B1 2	FT $ax=b$ if $a\neq1$.B0 for $\frac{21}{3}$ or if b is a multiple of a and fraction not simplified on FT.
12. (b) $75 = ½ \times 50 + 5 \times R$ $75 - 25 = 5 \times R$ $R = 10$		B1 B1 B1 3	Correct substitution. Isolating *R* term FT $aR=b$ if $a\neq1$ Accept embedded answer.
13. (Annual cost of units) 15000×4.028(p) 60420(p) or (£)604.2(0) (Fixed charge per year £6.98 × 12 =) (£)83.76 (cost of units + fixed charge per year – 48) ÷12 (£639.96÷12 or 63996÷12) (Monthly payment=) (£)53.33 or 5333(p)	✓ ✓ ✓ ✓ ✓	M1 A1 B1 M1 A1 5	Alternative mark scheme- Monthly cost (Monthly cost of units=)$15000\div12\times4.028$(p) (£)50.35 or 5035(p) (Monthly discount=)(48÷12=)(£)4 (£)604.2(0) ÷12 + 6·98 – 4 . (=£50·35+6·98 – 4) (Monthly payment=)(£)53.33 or 5333(p)
14. Ribbon marked. To be viewed with graph. (a) (£) 5400 (b) Appropriate straight line of best fit, with some points above and below the line at each end of the line, or touching at least one point at each end of the line. (c) Answer should be approximately (£) 7800		B1 B1 B1 3	FT from their line. B0 if no line drawn.

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June 2014 UNIT 3 (calculator allowed) Foundation Tier	✓	Mark	Comments
15. 1·62		B2 2	B1 for 1.6(23697…). All digits given must be correct.
16. 5 parts = 30 OR 30 ÷ 5 OR 7x – 2x = 30 OR equivalent (1 part) = 6 (Amount shared =) 6 × 9 = (£) 54	✓ ✓ ✓ ✓	M1 A1 m1 A1 4	Accept 5/9=30 FT their 1 part, provided M1 awarded. Award M1A1m1 A0 for answers of £12 and £42.
17. **To be viewed with diagram.** 360 ÷ 45 = 8 sides		 M1 A1 2	 Or appropriate working using the internal angle.
18. 3x – 6 = x + 2 3x – x = 2 + 6 x = 4		B1 B1 B1 3	For expanding the bracket. FT until 2nd error. Accept embedded answers
19. **To be viewed with diagram.** $8{\cdot}5^2 + 7^2$ $\sqrt{121{\cdot}25}$ = 11(·011…km) (Race distance =) 26·5(113…km)	 ✓ ✓ ✓ ✓	 M1 A1 A1 B1 4	 FT "their 11·011"+15.5 provided Pythagoras' attempted.

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UNIT 3 - HIGHER TIER

June 2014 UNIT 3 Higher Tier	✓	Mark	Comments
1. (a) 1.62		B2	B1 for 1.6(23697…). All digits given must be correct.
1. (b) 9(2 – y)		B1	
1. (c) 0.4 or equivalent.		B2	B1 for sight of 4 OR -3.6.
1. (d) 0.3 OR 3/10		B1	Accept embedded answers.
1. (e) 3x – 6 = x + 2 3x – x = 2 + 6 x = 4		B1 B1 B1	For expanding the bracket. FT until 2nd error. Accept embedded answers.
2. Ribbon marked. To be viewed with graph. (a) (£) 5400 (b) Appropriate straight line of best fit, with some points above and below the line at each end of the line, or touching at least one point at each end of the line. (c) Answer should be approximately (£) 7800		 B1 B1 B1	 Mark intention. FT from their line. B0 if no line drawn.
3. (Annual cost of units) 15000×4.028(p) 60420(p) or (£)604.2(0) (Fixed charge per year £6.98 × 12 =) (£)83.76 (cost of units + fixed charge per year – 48) ÷12 (£639.96÷12 or 63996÷12) (Monthly payment=)(£)53.33 or 5333(p) QWC: Look for • units - p, £ • spelling in at least 1 statement/sentence • clarity of text explanations QWC2: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer QWC1: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer	 ✓ ✓ ✓ ✓ ✓ <

June 2014 UNIT 3 Higher Tier	✓	Mark	Comments
7. To be viewed with diagram.			
$(SB^2 =)\ 8.5^2 + 7^2$	✓	M1	
$(SB^2 =)\ 121.25$ or $SB = \sqrt{121.25}$	✓	A1	
$(SB =)\ 11(.011\ldots km)$	✓	A1	
(Race distance =) 26.5(113…km)	✓	B1	FT 'their 11.011' + 15.5 provided Pythagoras attempted.
8. **Use Overlay.**			
Correct line drawn.		B1	Mark intention ±2mm.
Correct arc drawn from B.		B1	±2mm.
Correct region identified within the triangle.		B1	FT for a region bounded by a straight line crossing AB and BC and an arc centre B but outside tolerances.
9. 920000 – 30000 (= 890000)		M1	OR $9.2\times10^5 - 0.3\times10^5$ OR $92\times10^4 - 3\times10^4$ OR 89×10^4 OR 890×10^3
$= 8.9 \times 10^5$		A1	
10. (Volume of block =) $10 \times 8 \times 5$ (=400) (cm^3)	✓	B1	
(Density of metal =) $1100 \div 400$ OR $1.1 \div 400$ OR $1.1 \div 0.0004$	✓	M1	FT 1100 or 1.1 ÷ 'their volume' provided it is a product. Volume may be given in another metric unit.
$= 2.75$ OR 0.00275 OR 2750	✓	A1	
Appropriate unit g/cm^3 kg/cm^3 kg/m^3	✓	U1	
11. Ribbon marked			
(a) 18, 40, 100, 184, 200		B1	
(b) Use Overlay. To be viewed with table from (a).			
Idea, unique vertical plotting of the upper class boundary consistently with the corresponding cumulative frequency.		M1	FT, for all marks, their cumulative frequencies, provided an attempt made to be cumulative.
2 points plotted correctly.		A1	
All points correct and joined by straight lines or a curve, including to 0.		A1	SC1 if points plotted at mid-points and joined by straight lines or a curve, including to0.
(c) To be viewed with graph from (b).			
200 – their reading at 250 evaluated correctly.		B2	Accept 130. B1 for sight of their reading at 250 OR 84+16+½ of 60.
12. Method of working with all 3 terms to clear the 2 fractions.	✓ ✓	M2	M1 for appropriate working for 2 of the 3 terms. Clearing implies denominator of 1.
Correctly expanding brackets and collecting like terms i.e.			
$(24x - 2 - 5x = -40$ leading to) $19x - 2 = -40$	✓	A1	FT provided at least M1 awarded. FT until 2nd error.
$x = -2$	✓	A1	Mark their final answer. *If no marks awarded SC1 for sight of (19x − 2)/10.*
13. To be viewed with diagram.			
15º marked on diagram or used correctly.	✓	B1	
$h = \tan 15º \times 700$ OR $h = 700/\tan 75°$	✓✓	M2	FT their angle of depression. M1 for $\tan 15º = h/700$ OR M1 for $\tan 75° = 700/h$
$h = 187(.564\ldots)$ or 188	✓	A1	An answer of 2612(.435…) may earn B0M2A1 or B1M0A0. Watch out for compensating errors.
14. Ribbon marked.			
(a) Use overlay.			
Calculation of at least 3 of the coordinates.		B1	(-2,8) (-1,3) (0,0) (1,-1) (2,0) (3,3) (4,8)
Plotting at least 4 correct points.		P1	
Correct curve.		C1	CAO.
(b) To be viewed with graph from (a).			
0 and 2		B1	FT from their non-linear graph.
(c) To be viewed with graph from (a).			
Rearranging equation to $x^2 - 2x = x + 1$		M1	
Line $y = x + 1$ drawn		A1	
Solution of approximately -0.3 AND 3.3		A1	FT their curve. A solution obtained using the formula gets M0A0A0.
15. To be viewed with diagram.			
$(35/360)\times2\pi\times25$		M1	
$= 15.2(...)$ up to 15.3		A1	Accept an answer of 15 from correct working.
16. $p = k/r^2$ or $p \propto 1/r^2$		B1	
$6 = k/3^2$		M1	FT for non-linear start only.
$p = 54/r^2$		A1	

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June 2014 UNIT 3 Higher Tier	✓	Mark	Comments
17. To be viewed with diagram. (Area =) $(6x+4)(x+2)/2$ $3x^2 + 8x + 4 = 10$ OR $6x^2 + 16x + 8 = 20$ $3x^2 + 8x - 6 = 0$ OR $6x^2 + 16x - 12 = 0$ $\frac{-8 \pm \sqrt{(8^2 - 4\times3\times-6)}}{2\times3}$ OR $\frac{-16 \pm \sqrt{(16^2 - 4\times6\times-12)}}{2\times6}$ $(-8 \pm \sqrt{136})/6$ OR $(-16 \pm \sqrt{544})/12$ x = 0.6(10... or -3.276…) x = 0.6(10...)	✓ ✓ ✓ ✓ ✓ ✓ ✓	M1 m1 A1 M1 A1 A1 A1	Allow 1 slip. CAO. FT their equation provided it's a quadratic of comparable difficulty. Allow one slip in substitution. CAO from 'their quadratic.' CAO from 'their quadratic.' Realisation that x = -3.2 is not a valid solution. FT provided 2nd M1 awarded AND 1 possible and 1 impossible solution.
18. To be viewed with diagram. Strategy to find AD using sine rule, equating it to BC, then using cosine rule to find angle BFC. $AD = 10/\sin68 \times \sin60$ AD = 9(.340…) $\cos BFC = \frac{14^2 + 18^2 - AD^2}{2\times14\times18}$ (0.8586452...) *BFC* = 30.8(351…º)	✓ ✓ ✓ ✓ ✓	S1 M2 A1 M2 A1	M1 for AD/sin60 = 10/sin68 FT their derived AD. M1 for $AD^2 = 14^2 + 18^2 - 2\times14\times18\times\cos BFC$
19. (a) Correct sketch, with inflection points at (0,0), (180,0) and (360,0) AND vertical asymptotes at x = 90 and x = 270.		B2	B1 for a sketch with inflection points at (0,0), (180,0) and (360,0) OR vertical asymptotes at x = 90 and x = 270.
19. (b) 116(.565…º) or 117 (°) 296(.565…º) or 297(°)		B1 B1	 FT 180 + their first angle. MR-1 if additional angles given within the range 0 to 360.

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4353/02

MATHEMATICS (UNITISED SCHEME)

UNIT 3: Calculator-Allowed Mathematics
HIGHER TIER

A.M. MONDAY, 20 January 2014

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

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 **5***(a)*.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**9**	
2.	**6**	
3.	**3**	
4.	**4**	
5.	**7**	
6.	**2**	
7.	**3**	
8.	**5**	
9.	**5**	
10.	**4**	
11.	**5**	
12.	**4**	
13.	**4**	
14.	**6**	
15.	**8**	
16.	**4**	
17.	**4**	
18.	**7**	
Total	**90**	

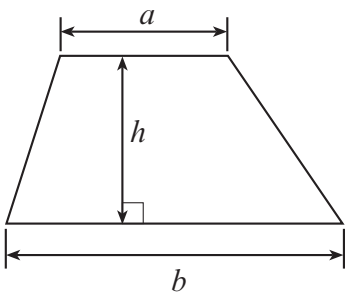
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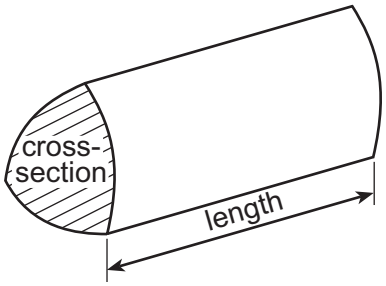
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Formula List

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

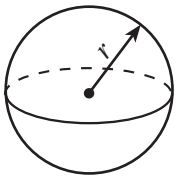


Volume of prism = area of cross-section × length



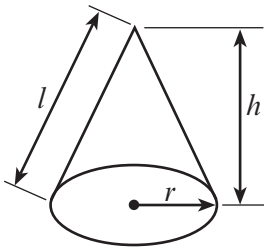
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

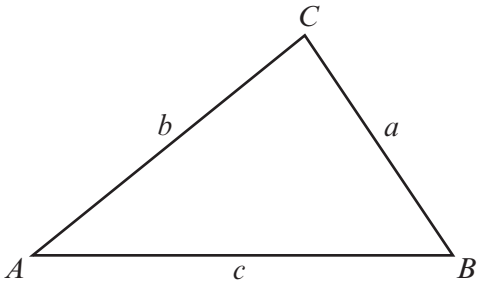


In any triangle ABC

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

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

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1. *(a)* Factorise $12y + 20y^2$. [2]

(b) Given that $x = 20$, $y = -3$ and $z = 5$, evaluate $3x + y^2z$. [2]

(c) Solve the equation $\frac{4x}{5} = 20$. [2]

(d) Solve the equation $6x - 19 = 2x + 12$. [3]

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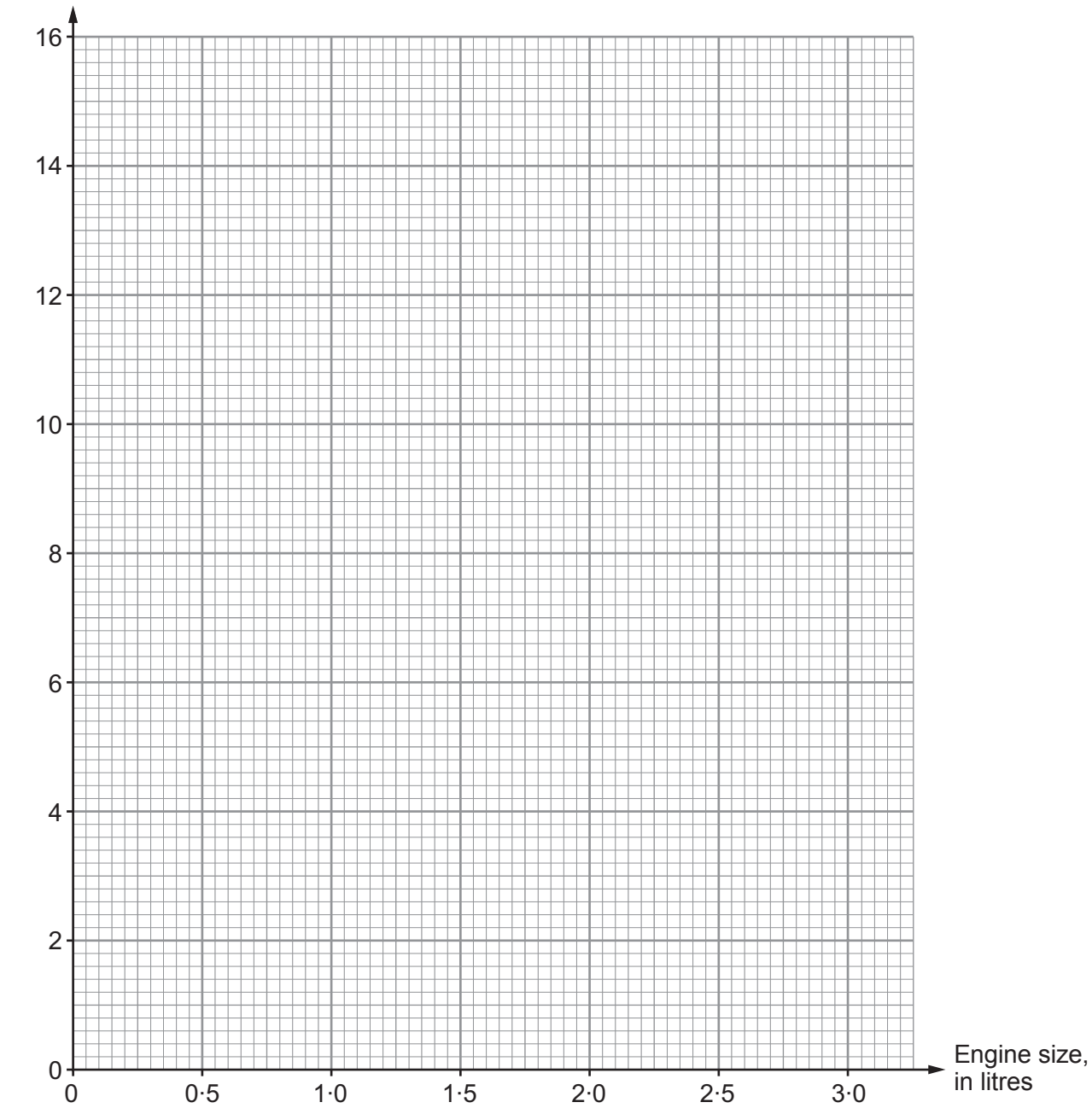
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2. The table shows the engine sizes of six cars and the distance they each travel per litre of petrol.

Engine size, in litres	1·0	2·2	1·4	2·0	2·5	1·7
Distance travelled per litre, in km	12·0	7·4	10·6	7·6	5·8	8·2

(a) Draw a scatter diagram to display this data. [2]



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(b) Describe the relationship between engine size and distance travelled per litre shown by your scatter diagram. [1]

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.....

(c) The mean engine size of the six cars is 1·8 litres.
The mean distance travelled per litre of petrol is 8·6 km.
Draw a line of best fit on your scatter diagram. [2]

(d) Another car has an engine of size 1·6 litres.
Use your line of best fit to estimate the distance it would travel per litre of petrol. [1]

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3. A car travels 90 miles in 2 hours 30 minutes. Calculate the average speed of the car in mph. [3]

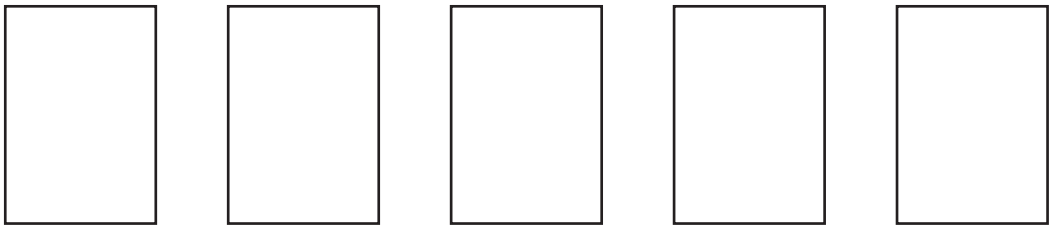
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Five **single digit numbers** need to be written on the cards above.
The median, mode, mean and range of the numbers must all be 5.
Write a possible set of **single digit numbers** on the cards, in ascending order. [4]

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5. Alan, Ben and Carwyn are three brothers.
Alan has 3 children, Ben has 2 children and Carwyn has 1 child.

(a) *You will be assessed on the quality of your written communication in this part of the question.*

Alan, Ben and Carwyn's parents win £5700.
They decide to share this money between Alan, Ben and Carwyn, in the ratio of the number of children that they each have.
How much money does each brother receive?
You must show all your working. [5]

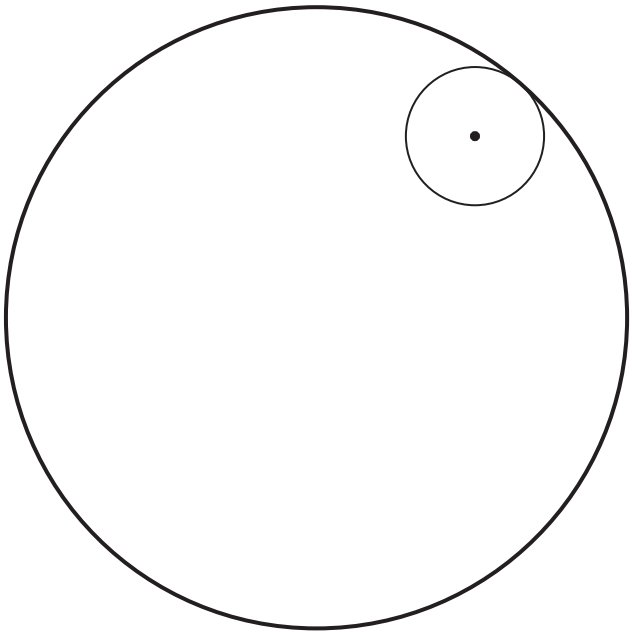
(b) Alan is happy with this suggestion.
Carwyn argues that it is unfair and that the money should be divided equally between the three brothers.
Will this way of sharing the money affect Ben's share? Show your working. [2]

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6. The diagram shows a coin inside a large circular ring.
The centre of the coin is shown.
The coin is rolled around the inside of the ring, so that it is always in contact with the ring.
Sketch the locus of the centre of the coin as it is rolled around the inside of the ring. [2]



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7.

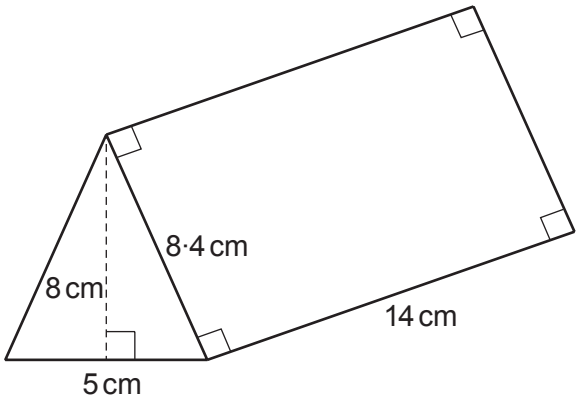


Diagram not drawn to scale

Calculate the volume of the triangular prism shown.
State the units of your answer. [3]

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8. The diagram shows a square drawn inside a regular hexagon.

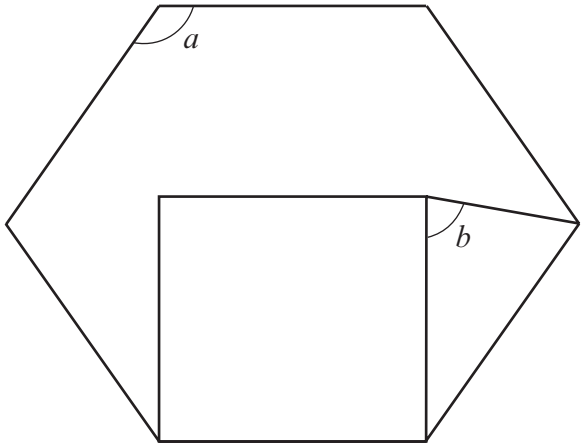


Diagram not drawn to scale

(a) Calculate the size of angle a. [2]

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a = ... °

(b) Calculate the size of angle b. [3]

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b = ... °

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9. The length of the rectangle below is 2 cm longer than the width.
The area of the rectangle is 70 cm^2.
Use the method of trial and improvement to find the width, correct to 1 decimal place. [5]



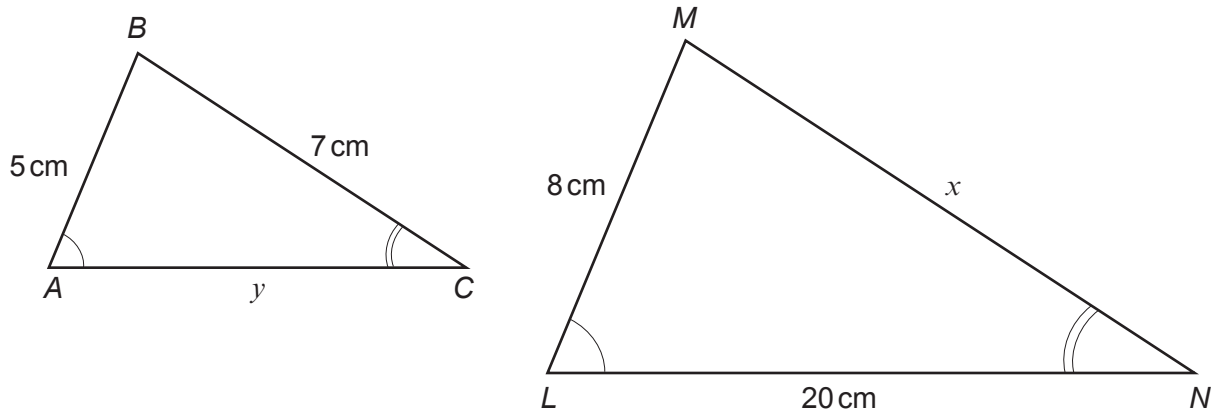
Diagram not drawn to scale

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10. The diagram shows two similar triangles *ABC* and *LMN*.



Diagrams not drawn to scale

(a) Calculate the length x. [2]

(b) Calculate the length y. [2]

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11. *(a)* Find the value of $(2 \times 10^{-2}) + (3 \times 10^{-1})$. Give your answer in standard form. [2]

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(b) Siwan runs a 20 km race. Her average stride length for the race is 125 cm.
Calculate the number of strides Siwan takes to run the 20 km race.
Give your answer in standard form. [3]

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12. A ship sails 80 km due south from a port *P* to a point *Q*. It then sails 45 km due west to a point *R*.
The diagram below shows the journey of the ship.

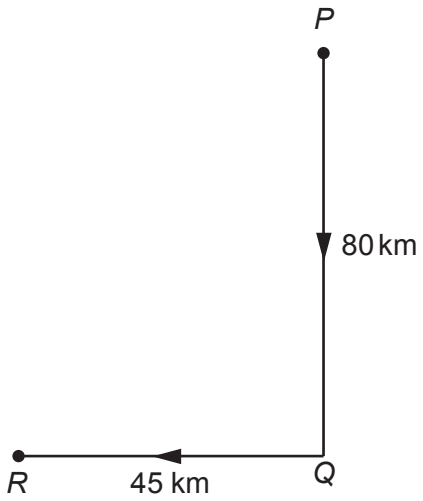


Diagram not drawn to scale

On what bearing does the ship now need to sail to travel directly back to port *P*? [4]

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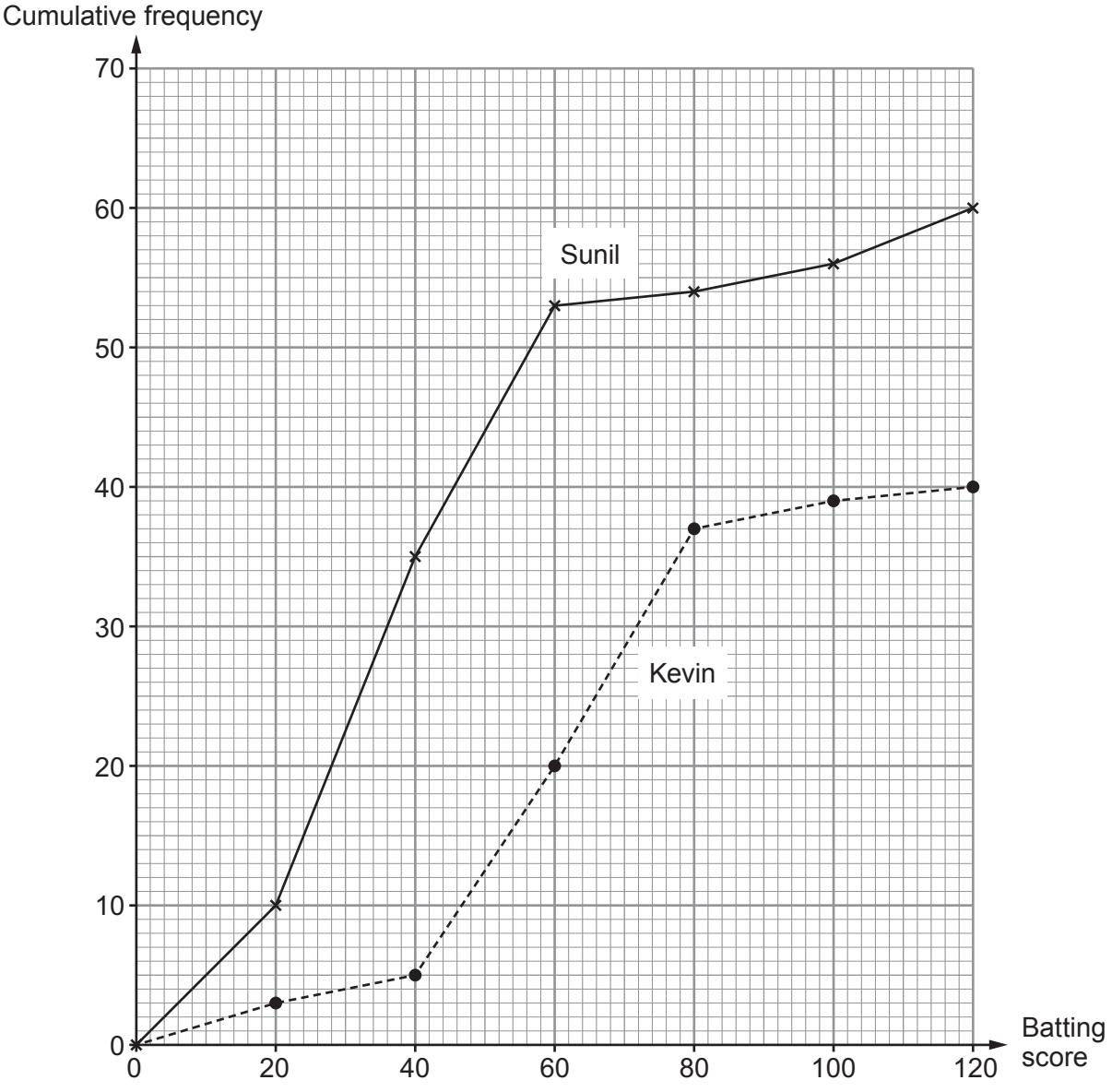
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13. Two cricketers, Sunil and Kevin, keep a record of their batting scores over a season. The cumulative frequency diagram below shows their batting scores over this season.



(a) Find the interquartile range for Sunil. [2]

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(b) Who has the higher average batting score, Sunil or Kevin? Give a reason for your answer. [2]

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14. When a ball is dropped, the distance it drops, d, is directly proportional to the square of its time of flight, t.
It is found that a ball takes 1 second to drop 4·9 metres.

(a) Find an expression for d in terms of t. [3]

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(b) Complete the following table. [3]

Distance, d, in metres	4·9		28·2
Time of flight, t, in seconds	1	2	

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15. *(a)* (i) Show that $(x + 2)^2 + 3(x + 1) - 11$ can be simplified to $x^2 + 7x - 4$. [2]

(ii) Solve the equation $x^2 + 7x - 4 = 0$, giving your answers correct to 2 decimal places. [3]

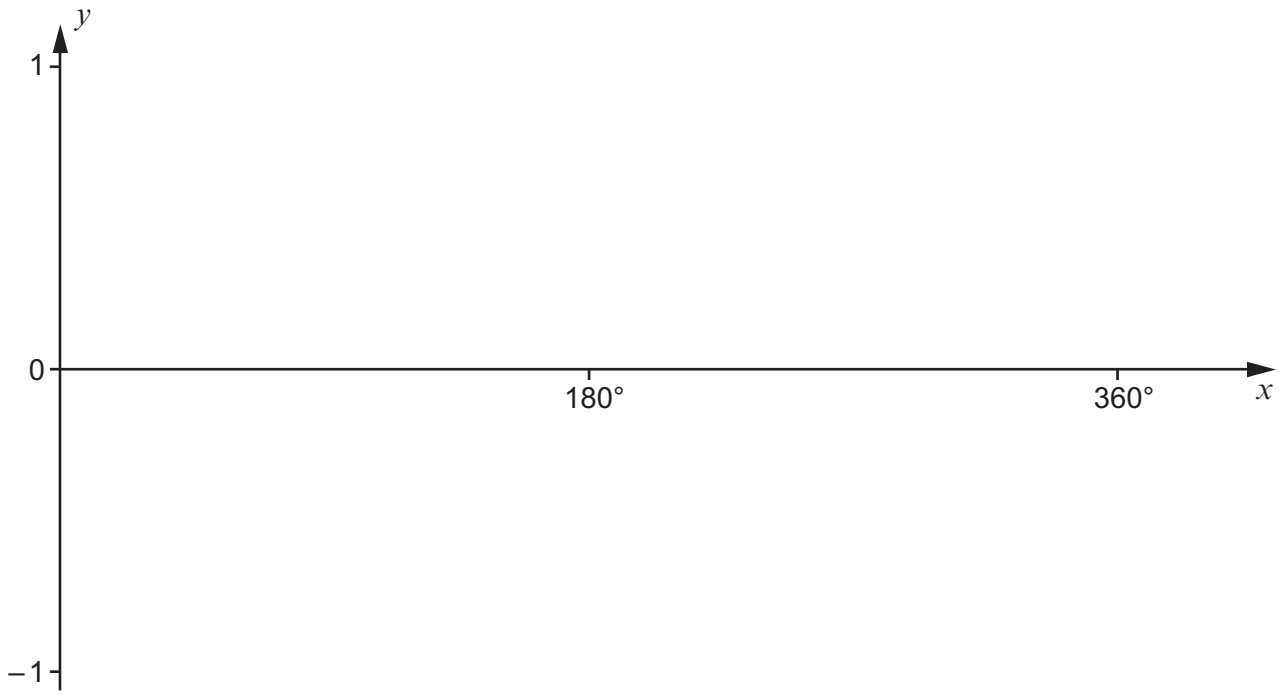
(b) Factorise the expression $5x^2 + 22x - 15$ and hence solve the equation $5x^2 + 22x - 15 = 0$. [3]

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16. *(a)* On the axes below, sketch the graph of $y = \cos x$, for values of x from 0° to 360°. [2]



(b) Find all the solutions of the following equation in the range 0° to 360°. [2]

$$\cos x = -0{\cdot}4$$

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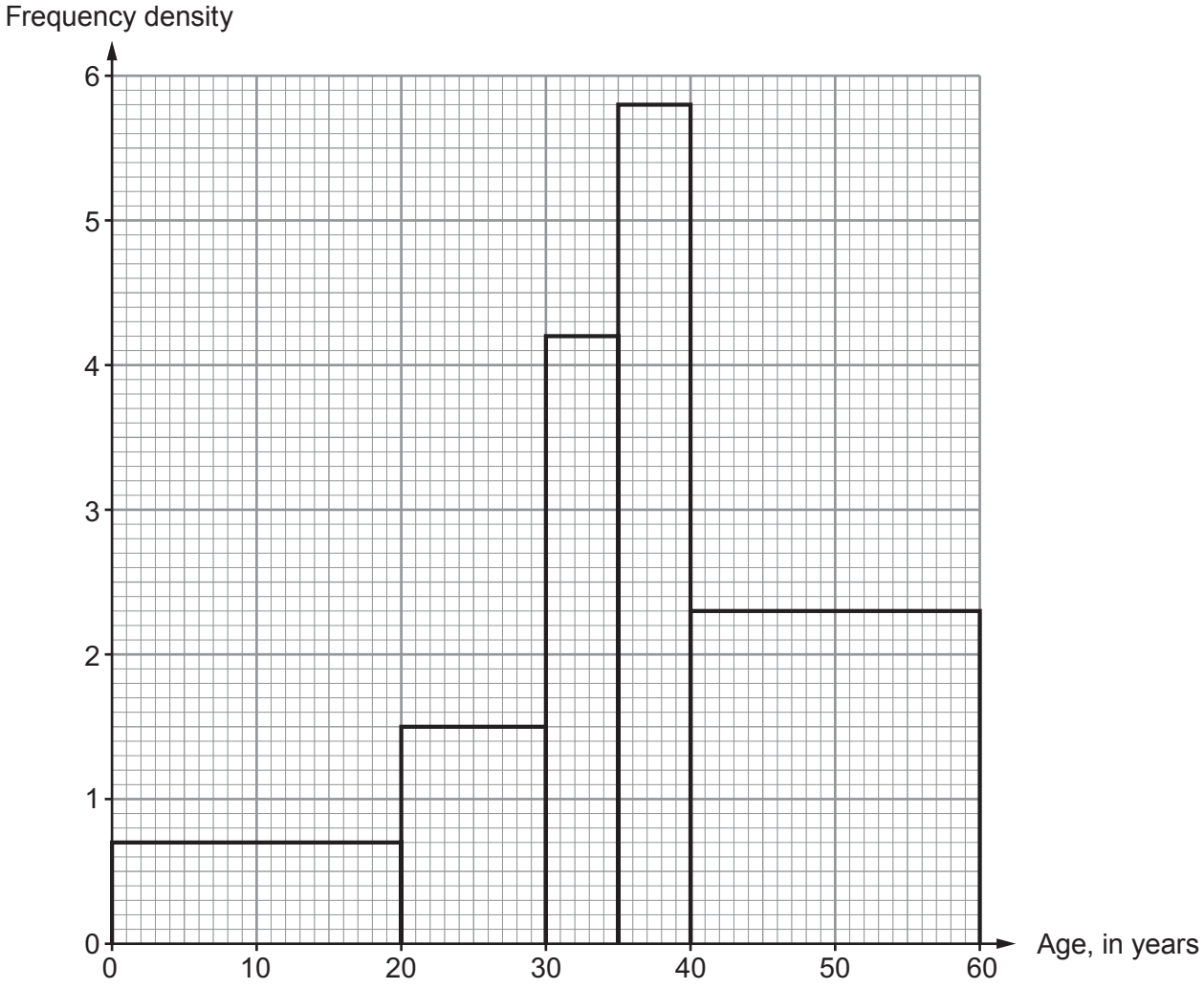
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17. The histogram below shows the ages of the people staying in a hotel one weekend.



(a) Use the histogram to complete the grouped frequency table below. [2]

Age in years	$0 \leqslant a < 20$	$20 \leqslant a < 30$	$30 \leqslant a < 35$	$35 \leqslant a < 40$	$40 \leqslant a < 60$
Frequency					

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(b) Calculate an estimate of the number of people whose ages are less than 24 years old. [2]

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18.

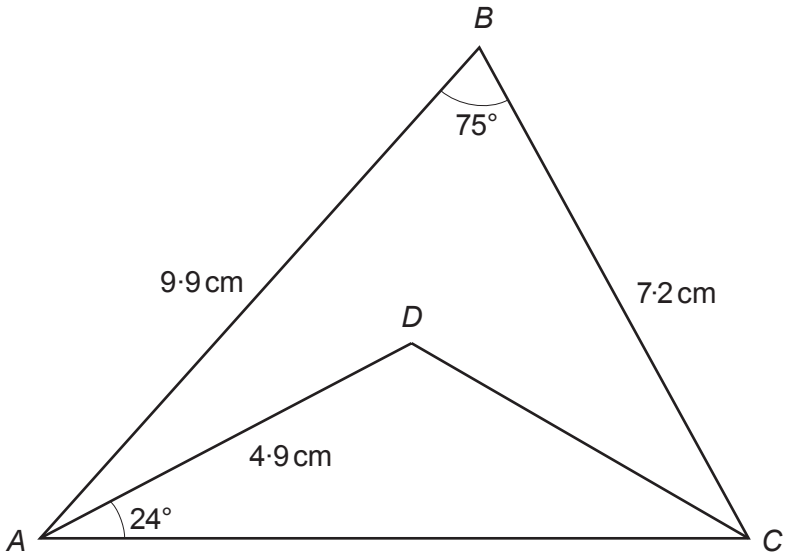


Diagram not drawn to scale

Calculate the area of the quadrilateral *ABCD*. [7]

END OF PAPER

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GCSE MARKING SCHEME

MATHEMATICS - UNITISED

JANUARY 2014

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2014 examination in GCSE MATHEMATICS - UNITISED. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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UNIT 3 - FOUNDATION TIER

UNIT 3 (calculator allowed) Foundation Tier	Mark	FINAL MARK SCHEME Comments
1. (a) 6(.00) 3.69 4(.00) 13.69 (b) 2 (rolls) (c) 11.98÷2 or equivalent (£) 5.99 ISW	B1 B1 B1 B1 B1 M1 A1 7	 FT candidate's values for at least one B1. FT candidate's total.
2. (a) 57 (b) 57.4	B1 B1 2	
3. (a) 1250 (millilitres) (b) 1 (litre) (c) 250÷80 3 full cups	B1 B2 M1 A1 5	 B1 for sight of 1000(ml) as final answer or in working If units are given they must be correct. 1000 litres without working gets B0 FT their volume from (a) Amount left over, if given, must be correct for A1 e.g. 3.125 with no working gets M1 A0. 3 cups 10ml left over gets M1 A1.
4. (a) Evidence of counting squares 35-38 (square metres) (b) 20 (m)	M1 A1 B1 3	
5. (a) 31.36 (b) 1024 (c) 5.3	B1 B1 B1 3	
6.(Cost of individual tickets=) 2×4.95 (£9.90) + 3×4.60(£13.80) = (£) 23.7(0) (Saving = 23.7 − 14.5=) (£) 9.2(0) Look for • Spelling • Clarity of text explanations, • Consistent use of £ or p signs. • Consistent use of mathematical symbols. QWC2: Candidates will be expected to • Present work clearly, with words explaining process and steps AND • Make few, if any, mistakes in mathematical form, spelling, punctuation and grammar in their final answer. QWC1 : Candidates will be expected to • Present work clearly, with words explaining process or steps OR • Make few, if any, mistakes in mathematical form, spelling, punctuation and grammar in their final answer.	M1 A1 A1 QWC2 <

UNIT 3 (calculator allowed) Foundation Tier	Mark	FINAL MARK SCHEME Comments
7. S and Q	B2 2	B1 for at least one correct answer and no more than one incorrect answer.
8. (a) 13 (b) 7	B1 B1 2	Accept embedded answers
9. (a) April (b) 11 (°C) (c) 100 (mm) (d) Spring, Summer, Autumn, Winter indicated along one axis AND vertical axis correctly labelled Uniform scale for frequency axis starting at 0 Four bars at correct heights	B1 B1 B1 B1 B2 6	 Or indicated on the bars themselves. B1 for at least 2 correct bars, consistent with their scale. Bars must be of equal width.
10. (a) $12\times5-5\times3-3\times2$ (= 60 −15 − 6) 39 (b) Strategy to explore possible combinations. $18\times5=90$ $90-3=87$ so 18 correct answers (with one incorrect answer). The mark drops to 85 from 87 so the 20th question scores −2, (so the last question was not answered).	M1 A1 S1 B1 B1 5	Sight of two of 60, −15, −6 and an attempt to combine marks gets M1 39 alone get 2 marks. Evidence of trial and improvement or correct answer gets S1. Sc2 for correct answer with no working Correct calculations infer correct answer
11. First arc(s) crossing the given line. Final arc and line with angle of 60° at the point *X*	B1 B1 2	Arc must be big enough for the second arc to cut it. B2 for correct construction at X Allow ±2°**.** If no arc(s) B0 B0. Arc must be big enough for the second arc to cut it. B1 maximum for a correct construction elsewhere on the line.
12. (a) 5 (miles) (b) 30 (mins) (c) Reference to decrease in steepness, gradient or equivalent after horizontal section. (d) A horizontal line stopping at the point (14:00, 7) Point at (16:12, 12) Points joined with straight lines.	B1 B1 E1 B1 B1 B1 6	 Accept half an hour Ignore calculations. Explanation should refer to gradient, slope or steepness or any other evidence **from the graph**. B1 for a horizontal line that continues past (14:00, 7) so long as no other line is drawn. FT their points, provided one point correct and walk finishes at 12 miles.
13. (a) Method of finding the number of whole blocks that fit in length, width and height. $9\times5\times4$ 180 (blocks) (b) 1600 – 400 ÷ 60 20 (blocks)	M1 m1 A1 M1 m1 A1 6	May be implied by sight of two of 9, 5 or 4 Multiplication of three values, at least two correct C.A.O. SC1 for 26910÷125 or 215.28 or 215 C.A.O

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UNIT 3 (calculator allowed) Foundation Tier	Mark	FINAL MARK SCHEME Comments
14. (a) $57 = 4\times3 + 5C$ $5C = 45$ $C = 9$ (b) $6x - 2x = 12 + 19$ $4x = 31$ $x = 7.75$ or $7\frac{3}{4}$	B1 B1 B1 B1 B1 B1 6	Correct substitution. FT until second error. Isolating the C. FT if $aC = b$ and $a \neq 1$. Accept embedded answer. FT until 2nd error. Accept embedded answer. Mark final answer. Accept improper fractions provided they are in simplest form.
15 2, 5, 5, 6, 7 or 3, 4, 5, 5, 8 Median of 5. At least two 5s entered with no other number occurring more times. Difference of 5 between the highest and lowest numbers. The total of the 5 numbers being 25, provided not all 5s.	 B1 B1 B1 B1 4	Use of 2 digit numbers, mark as a misread.
16.(a) (Each share = £)5700 ÷ (1+2+3) (= £950) (Alan receives £ 3×950 =£) 2850, (Ben receives £ 2×950 =) 1900 and (Carwyn receives £) 950. (b) 5700 ÷ 3 = 1900 OR Ben gets the same fraction (2/6 = 1/3) No (it does not affect the amount Ben receives).	M1 A2 B1 E1 5	FT 'their 950' for A1 if all amounts correct. A1 for any 2 correct amounts. A1 for no labels or incorrect labels. Do not award E1 if B1 not awarded. FT Ben's share from (a).
17. (a) All points plotted correctly. (b) Negative correlation OR "As engine size increases the distance travelled on one litre decreases".	B2 E1 3	B1 for 3, 4 or 5 points plotted, not joined or. B1 for all points plotted correctly but joined. The word correlation is needed if the first answer used. Accept inverse relationship.
18. Sketch of circle of correct radius drawn.	B2 2	Allow freehand sketch. Use overlay. (±5mm) B1 for intention of sketching the correct circle using points, or arcs, OR B1 for intention of correct circle but outside the tolerance. Ignore other lines on the diagram drawn to find the centre of the circle. Penalise −1 for other loci drawn that are not intended to find the centre of the circle.
19. ½ × 5×8×14 280 cm^3	M1 A1 U1 3	
20. Interior Angle of Hexagon ((6 - 2) × 180) ÷ 6 120(°) ($x = (180 - 120)/2 =$) or ($x = 120 - 90 =$) or ($x = 120 \div 4 =$) 30(°)	M1 A1 B1 3	Or 180 – (360 ÷ 6) Or 360 ÷ 3 Or 60×2 Working may be implied from diagram. FT "their 120°" B1 requires evidence of an appropriate method used

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UNIT 3 - HIGHER TIER

Unit 3 Higher Tier		FINAL MARK SCHEME Comments
1. (a) $4y(3 + 5y)$	B2	B1 for $4y(3\ldots.)$ or $4y(\ldots..+ 5y)$ or correct partial factorisation.
(b) 105	B2	B1 for answer of 15 OR B1 for adding 45 to their first term or for sight of +45.
(c) $4x = 20 \times 5$ OR $\frac{x}{5} = \frac{20}{4}$	M1	
$x = 25$	A1	
(d) $6x - 2x = 12 + 19$	B1	FT until 2nd error.
$4x = 31$	B1	
$x = 7.75$ or $7\frac{3}{4}$	B1 9	Mark final answer. Accept improper fractions provided they are written in simplest form. Accept embedded answers.
2. (a) All points plotted correctly.	B2	B1 for 3, 4 or 5 points plotted correctly, not joined, or B1 for all points plotted correctly but joined.
(b) Negative correlation OR "As engine size increases the distance travelled on one litre decreases".	E1	The word correlation is needed if the first answer used. Accept inverse relationship.
(c) Appropriate straight line of best fit drawn through (1.8, 8.6), with some values above and below the line.	B2	B1 for unreasonable line of best fit drawn through (1.8, 8.6) B1 for reasonable line of best fit but not drawn through (1.8, 8.6).
(d) From their line of best fit ± 0.1 (km)	B1 6	If no line of best fit, accept answer of 9.4 to 9.6 inclusive.
3. 90 ÷ time	B1	Accept 90 ÷ 2.3 for B1 only
90 ÷ 2.5	M1	
= 36 (mph)	A1 3	
4. 2, 5, 5, 6, 7 or 3, 4, 5, 5, 8		Use of 2 digit numbers, mark as a misread.
Median of 5.	B1	
At least two 5s entered with no other number occurring more times.	B1	
Difference of 5 between the highest and lowest numbers.	B1	
The total of the 5 numbers being 25, provided not all 5s	B1 4	
5. (a) (Each share = £) 5700 ÷ (1+2+3) (=£950)	M1	FT 'their 950' for A1 if all amounts correct.
(Alan receives £ 3×950 =£)2850,	A2	A1 for any 2 correct amounts.
(Ben receives £ 2×950 =£)1900 and		A1 for no labels or incorrect labels.
(Carwyn receives £) 950.		
QWC: Look for • units £ • spelling in at least 1 statement/sentence • clarity of text explanations		QWC2 Presents material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar.
QWC2: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer	QWC 2	QWC1 Presents material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar.
QWC1: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer.		QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.
(b) 5700 ÷ 3 = 1900 OR Ben gets the same fraction (2/6 = 1/3)	B1	
No (it does not affect the amount Ben receives).	E1 7	Do not award E1 if B1 not awarded. FT Ben's share from (a).

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Unit 3 Higher Tier		FINAL MARK SCHEME Comments
6. Sketch of circle of correct radius drawn.	B2 2	Allow freehand sketch. Use overlay. (±5mm) B1 for intention of sketching the correct circle using points, or arcs, OR B1 for intention of correct circle but outside the tolerance. Ignore other lines on the diagram drawn to find the centre of the circle. Penalise −1 for other loci drawn that are not intended to find the centre of the circle.
7. ½×5×8×14 280 cm^3	M1 A1 U1 3	 Independent of other marks.
8. (a) ((6 - 2) × 180) ÷ 6 120(°) (b) (Angle at bottom of triangle = 120 – 90 =) 30° (180 – 30) / 2 75(°)	M1 A1 B1 M1 A1 5	OR 180 – (360÷6) OR 360÷3 OR 60×2 May be indicated on the diagram. FT 'their 120' – 90. FT 'their 120' – 90.
9. Strategy of multiplying h by (h+2) either numerically or algebraically towards an answer of 70 or equivalent. One correct evaluation $7 \le h \le 8$ 2 correct evaluations $7.35 \le h \le 7.55$ one either side of 70 2 correct evaluations $7.35 \le h \le 7.45$ one either side of 70 *If evaluations not seen, accept 'too high' or 'too low'.* $h = 7.4$	S1 B1 B1 M1 A1 5	h / $h \times (h+2)$ / h / $h \times (h+2)$ 7 / 63 / 7.35 / 68.7225 8 / 80 / 7.36 / 68.8896 7.1 / 64.61 / 7.37 / 69.0569 7.2 / 66.24 / 7.38 / 69.2244 7.3 / 67.89 / 7.39 / 69.3921 7.4 / 69.56 / 7.41 / 69.7281 7.5 / 71.25 / 7.42 / 69.8964 7.6 / 72.96 / 7.43 / 70.0649 7.7 / 74.69 / 7.44 / 70.2336 7.8 / 76.44 / 7.45 / 70.4025 7.9 / 78.21
10. (a) (8 ÷ 5) × 7 or 7 ÷ (5 ÷ 8) 11.2 (cm) (b) 20 ÷ (8 ÷ 5) or 20 × (5 ÷ 8) 12.5 (cm)	M1 A1 M1 A1 4	 Accept 11 from correct working. Accept 13 from correct working.
11. a) 0.02 + 0.3 or 0.32 or equivalent 3.2×10^{-1} b) Correct conversion to common units. 20,000 ÷ 1.25 or 2,000,000 ÷ 125 (= 16000 or equivalent) 1.6×10^4	M1 A1 B1 M1 A1 5	 FT with incorrect place value provided conversion attempted.
12. tan (RPQ) = 45/80 OR tan(PRQ) = 80/45 29(.35…°) OR 60.6(42…°) or 61. (Bearing =) 029(.35…°)	M1 A2 B1 4	 A1 for $\tan^{-1}(45/80 (= 0.5625))$ or $\tan^{-1}(80/45 (= 1.77...))$ FT from incorrect trigonometry AND FT 'their angles' obtained from premature rounding.
13. a) Interquartile range: Readings from cf's of 15 and 45 (50 to 52) – (24 to 25) = 25 to 28 inclusive b) Valid reason e.g 'Kevin's median is higher than Sunil's', 'Kevin's graph is to the right of Sunil's' Kevin	 M1 A1 E1 B1 4	 SC1 for Kevin's IQR of 24 to 26 inclusive. Accept sight of medians for both cricketers (36 and 60). Provided E1 awarded. Penalise −1 if incorrect medians are quoted.
14. a) $d \propto t^2$ or $d = kt^2$ $4.9 = k \times 1^2$ $d = 4.9t^2$ b) d = 19.6 (when t = 2) $t^2 = 28.2/4.9 (= 5.755...)$ or $(t =) \sqrt{(28.2/4.9)}$ t = 2.39(89…) or 2.4(0)	B1 M1 A1 B1 M1 A1 6	 FT for non-linear only. Maybe implied by responses to (b). FT from their non-linear (a). .

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Unit 3 Higher Tier		FINAL MARK SCHEME Comments
15. a) i)Correct expansion of both brackets $x^2 + 4x + 4 + 3x + 3 - 11$ (=) $x^2 + 7x - 4$	M1 A1	
ii) (x =) $\frac{-7 \pm \sqrt{(7^2 - 4\times1\times(-4))}}{2\times1}$	M1	Use of formula, allow one slip in substitution.
(x =) $\frac{-7 \pm \sqrt{65}}{2}$	A1	CAO.
(x =) 0.53 and -7.53	A1	CAO. Must be correct to 2 decimal places.
b) $(5x - 3)(x + 5)$ $x = 3/5$ or $x = -5$	B2 B1 8	B1 for $(5x\ldots3)(x\ldots5)$. FT for their pair of brackets provided at least one bracket is of form (ax…). Must come from factorising.
16. a) Cosine curve starting at 1 on the y axis Maximum and minimum points at (0,1), (180, -1) and (360,1)	M1 A1	
b) 113.578...(º) 246.42…(°) with no other angles given.	B1 B1 4	Accept rounded or truncated answers for both B1's. FT 360 – their first angle.
17. a) Frequencies: 14, 15, 21, 29, 46	B2	B1 for 2, 3 or 4 correct frequencies.
b) $14 + 0{\cdot}4 \times 15$ or equivalent 20	M1 A1 4	FT 'their 14' and 'their 15' provided not 0·7 and 1·5.
18. Overall strategy e.g. cosine rule & ½absinC $AC^2 = 9.9^2 + 7.2^2 - 2\times9.9\times7.2\times\cos75$ $AC^2 = 112.95\ldots$ AC = 10.6(279…) Area ABC = ½×9.9×7.2×sin75 (= 34.425…) Area ADC = ½×AC×4.9×sin24 (= 10.590…) Area quadrilateral = 23.8(348…cm^2)	S1 M1 A1 A1 M1 M1 A1 7	 FT provided M1 awarded. FT their AC but not for 9.9, 7.2 or 4.9. Accept answers in the range 23.8 to 23.9. FT if one of the last M1 marks awarded, and their calculations are accurate to 1 d.p.

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4353/02

MATHEMATICS (UNITISED SCHEME)
UNIT 3: Calculator-Allowed Mathematics
HIGHER TIER

A.M. MONDAY, 11 November 2013

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

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 **6**.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**4**	
3.	**5**	
4.	**5**	
5.	**6**	
6.	**7**	
7.	**4**	
8.	**6**	
9.	**4**	
10.	**7**	
11.	**8**	
12.	**4**	
13.	**7**	
14.	**3**	
15.	**7**	
16.	**9**	
Total	**90**	

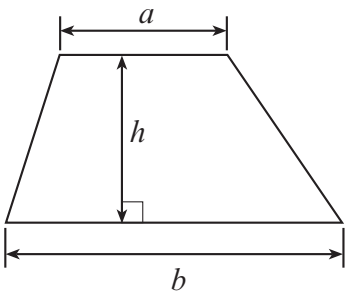
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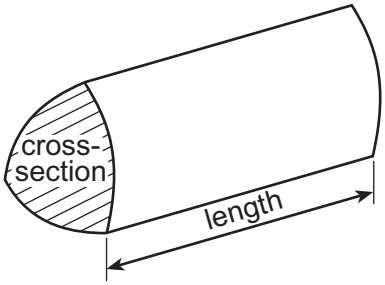
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Formula List

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

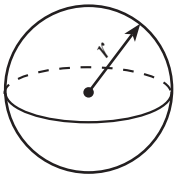


Volume of prism = area of cross-section × length



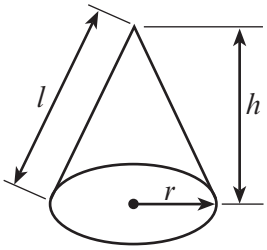
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

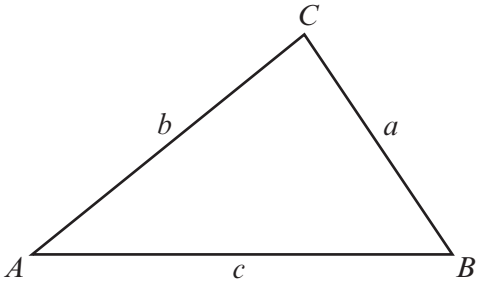


In any triangle ABC

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

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

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1. *(a)* Factorise $x^2 - 6x$. [1]

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(b) Solve $7x + 13 = 3x + 5$. [3]

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Turn over.

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2. A sportswear manufacturer has designed a logo to go on all its clothing.
The design of the logo is shown below.

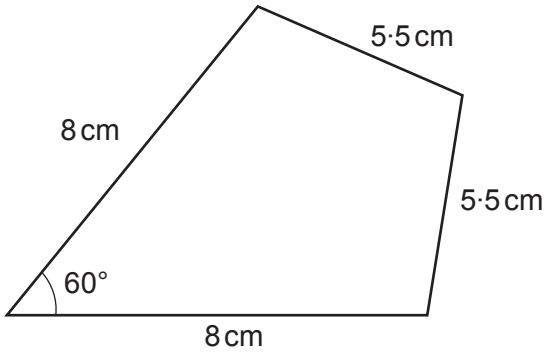


Diagram not drawn to scale

Using a ruler and a pair of compasses, construct an accurate diagram of the logo.
You must show all your construction lines.
One line has already been drawn for you. [4]

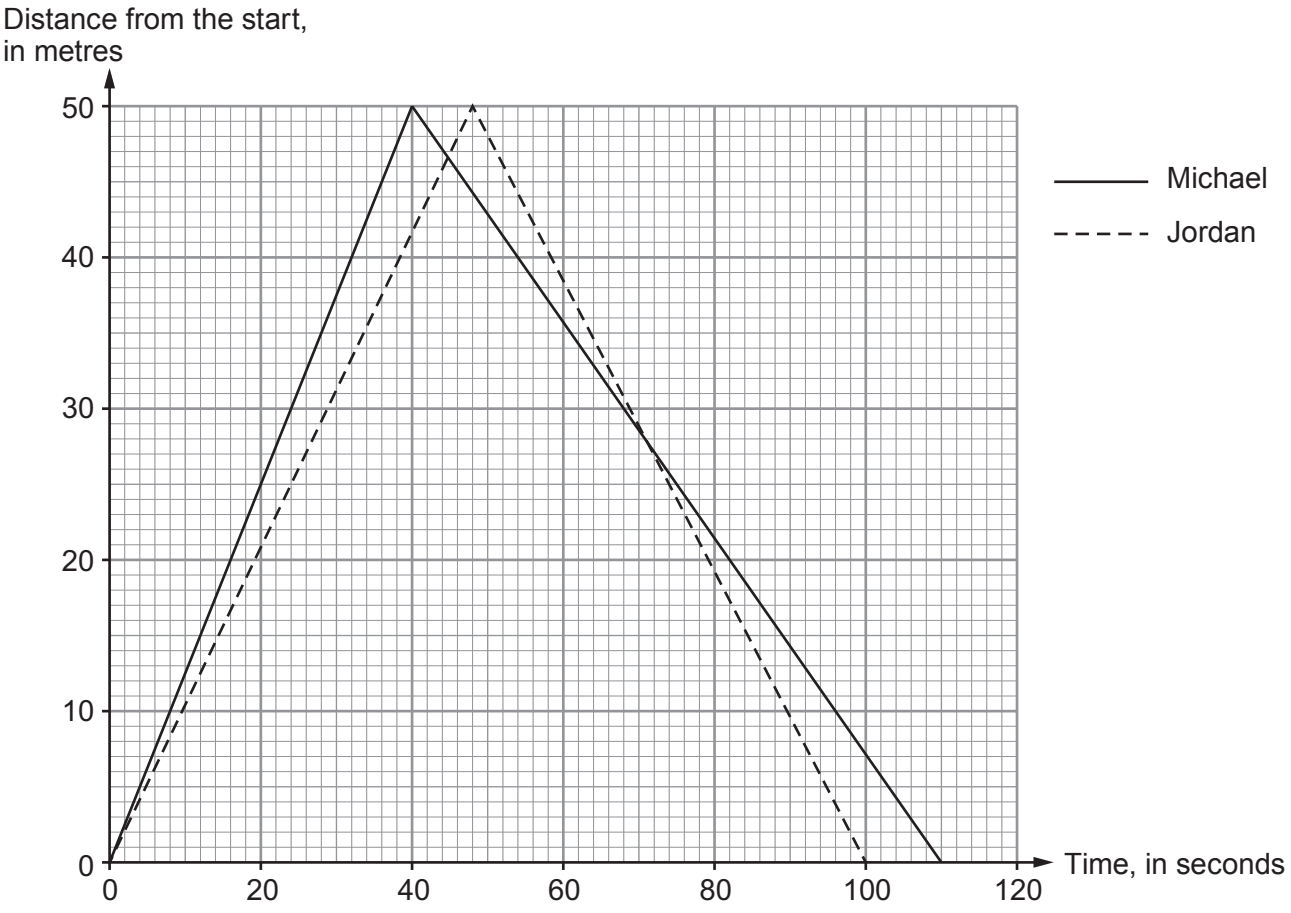
8 cm

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3. Two swimmers, Michael and Jordan, have a race over two lengths of a swimming pool. The travel graph for the race is shown below.



(a) Who was in the lead during the first length of the race? Use the graph to explain your answer. [1]

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(b) What was Michael's average speed for the first length of the race? Give the units of your answer. [3]

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(c) For what length of time were Michael and Jordan swimming in opposite directions? [1]

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4. Anil wants to paint the outside of his house.
The diagram shows one of the sides of Anil's house.
The width of this side is 7 m and the vertical height is 9·5 m.

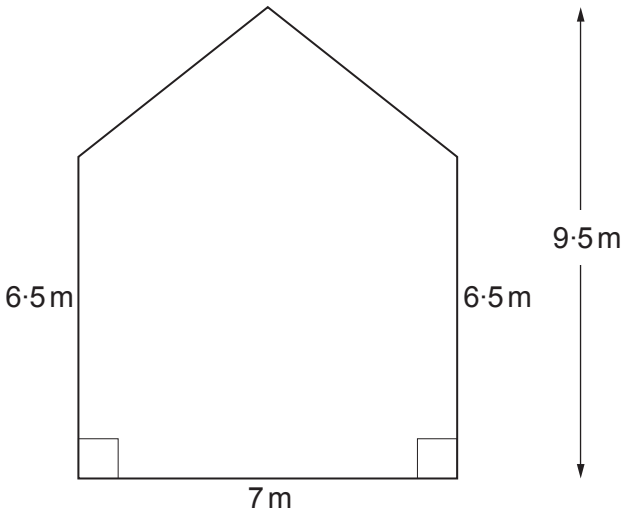


Diagram not drawn to scale

(a) Calculate the area of this side of Anil's house. [3]

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(b) A tin of paint covers an area of 15 m^2.
How many tins of paint does Anil need to buy in order to paint this side of his house? [2]

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5. Ffion's Pizzeria serves two sizes of circular pizza of the same thickness.

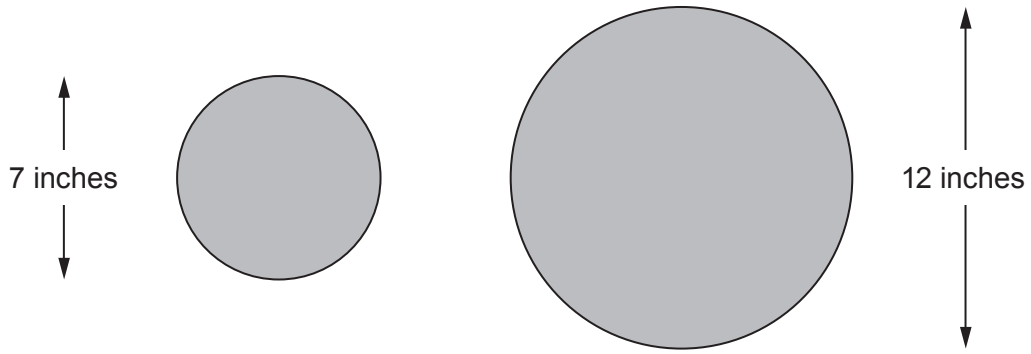


Diagram not drawn to scale

The small pizza has a diameter of 7 inches and costs £4.
The large pizza has a diameter of 12 inches and costs £10.

(a) Calculate the area of the top of the large pizza. [2]

(b) By considering the area of the top of each pizza, decide which pizza is the better value for money. [4]

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

A steel manufacturer makes high quality stainless steel by mixing composite steel, chromium and nickel in the ratio 7 : 2 : 1.
The costs of the materials are shown in the table below.

Material	Cost per kg
Composite steel	50p
Chromium	£1.90
Nickel	£12.70

Calculate the total cost of the materials needed to make 500 kg of high quality stainless steel.
You must show all your working. [7]

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7. A solution to the equation $x^3 + 3x = 90$ lies between 4 and 5.
Use the method of trial and improvement to find this solution correct to 1 decimal place. [4]

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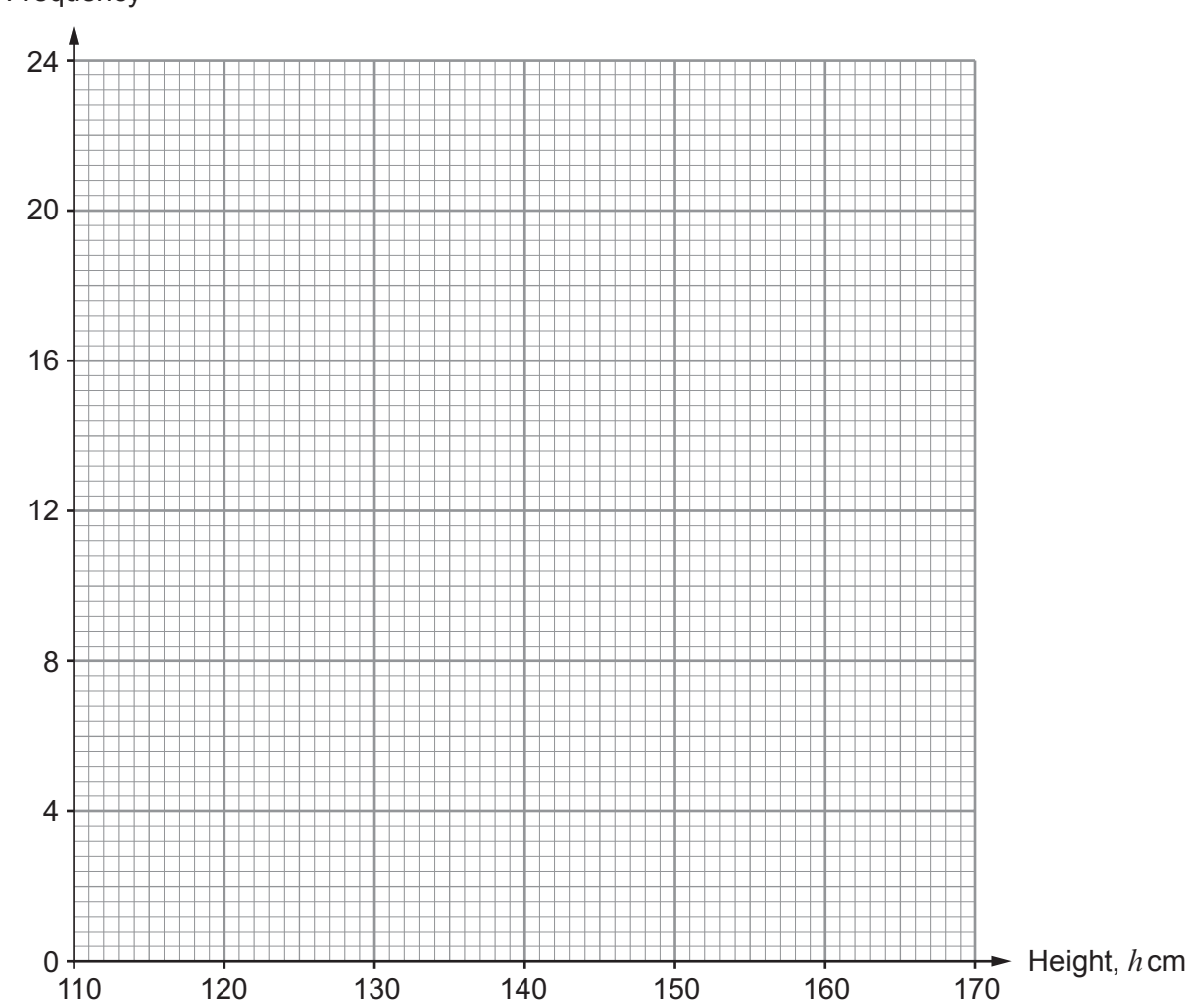
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8. The heights, in centimetres, of 55 children are shown in the grouped frequency table below.

Height, h cm	Frequency
$120 < h \leqslant 130$	2
$130 < h \leqslant 140$	8
$140 < h \leqslant 150$	13
$150 < h \leqslant 160$	22
$160 < h \leqslant 170$	10

(a) Draw a frequency polygon for the heights of the children. [2]



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(b) Calculate an estimate of the mean height of the children. [4]

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Examiner only

9. *(a)* Find the value of $(2{\cdot}4 \times 10^3) \times (6{\cdot}2 \times 10^5)$.
Give your answer in standard form, to 2 significant figures. [2]

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(b) A stack of 500 sheets of paper has a thickness of 4·8 cm.
Calculate the thickness of 1 sheet of paper in **millimetres**.
Give your answer in standard form. [2]

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10. *(a)* Calculate the length of *AC* in the triangle below. [3]

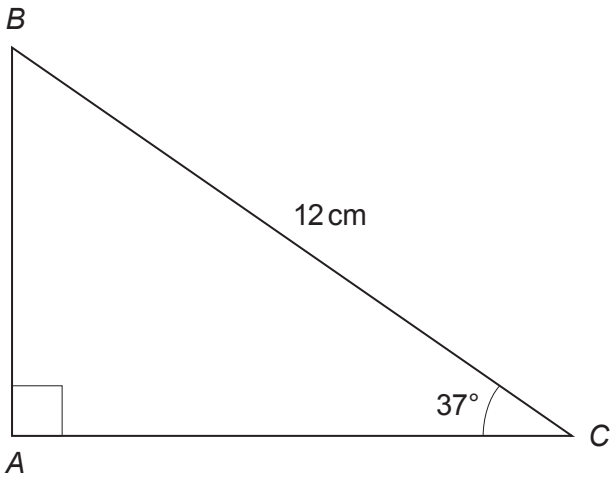


Diagram not drawn to scale

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(b) The diagram below shows a rhombus with diagonals of length 18 cm and 13 cm. The diagonals bisect each other at right angles. [4]

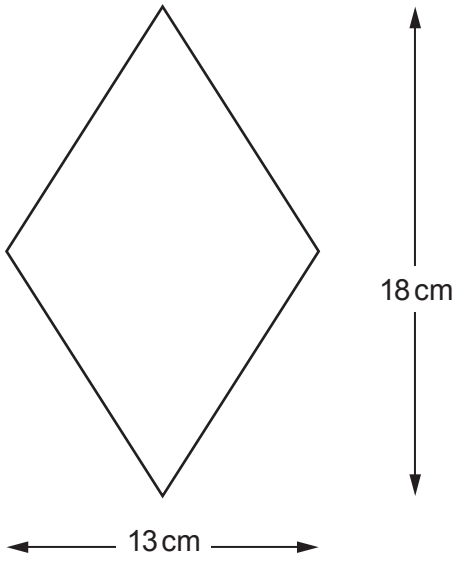


Diagram not drawn to scale

Calculate the perimeter of the rhombus.

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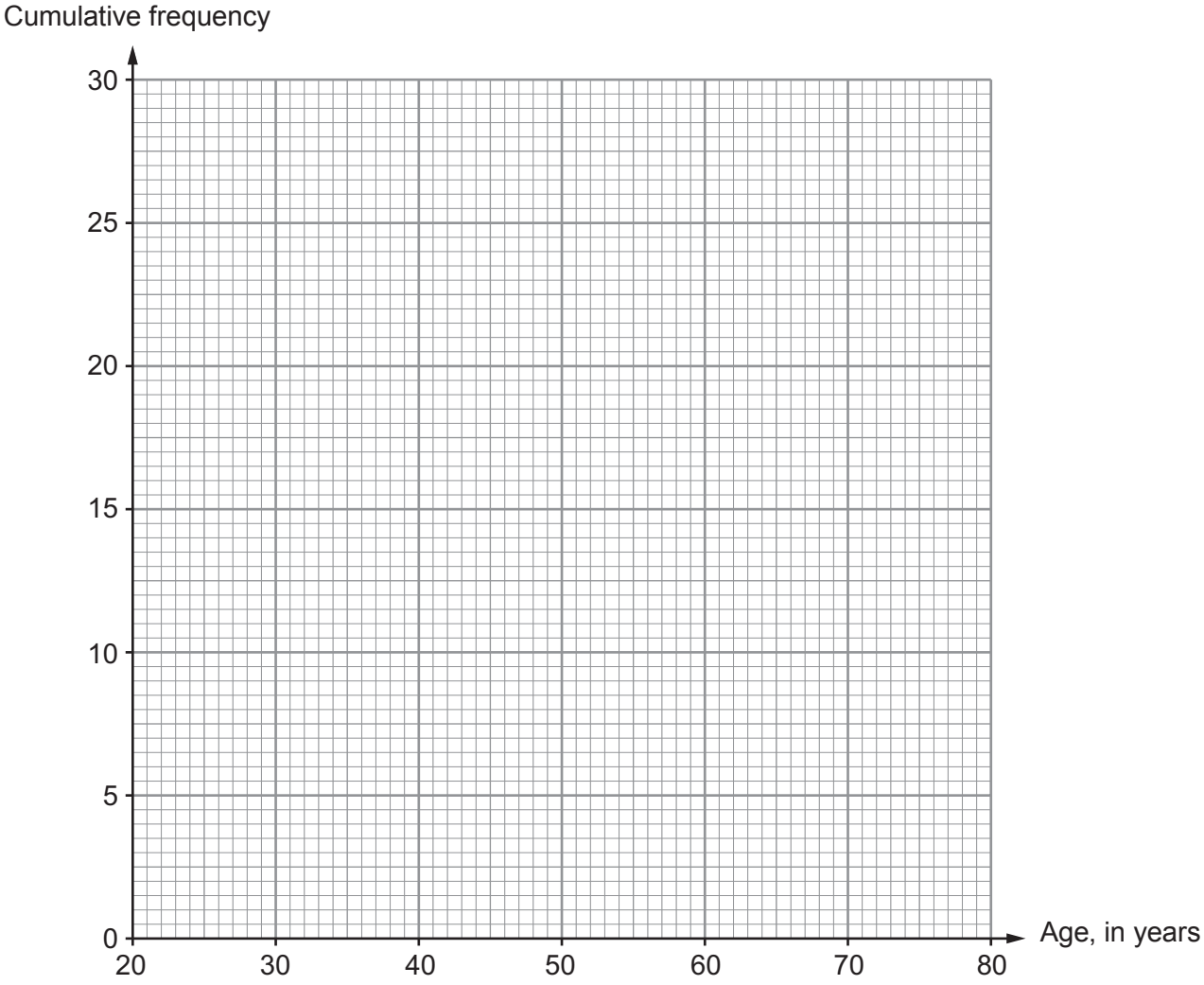
11. A bus company carried out a survey to find out the ages of the passengers travelling on a particular route on a Tuesday.
Here are the results for the 10 a.m. bus.

Age, a years	Frequency
$20 \leqslant a < 30$	4
$30 \leqslant a < 40$	2
$40 \leqslant a < 50$	1
$50 \leqslant a < 60$	4
$60 \leqslant a < 70$	12
$70 \leqslant a < 80$	7

(a) Complete the cumulative frequency table below. [1]

Age, a years	< 20	< 30	< 40	< 50	< 60	< 70	< 80
Cumulative frequency	0						

(b) Draw a cumulative frequency diagram showing the ages of the passengers on the bus. [3]



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(c) Use your cumulative frequency diagram to estimate the median and interquartile range of the ages. [3]

Median = ... Interquartile range = ...

(d) The median age for the 4 p.m. bus on the Tuesday was lower than the median age for the 10 a.m. bus.
Give a possible reason for this. [1]

12. Solve the following equation. [4]

$$\frac{x-1}{2}+\frac{4x-6}{3}=\frac{1}{4}$$

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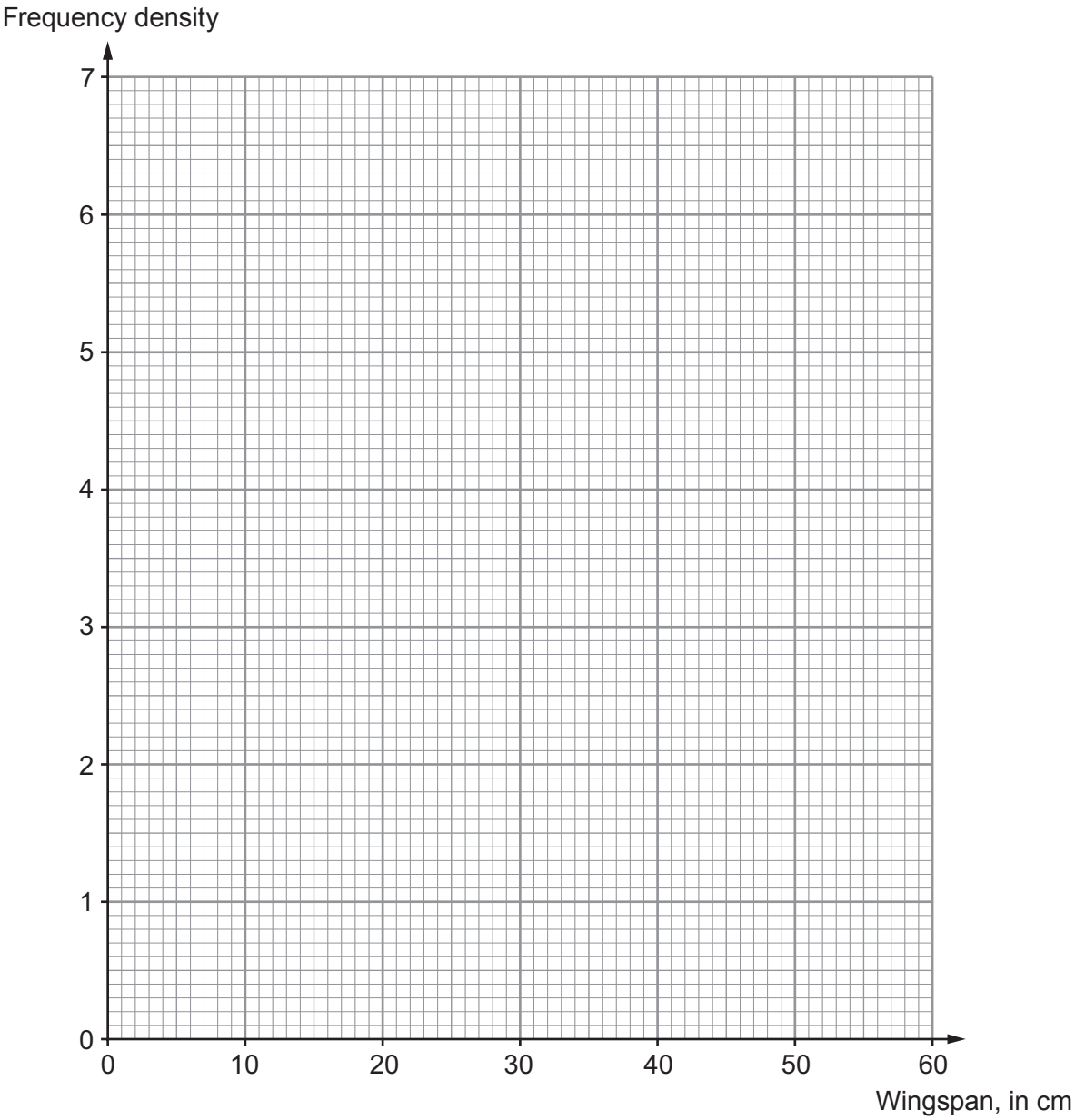
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13. *(a)* The table shows the wingspan, in cm, of the birds in a local bird sanctuary.

Wingspan, x cm	Frequency	Frequency density
$10 < x \leqslant 20$	18	
$20 < x \leqslant 30$	26	
$30 < x \leqslant 35$	30	
$35 < x \leqslant 45$	22	
$45 < x \leqslant 60$	30	

Complete the frequency density column in the table and draw a histogram for the wingspan of the birds on the graph paper below. [3]

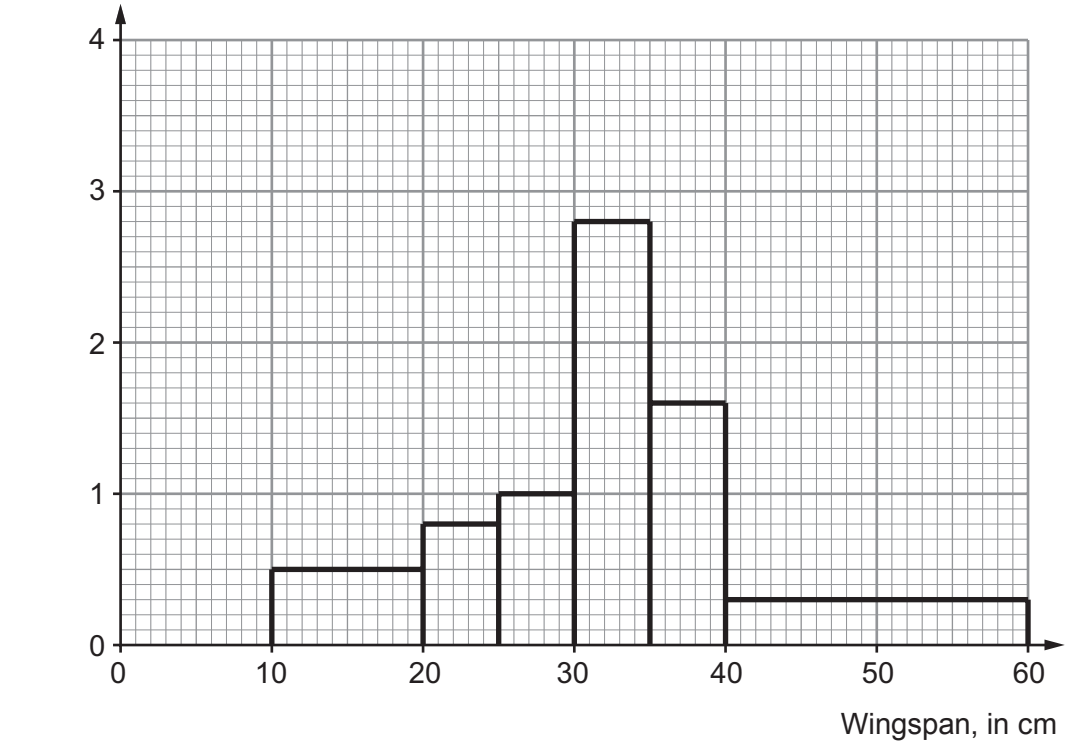


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(b) The histogram for the wingspan of the parrots in the sanctuary is shown below.



Use the histogram to calculate an estimate for the median wingspan of the parrots in the sanctuary. [4]

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14. Factorise the expression $3x^2 - 37x + 12$ and hence solve the equation $3x^2 - 37x + 12 = 0$. [3]

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15. In the parallelogram *FGHJ*, *FG* = 9·5 cm and $F\hat{G}H$ = 125°.

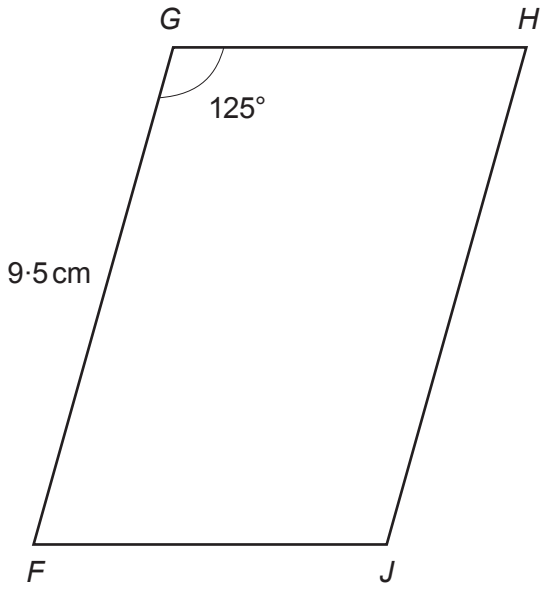


Diagram not drawn to scale

The area of the parallelogram is 36·5 cm^2.
Calculate the length of the diagonal *FH*. [7]

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16. A car travels between two sets of traffic lights, starting at time $t = 0$.
The graph shows the velocity of the car in metres per second.



(a) Calculate an estimate for the acceleration of the car when $t = 20$. [3]

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(b) Calculate an estimate of the area bounded by the curve, the time axis and the line $t = 30$. Use the trapezium rule with ordinates $t = 0$, $t = 10$, $t = 20$ and $t = 30$. [3]

(c) Calculate an estimate of the average speed of the car for the entire 60 second journey. [3]

END OF PAPER

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GCSE MARKING SCHEME

MATHEMATICS UNITISED

NOVEMBER 2013

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the November 2013 examination in GCSE Mathematics Unitised. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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UNIT 3 FOUNDATION

2013 November UNIT 3 (calculator allowed) Foundation Tier Mark Scheme	Mark	Comments (page 1)
1. (a)(£) 3·5(0) or 350(p) (£)1·92 or 192(p) (£)1·7(0) or 170(p) (£) 2·25 or 225(p) (b) 20 – 9·37 or 2000 – 937 (£) 10·63 or 1063(p) (c) 5·49 ÷ 3 or 549 ÷ 3 (£)1·83 or 183(p)	B1 B1 B1 B1 M1 A1 M1 A1 8	 FT one error. Attempt to subtract or find the difference
2. (a) 127 (b) 138 000 (c) 14·2	B1 B1 B1 3	
3. Evidence of square counting 40-50 (squares) Candidate's area × 10 (cm^2)	M1 A1 B1 3	E.g. dots or marks in the squares. F.T. 'their area' × 10 Final answer of 400-500 gets 3 marks.
4. (a) Attempt to use 60 minutes = 1 hour in context. e.g. 4 × 60 + 50 OR 310 / 60 (Delay =) 20 (minutes) (b) 13:50 + 3 hours 15 minutes. 17:05 or 5:05 (pm) (c) Attempt to find time between 6:30 a.m. and 5:55 p.m. with correct interpretation of a.m. and p.m. 11 hours and 25 minutes.	M1 A1 M1 A1 M1 A1 6	Sight of 290 (minutes) or 5.16(66…) or 5.17 (hours) or 5 hours 10 minutes C.A.O. Attempt to add time Accept 11:25 or 11·25
5. (a) Drawing showing 2 and a half circles (b) Mon-36, Tues-16, Wed-18, Thur-22 (c) Ordering data 16, 18, 22, 30, 36 Median 22 (d) Mon, Tues, Wed, Thur, Fri (or equivalent) along one axis Uniform scale and label for frequency or equivalent. Five bars at correct heights	B1 B2 M1 A1 B1 B1 B2 9	 B1for any 2 or 3 correct answers. FT candidate's values from table. Or indicated on the bars themselves. FT from their table values. B1 for at least 3 correct bars on FT. B1 for unequal width bars.
6. Correct rectangle or square with sum of two sides equal to 12 and product of two sides greater than 32. e.g. 6 by 6 or 7 by 5	B3 3	Any orientation. B2 for perimeter= 24 cm but area<32cm^2 eg. 3 by 9 or 2 by 10 B1 for area >32 cm^2 but perimeter ≠24 cm B1 for stating area = 32 (cm^s) and Perimeter = 24(cm) B0 for 4 by 8 or 8 by 4

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2013 November UNIT 3 (calculator allowed) Foundation Tier Mark Scheme	Mark	Comments (page 2)
7. Set dinner discount (£)2.34 Set dinner cost after discount (£)23·40-(£)2·34=(£)21·06 (Set dinner cost for each person £7·02) Total general Menu cost 3×(£)4·50+3× (£)1·85+(£)1·59 (£)20·64 General menu cost for each person (£)20·64 ÷3 =(£) 6·88 (cheaper option) Look for • Spelling • Clarity of text explanations, • Consistent use of £ or p QWC2: Candidates will be expected to • Present work clearly, with words explaining process and steps AND • Make few, if any, mistakes in mathematical form, spelling, punctuation and grammar in their final answer. QWC1 : Candidates will be expected to • Present work clearly, with words explaining process or steps OR • Make few, if any, mistakes in mathematical form, spelling, punctuation and grammar in their final answer.	B1 B1 M1 A1 M1 A1 QWC 2 8	Alternative 0.9×23·40=21·06 for B2 FT 'their £2·34' from appropriate working. Total price or price per person may be seen. Ignore incorrect division if (£)21·06 seen. Treat multiplication of price of set meal by 3 as misread. Alternative method if total cost not shown: (£)1.59÷3=(£)0.53 for M1A1 (£)4.50+(£)1.85+(£)0.53=(£)6.88 for M1A1 FT their costs so that correct division of their lower total by 3 gets M1 A1. QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR Evident weakness in organisation of material but using acceptable mathematical form, with few, if any, errors in spelling, punctuation and grammar. QWC0 Evident weakness in organisation of material, and errors in use of mathematical form, spelling, punctuation and grammar.
8. Calculation A 3.46 Calculation B 2.(051828453….) Calculation C 3.65 Order B, A ,C	B1 B1 B1 B1 4	CAO Rounded or truncated CAO FT candidate's values in ascending order.
9.(a) a=8 (b) $2y$=16 y=8 (c) $x/3$ =10 or x+ 15 = 45 x=30	B1 B1 B1 B1 B1 5	Accept embedded answers throughout.
10. Cubing whole numbers. Trial and improvement shown. Answer of (13×13×13=) 2197(cm^3)	S1 B2 3	Alternative method. Cube root of 2500 with appropriate rounding. B1 for 13×13×13 or 13 cubed without 2197
11. A triangle with at least two correct lengths (±2mm) One line drawn correctly AND two intersecting arcs drawn from the ends of this line. Triangle correctly constructed using intersecting arcs with all 3 sides of the correct length (±2mm).	B1 M1 A1 3	Any orientation.

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2013 November UNIT 3 (calculator allowed) Foundation Tier Mark Scheme	Mark	Comments (page 3)
12.**Both** heart rates correct **AND** Bethan identified as higher Alan 188.(8) Bethan 201.(8)	B2 2	B1 for sight of one of 188(.8) or 201(.8)
13. (a) All points plotted correctly (b) Line of best fit with positive gradient and points above and below. (c) (i)Identify worker C (ii)Appropriate reading for 40 year old from candidate's line of best fit.	B2 B1 B1 B1 5	B1 for at least 5 correct plots. Ignore line of best fit at this stage. Penalise -1 if joined point to point. Worker C, named, described or identified on the graph. Consistent with candidate's positive gradient line of best fit. FT 'their (c)(i)'.
14. a) Michael with reason, e.g. "Michael because he took less time", "Michael finished in 40 sec", "Michael, his line is steeper" b) 50 ÷ 40 or equivalent OR 25 × 60/20 1.25 or equivalent OR 75 m/s OR m/min c) 8 (seconds)	E1 M1 A1 U1 B1 5	Allow "Michael because he was faster" M1A0 for use of e.g. 26 ÷ 20 (misread from graph) If no marks awarded, SC1 for answers of 1.04 or 62.5 (Jordan's speed in m/s or m/min) or 0.9…(speed for whole race) Must be appropriate.
15. One correct evaluation $4 \leq x \leq 5$ 2 correct evaluations $4.2 \leq x \leq 4.35$ One either side of 90 2 correct evaluations $4.25 \leq x \leq 4.35$ One either side of 90 *If evaluations not seen, accept 'too high' or 'too low'.* $x = 4.3$	B1 B1 M1 A1 4	x / $x^3 + 3x$ / x / $x^3 + 3x$ 4 76 4.21 87.24… 5 140 4.22 87.81… 4.1 81.221 4.23 88.37… 4.2 86.688 4.24 88.94… 4.3 92.407 4.25 89.51… 4.4 98.384 4.26 90.08… 4.5 104.625 4.27 90.66… 4.6 111.136 4.28 91.24… 4.7 117.923 4.29 91.82… 4.8 124.992 4.9 132.349 4.35 95.36….. Watch for comparison to 0
16. $(AB^2 =) 3 \cdot 3^2 + 5 \cdot 6^2$ $AB^2 = 42.25$ OR $(AB =) \sqrt{42.25}$ OR $(AB =)$ 6.5(cm)	M1 A1 A1 3	Addition of squares seen or implied $(AB=)\sqrt{(3 \cdot 3^2 + 5 \cdot 6^2)}$ alone gets M1A0A0
17. a) Points plotted at mid-points of groups and straight lines connecting the points b) Sight of the mid-points 125, 135, 145, 155, 165 125×2 + 135×8 + 145×13 + 155×22 + 165×10 (250 + 1080 + 1885 + 3410 + 1650 = 8275) '*Their 8275*' ÷ 55 = 150(.45)	B2 B1 M1 m1 A1 6	B1 at least 4 points plotted and joined correctly OR for all points plotted correctly but not joined, OR consistent horizontal translation within the limits of the groups. Accept intention of straight lines. Ignore any lines outside the first and last points FT their mid-points from within or at the bounds of the groups

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UNIT 3 - HIGHER TIER

Unitised Unit 3 – Nov 2013 Higher Tier Mark scheme – Post Conference		
1. a) $x(x - 6)$ b) $7x - 3x = 5 - 13$ $4x = -8$ $x = -2$	B1 B1 B1 B1 4	 FT until 2nd error
2. Suitable arcs drawn for 60° angle 60° angle drawn with line 8cm long Arcs drawn 5.5cm from the ends of the 8cm lines 2 lines of length 5.5cm joining to complete the kite	M1 A1 B1 B1 4	Use overlay. Allow ±2°. Allow ±2mm for all lengths.
3. a) Michael with reason, e.g. "Michael because he took less time", "Michael finished in 40 sec", "Michael, his line is steeper" b) 50 ÷ 40 or equivalent OR 25 × 60/20 1.25 or equivalent OR 75 m/s OR m/min c) 8 (seconds)	E1 M1 A1 U1 B1 5	Allow "Michael because he was faster" M1A0 for use of e.g. 26 ÷ 20 (misread from graph) If no marks awarded, SC1 for answers of 1.04 or 62.5 (Jordan's speed in m/s or m/min) or 0.9… (speed for whole race) Must be appropriate.
4. a) (6.5 × 7) + (½×7×3) OR 2×½(9.5 + 6.5)×3.5 $= 56(m^2)$ b) 56/15 (= 3.73...) 4 (tins needed)	M2 A1 M1 A1 5	M1 for (6.5×7) + ... OR .... + (½×7×3) CAO FT '*their* 56' Award provided rounding up required
5. a) $\pi \times 6^2$ Answers in the range 113 to 113.14(…sq inches) b) (Area of small pizza =) 38.4 to 38.5 Perform calculations that allow comparison e.g. Large 113 ÷ 10 = 11.3 to 11.314(…) (sq inch per £) *or 10 ÷ 113 = (£)0.08(8)(per sq inch)* Small 38.4 ÷ 4 = 9.6 to 9.625 (sq inch per £) *or 4 ÷ 38.4 = (£)0.10 (per sq inch)* Statement implying that large pizza is better value	M1 A1 B1 M2 A1 6	 Sight of area of small pizza FT *their* areas provided not 7 and 12. M1 for each calculation. *Alternative method to get £10 worth of small pizza or £4 worth of large pizza* *B1 sight of 2.5 as a multiplier or divisor* *M1 for 2.5×38.4(=96) OR 113 ÷ 2.5(=45.2)* *Alternative method to get comparable price for large or small pizza using similar areas:* *B1 for $(12/7)^2$ or 2.9(38…) OR $(7/12)^2$ or 0.3(40…)* *M1 for 2.9(38...) × 4 OR 0.3(40…) ×10* *A1 for £11.75(5…) OR £3.40(2…)* SC2 for convincing argument e.g. 3 small pizzas give nearly the same area for £2 more If no marks awarded, SC1 for convincing statement after comparing costs or areas

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6. (1 part =) 500/10 (Composite steel) = 350(kg) (Chromium) = 100(kg) (Nickel) = 50(kg) (Cost of Composite Steel =) (£) (0.)50 × 350 (Cost Of Chromium needed =) 1.90 × 100 (Cost of Nickel needed =)12.70 × 50 (Total cost =) (0.)50 × 350 + 1.90 × 100 + 12.70 × 50 (Total Cost =) £1000 QWC: Look for • correct units used i.e. kg, £, p • spelling in at least 1 statement/sentence • clarity of text explanations QWC2: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer QWC1: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer	M1 A2 M1 A1 QWC 2 7	A1 for any 2 correct FT their weights provided first M1 awarded CAO *Alternative method:* *Price of 10kg:* *M4 for 7×50p×50 + 2×£1.90×50 + 1×£12.70×50* *OR M3 for any 2 correct with intention to add* *OR M2 for any 1 correct with intention to add* *OR M1 for 7×50p+ 2×£1.90+ 1×£12.70 (=£20)* *A1 for £1000 CAO* QWC2 Presents material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.
7. One correct evaluation $4 \leq x \leq 5$ 2 correct evaluations $4.2 \leq x \leq 4.35$ one either side of 90 2 correct evaluations $4.25 \leq x \leq 4.35$ one either side of 90 *If evaluations not seen, accept 'too high' or 'too low'.* $x = 4.3$	B1 B1 M1 A1 4	$\underline{x}$ $\underline{x^3 + 3x}$ $\underline{x}$ $\underline{x^3 + 3x}$ 4 76 4.21 87.24… 5 140 4.22 87.81… 4.1 81.221 4.23 88.37… 4.2 86.688 4.24 88.94… 4.3 92.407 4.25 89.51… 4.4 98.384 4.26 90.08… 4.5 104.625 4.27 90.66… 4.6 111.136 4.28 91.24… 4.7 117.923 4.29 91.82… 4.8 124.992 4.9 132.349 4.35 95.36… Watch for comparison to 0.
8. a) Points plotted at mid-points of groups and straight lines connecting the points b) Sight of the mid-points 125, 135, 145, 155, 165 125×2 + 135×8 + 145×13 + 155×22 + 165×10 (250 + 1080 + 1885 + 3410 + 1650 = 8275) '*Their 8275*' ÷ 55 = 150(.45)	B2 B1 M1 m1 A1 6	B1 at least 4 points plotted and joined correctly OR for all points plotted correctly but not joined, OR consistent horizontal translation within 1 small square. Accept intention of straight lines. Ignore any lines outside the first and last points. FT their mid-points from within or at the bounds of the groups

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Unitised Unit 3 – Nov 2013 Higher Tier Mark scheme – Post Conference		
9. a) 1.5×10^9 b) 9.6×10^{-2} (mm)	B2 B2 4	B1 for 1.4×10^9 or 1.49×10^9 or 15×10^8 or 1.488×10^9 B1 for 0.096(mm) or 9.6×10^{-3} (cm)
10. a) $12 \times \cos37°$ 9.6 (cm) or 9.5(83..cm) b) (length^2 =) $9^2 + 6.5^2$ length^2 = 123.25 OR (length =) $\sqrt{123.25}$ (*length* =) 11(.101…) (Perimeter =) 44(.407…cm)	M2 A1 M1 A1 A1 A1 7	M1 for cos37 = AC/12 Accept an answer of 10 from correct working FT 'their length' × 4
11. a) 4, 6, 7, 11, 23, 30 b) Idea, plotting the upper class boundary consistently with the corresponding cumulative frequency. At least 3 points plotted correctly. All points correct and joined by straight lines or a curve. c) Median = Answers in the range 63 to 64 inclusive Interquartile range: (69 to 70) – (51 to 53) Answers in the range 16 to 19 inclusive d) valid comment e.g. more young people would use the bus at 4p.m.. fewer old people	B1 M1 A1 A1 B1 M1 A1 E1 8	 FT, for all marks, provided frequencies are cumulative. SC1 if points plotted at mid-points. FT their diagram provided frequencies are cumulative. Intention to subtract must be clear Must FT from their calculation if shown. Allow a consistent misread of the horizontal scale. CAO
12. $6(x - 1) + 4(4x – 6) = 3 \times 1$ or equivalent $22x – 30 = 3$ or equivalent $x = 1.5$	M2 A1 A1 4	For correctly clearing all 3 fractions M1 for clearing 2 fractions FT from M1 Mark their final answer. *If no marks awarded SC1 for sight of (11x − 15)/6 or (22x – 30)/12*
13. a) Frequency densities of 1.8, 2.6, 6, 2.2, 2 Histogram of their frequency densities drawn b) An attempt to add the areas of the bars (5 + 4 + 5 + 14 + 8 + 6) = 42 Search for the median within the 30-35 group = 32.5	M2 A1 M1 A1 M1 A1 7	M1 for any 3 or 4 correct. Provided M1 awarded. CAO FT their 42 provided a clear attempt made to add the areas of the bars
14. $(3x – 1)(x – 12)$ $x = 1/3$ (or 0.33) or $x = 12$	M2 A1 3	M1 for (3x…1)(x…12) FT provided at least M1 awarded. Do not accept solutions from use of the quadratic formula only.
15. Use of ½absinC followed by cosine rule $18.25 = ½\times9.5\times GH\times\sin125°$ $GH = (2 \times 18.25)/(9.5 \times \sin125°)$ GH = 4.69(…) or 4.7 $FH^2 = 9.5^2 + GH^2 – 2\times9.5\times GH\times\cos125$ $FH^2 = 163.35$ to 164 FH = 12.7(8) or 12.8(cm)	S1 M1 m1 A1 M1 A1 A1 7	*Alternative strategy – Calculate the height, then base, then cosine rule* FT provided M1 awarded

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16. a) Tangent drawn	S1	
Idea of increase in *y*/increase in *x*	M1	
Gradient from a reasonable tangent	A1	About 0.4 (ms^{-2})
b) Split into 3 areas and attempt to sum	M1	
(Area =) ½×10(0 + 2×17 + 2×23 + 25)	M1	Or equivalent. Award for up to 1 error in reading scale.
= 525	A1	CAO
c) (Total distance travelled =) 525 + (10×25) + (½×20×25) (=1025)	M1	FT 'their 525'
(Average speed =) 'their 1025'/60	M1	
= 17.(08…) (m/s)	A1	CAO for 'their 525'
	9	

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Surname	Centre Number	Candidate Number
Other Names		0

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GCSE

4353/02

MATHEMATICS (UNITISED SCHEME)

UNIT 3: Calculator-Allowed Mathematics HIGHER TIER

A.M. MONDAY, 17 June 2013

$1\frac{3}{4}$ hours

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a 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.

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 continuation page at the back of the booklet, taking care to number the question(s) correctly.

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 **5**.

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

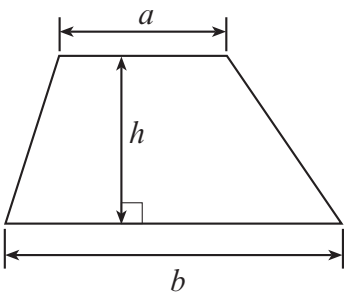
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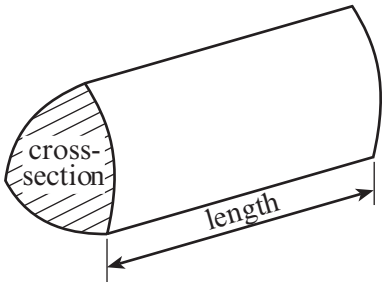
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Formula List

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

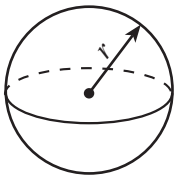


Volume of prism = area of cross-section × length



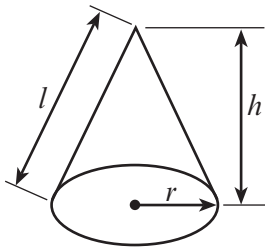
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

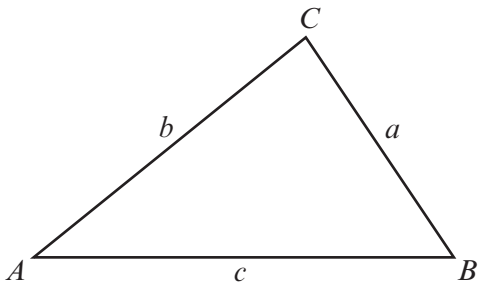


In any triangle ABC

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

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

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1. Daisy buys a torch and a battery.
The torch costs eight times as much as the battery.
Daisy pays with a £20 note and gets £15.86 change.
How much does the battery cost?

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[4]

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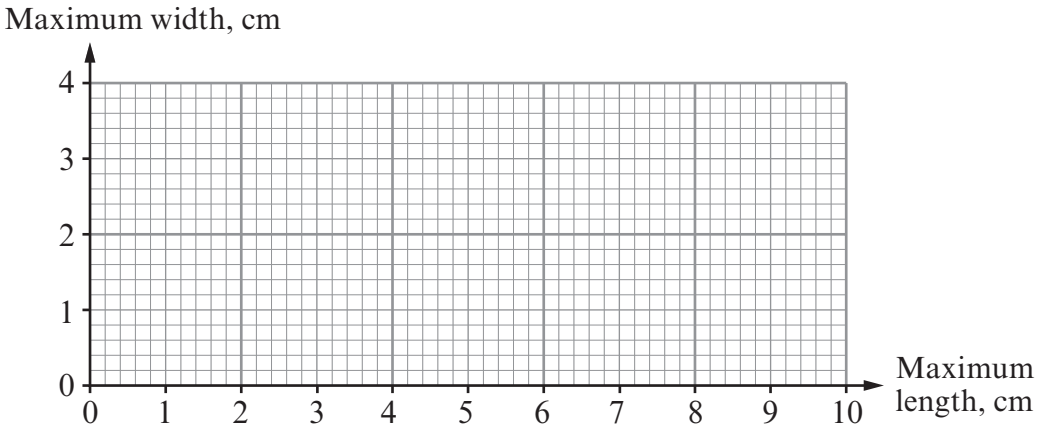
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2. The maximum lengths and maximum widths of a number of leaves from one tree were measured.

Maximum length, cm	6·8	7·4	3·2	8·2	9·4	7·6	4·2	2·8	8·4
Maximum width, cm	2·4	2·6	1·2	3·0	3·4	2·8	1·4	1·0	3·2

(a) Draw a scatter diagram to display these measurements. [2]



(b) Draw, by eye, a line of best fit on your scatter diagram. [1]

(c) State the type of correlation shown in your scatter diagram. [1]

.....

(d) Another leaf from the same tree has a maximum length of 5 cm.
Use your line of best fit to estimate the maximum width of this leaf in cm.

..... cm [1]

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3. *(a)* Factorise $12x^2 - 48x$.

.....

.....

[2]

(b) Find the value of $2x^3$ when $x = -5$.

.....

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.....

[1]

(c) Given that $a = 25$, $b = -3$ and $c = 7$, evaluate $\dfrac{a-b}{8c}$.

Express your answer as a decimal.

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.....

.....

[3]

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Turn over.

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4. Iona went on holiday to Stone Edge last July.
She recorded the temperature at midday each day.

Temperature, t °C	$0 \leqslant t < 5$	$5 \leqslant t < 10$	$10 \leqslant t < 15$	$15 \leqslant t < 20$	$20 \leqslant t < 25$
Number of days	0	5	9	17	0

(a) Using Iona's data for the temperatures in Stone Edge last July,

(i) calculate an estimate for the mean,

.....

.....

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.....

[4]

(ii) explain how you know that the modal group is $15 \leqslant t < 20$,

.....

.....

[1]

(iii) what is the maximum possible range of the temperatures recorded by Iona?

.....

[1]

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(b) Dewi lives in Caerddu.
He recorded the midday temperature, in °C, each day in July last year.
He decided on groups for recording the temperature.
From his grouped data he worked out the following:

- estimated mean: 18·2°C
- modal group: $10 \leqslant t < 20$, where t is the temperature in °C
- range: 8°C

Dewi decides to compare his averages and spread of data with Iona's data.

(i)

	Temperature, t °C	
	Estimated mean	Modal group
Caerddu (Dewi's data)	18·2°C	$10 \leqslant t < 20$
Stone Edge (Iona's data)	.....	$15 \leqslant t < 20$

Why might Dewi choose to use the estimated mean rather than the modal group to compare the data?

.....

.....

.....

.....

[1]

(ii)

	Temperature, t °C	
	Estimated mean	Maximum range
Caerddu (Dewi's data)	18·2°C	8°C
Stone Edge (Iona's data)	.....	.....

Why might Dewi find it more useful to use the estimated mean rather than the maximum range to compare the data?

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[1]

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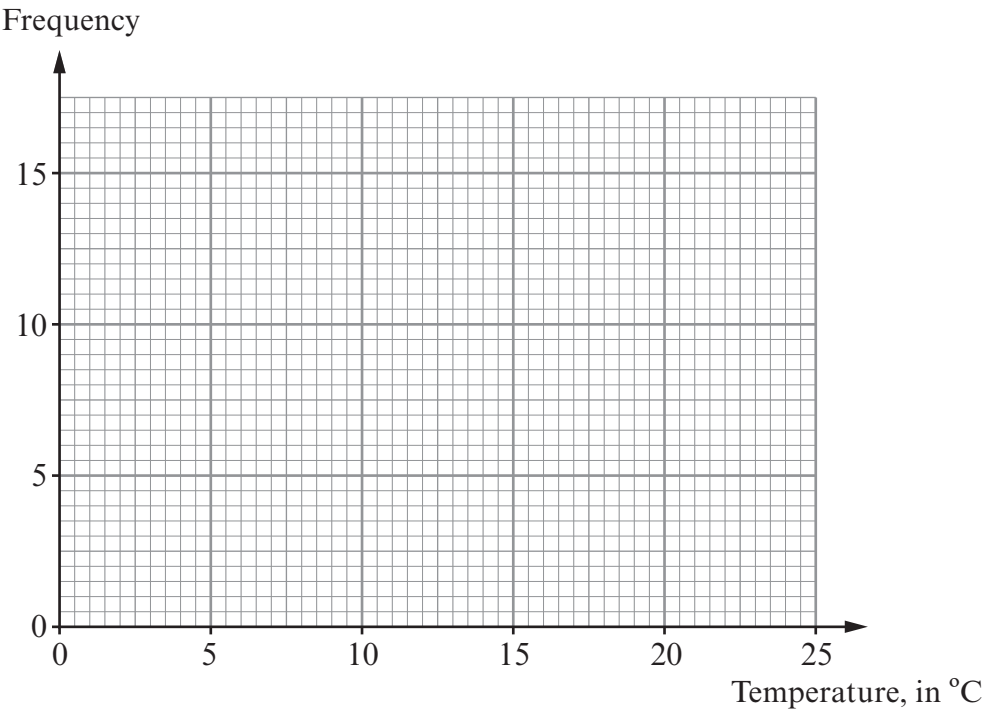
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(c) Iona's frequency table is shown again below.
Use the graph paper below to draw a frequency polygon to illustrate the temperatures that Iona recorded on holiday in Stone Edge. [2]

Temperature, t °C	$0 \leqslant t < 5$	$5 \leqslant t < 10$	$10 \leqslant t < 15$	$15 \leqslant t < 20$	$20 \leqslant t < 25$
Number of days	0	5	9	17	0



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

Tansy opened a regular savings account.
Interest is only payable on 31st December each year.
Tansy paid £20 into her account on the first day of every month, starting from 1st January 2012.
On 31st December 2012, interest of 1·4% of the total amount of money that Tansy had saved during 2012 was added to her account.
Calculate how much money Tansy had in her account on 15th April 2013.

[6]

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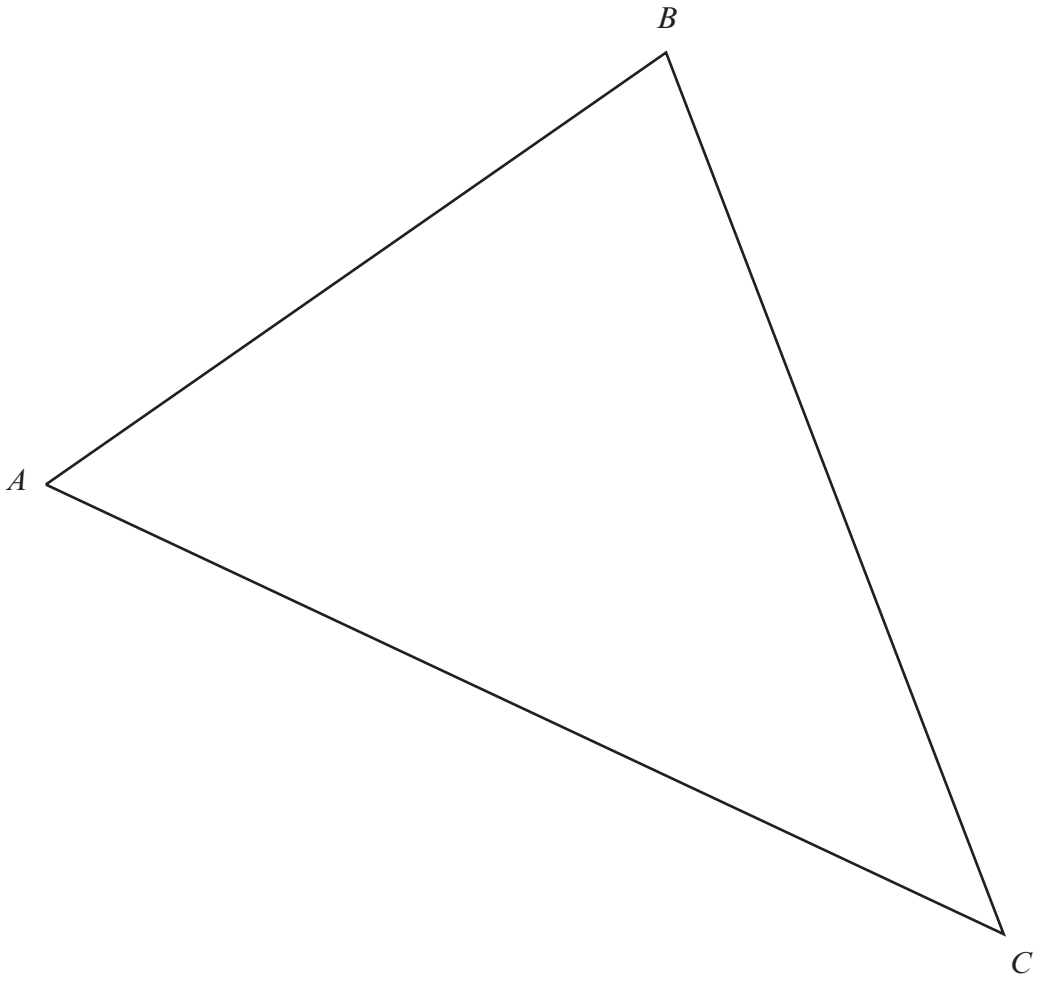
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6. *(a)* A region is found within triangle ABC using the following criteria.
Points in the region are:

- nearer to B than to C,
- greater than 4 cm from A.

Shade this region in the triangle ABC. [3]



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(b) Calculate the area of the quadrilateral *ABCD*.

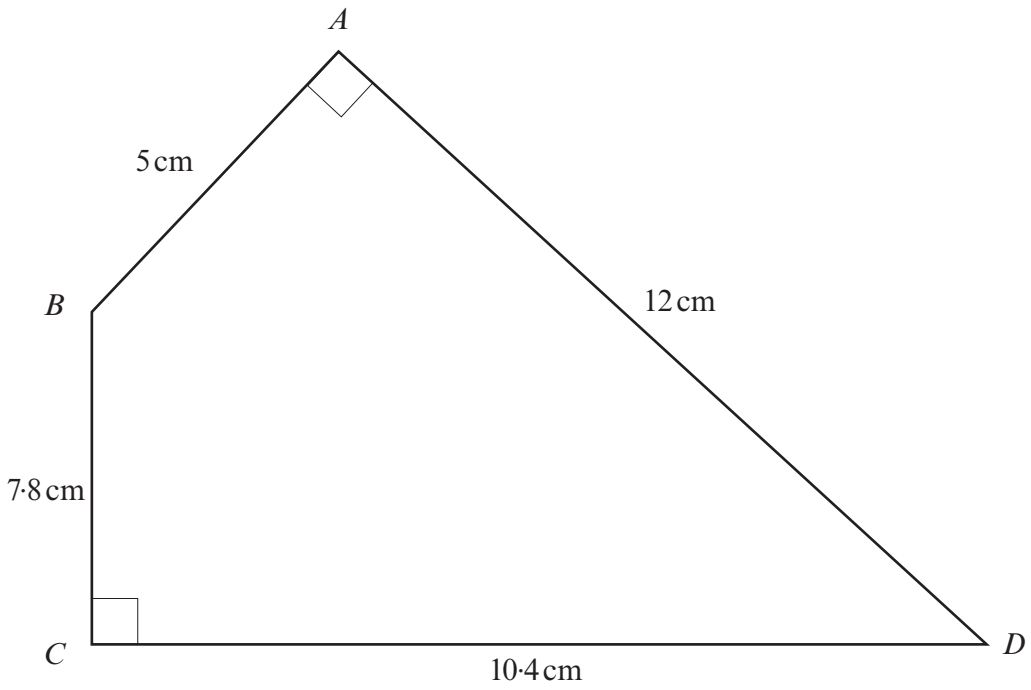


Diagram not drawn to scale

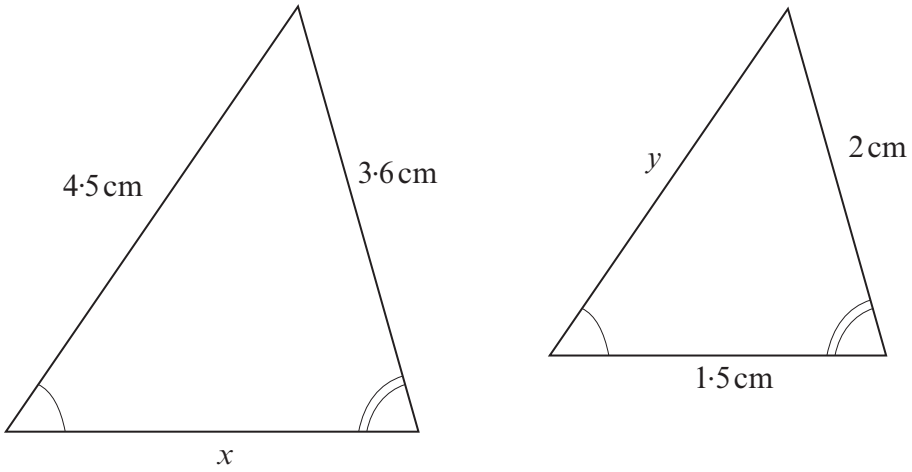
[5]

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7. *(a)* The triangles shown below are similar.



Diagrams not drawn to scale

Calculate the lengths x and y.

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.....

x = ... cm y = ... cm

[4]

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(b) You are given the following information about two congruent triangles.

- The triangles are not right-angled triangles.
- In both triangles, one side is of length 3·4 cm and another side is of length 6·2 cm.

One extra piece of information is needed to prove that the triangles are congruent.
There are two possible options for this extra piece of information.
What are the two possible options?

Option 1: .....

.....

.....

.....

Option 2: .....

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[2]

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8. *(a)* Factorise $6x^2 + 5x - 25$.

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[2]

(b) Solve the following equation.

$$\frac{8x+1}{3} - \frac{4x+7}{2} = \frac{1}{2}$$

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[4]

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9. A small boat is 4·5 km from a lighthouse.
The bearing of the small boat from this lighthouse is 090°.
The small boat is 3·2 km due North of an oil tanker.

(a) Calculate the distance between the oil tanker and the lighthouse.

Distance between the oil tanker and the lighthouse = ... km

[4]

(b) Calculate the bearing of the lighthouse from the oil tanker.

Bearing of the lighthouse from the oil tanker = ... °

[4]

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10. A large rectangular tile has width x cm, length $(x + 5)$ cm and area 2100 cm^2.
Use the quadratic formula to calculate the width of the tile, giving your answer correct to 1 decimal place.

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[4]

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11.

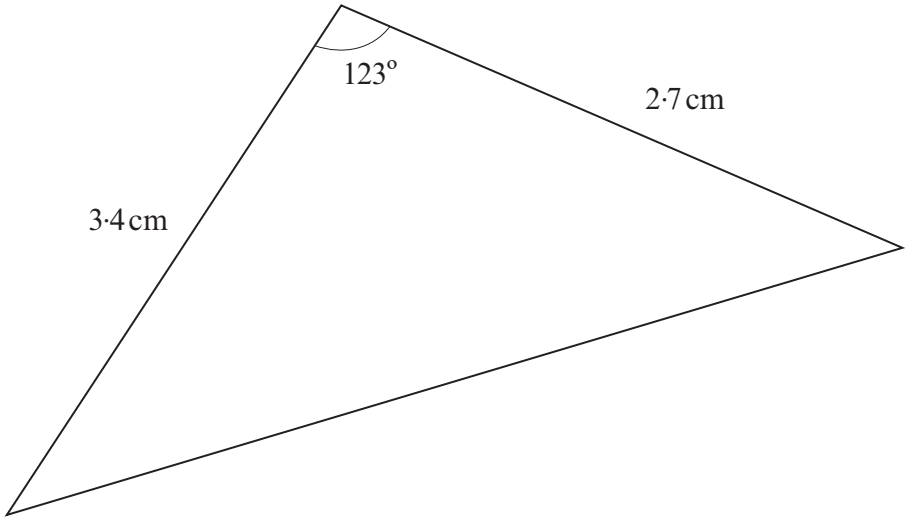


Diagram not drawn to scale

Calculate the area of the triangle.

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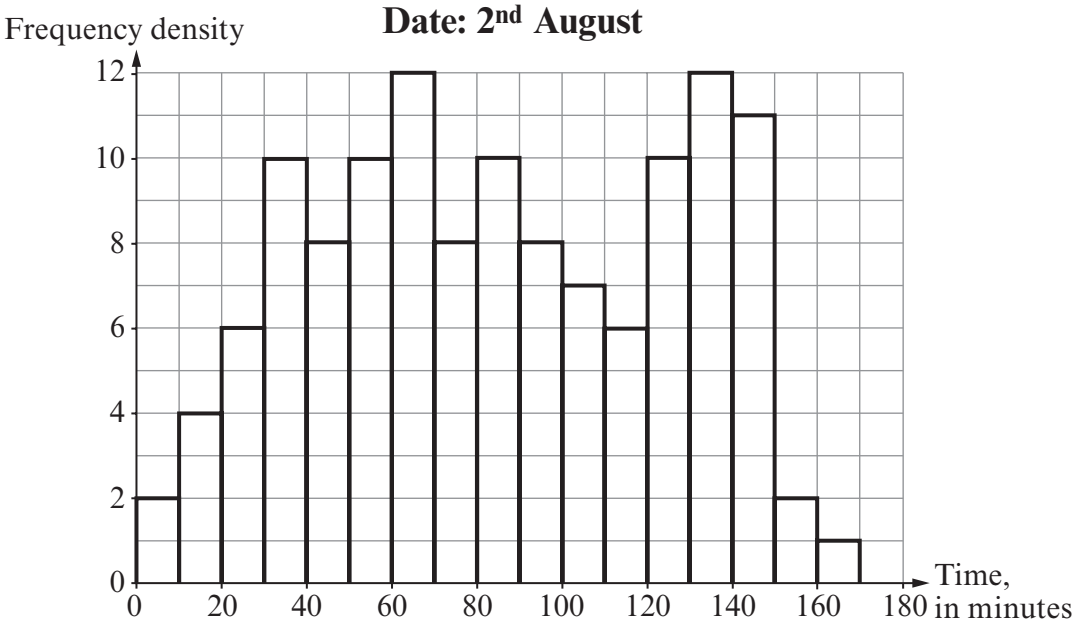
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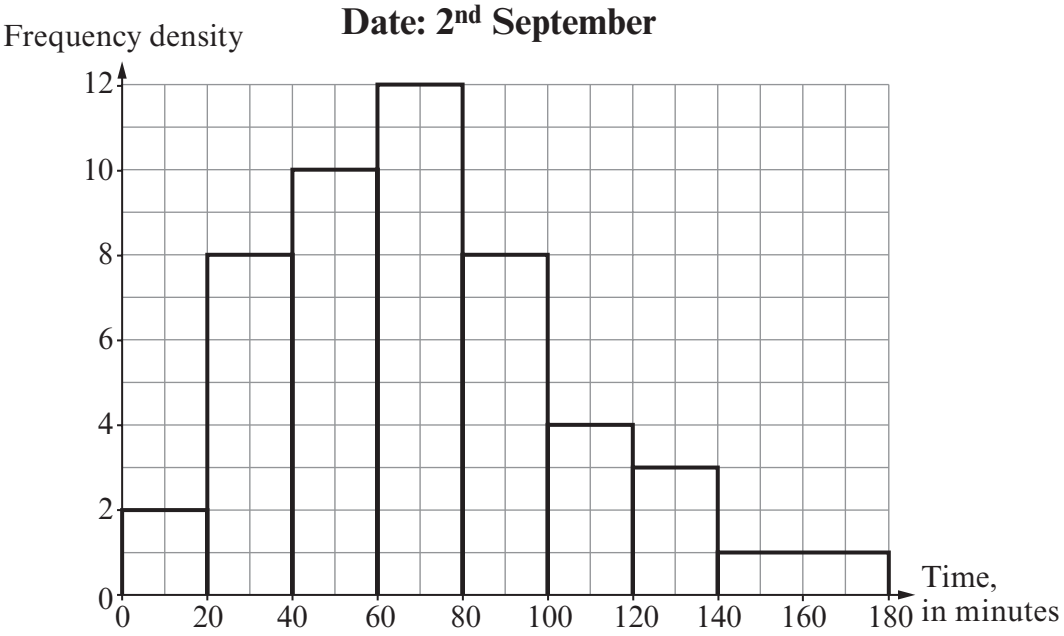
[3]

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12. The histograms below show the total times that office workers in a company spent on the phone on 2nd August and on 2nd September.





(a) Calculate the number of office workers who spent a total time of 60 minutes or less on the phone on 2nd August. [3]

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(b) Explain why it is not possible to use the histogram to calculate how many telephone calls were made on 2nd August?

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[1]

(c) Grant suggested that it is not possible to calculate exactly how many office workers spent longer than 130 minutes on the telephone on 2nd September.
Is Grant correct? You must give a reason for your answer.

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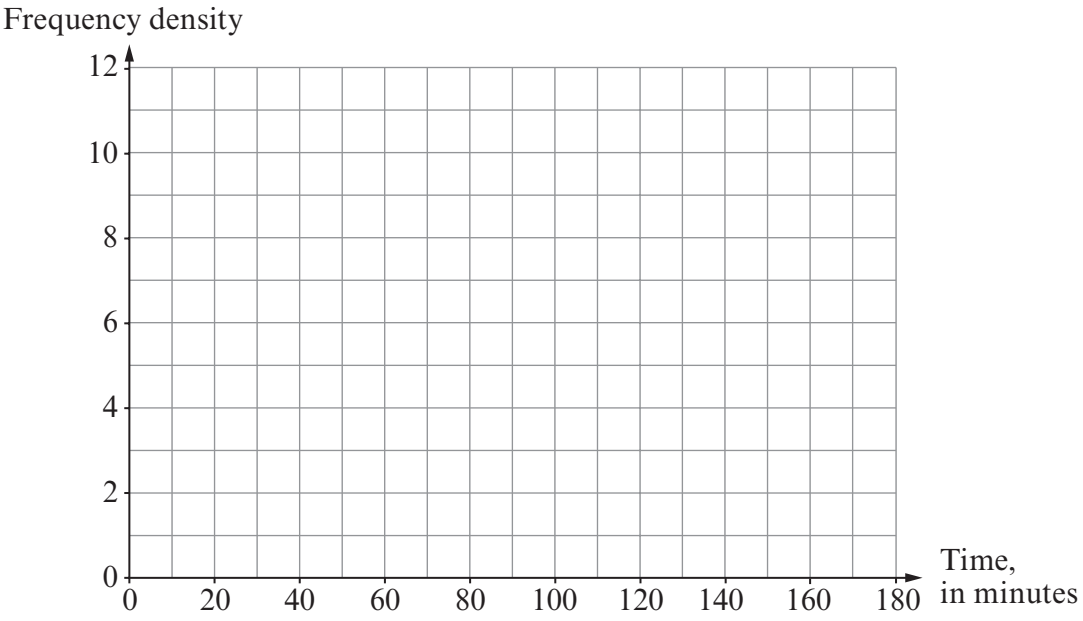
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[1]

(d) Use the graph paper below to redraw the 2nd August histogram, using groups of the same width as those in the histogram for 2nd September.

[3]

Date: 2nd August



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13. *(a)* Use the graph paper below to draw a graph of the equation $y = 6 + x - x^2$ for values of x from -2 to 3.

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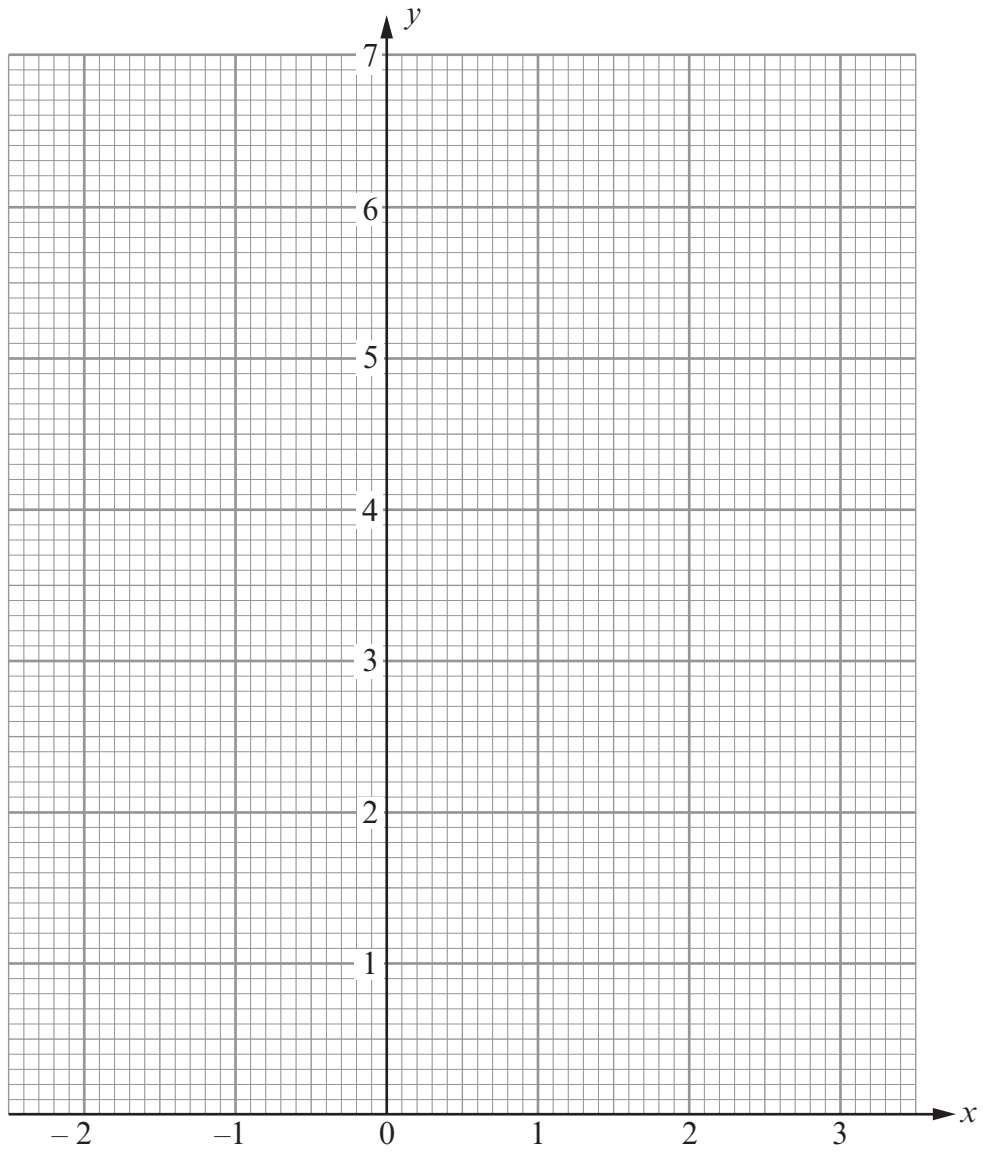
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[3]



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(b) Use your graph to solve the following equations.

(i) $6 + x - x^2 = 0$

.....

[1]

(ii) $4 + x - x^2 = 0$

.....

.....

.....

[2]

(c) Use the trapezium rule, with the ordinates $x = 0$, $x = 1$, $x = 2$ and $x = 3$, to estimate the area of the region enclosed by the curve, the positive x-axis and the positive y-axis.

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[4]

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14. A flagpole AB, of height 5·6 m, stands on top of a wall BC.
ABC forms a straight line.
The wall leans slightly so that it makes an angle of 94° with the horizontal ground CD.
The angle of elevation of the **top of the wall**, B, from the point D is 40°.

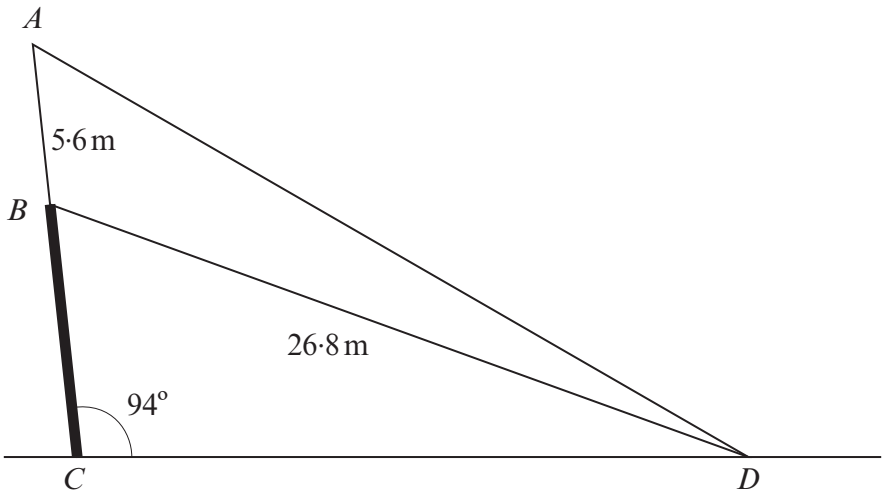


Diagram not drawn to scale

Given that BD = 26·8 m, calculate AD.

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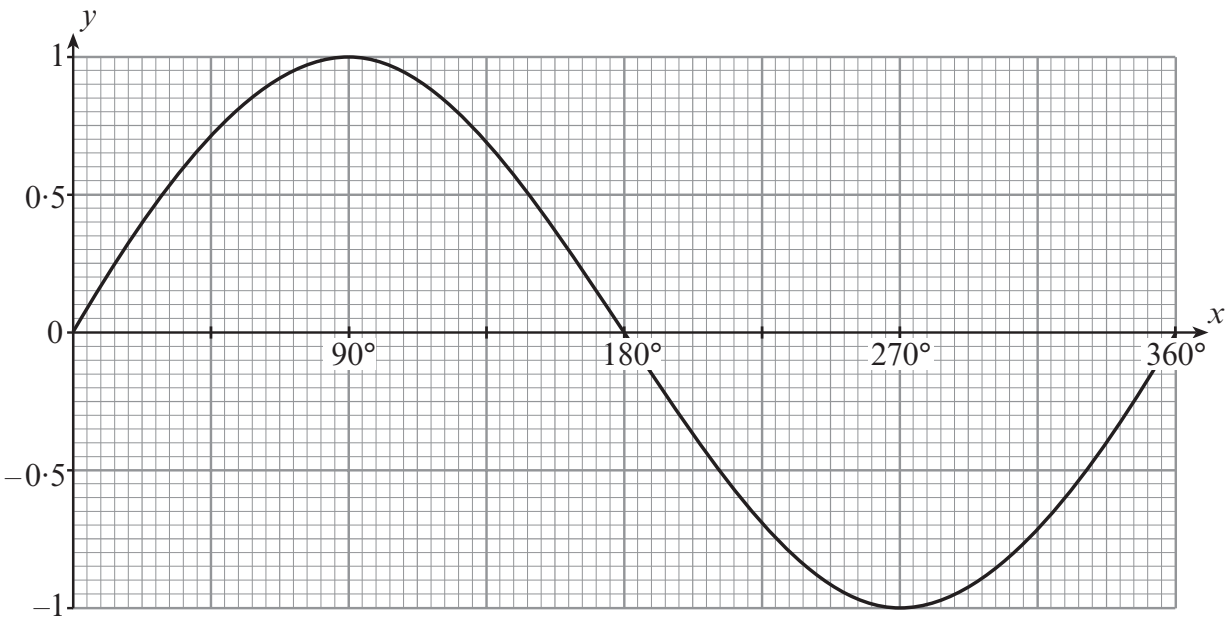
[4]

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15. The diagram below shows the graph of $y = \sin x$ for values of x from 0° to 360°.



Calculate all the solutions of the following equation between 0° to 360°.

$$\sin x = -0{\cdot}26$$

.....

.....

.....

.....

[2]

END OF PAPER

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Turn over.

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

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GCSE MARKING SCHEME

MATHEMATICS - UNITISED

SUMMER 2013

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2013 examination in GCSE MATHEMATICS - UNITISED. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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Unit 3 - Foundation Tier	12
Unit 3 - Higher Tier	15

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2013 June UNIT 3 (Calculator allowed) Foundation Tier	Marks	FINAL MARK SCHEME Comments
Parts (a)(i) & (ii) marked at the same time 1. (a) (i) 4.56 (potatoes) 10.08 (cereal) 7.56 (milk) 22.2(0)	 B1 B1 B1 B1	 F.T. their figures for 1 error Unsupported 22.2(0) gets B4.
1. (a) (ii) For example, 10% = (£) 2.22 5% = (£) 1.11	M1 A1	Any valid method F.T. their (a)(i). Ignore extra decimal places in their answer. If (£)1.11 not given, then (£) 21.09 gains M1 A1
1. (b) 9630	B1	
1. (c) (i) 8.5	B1	Extra zeros get B0, e.g. 8.50 gets B0.
1. (c) (ii) 8	B1	Extra zeros get B0, e.g. 8.0 gets B0
1. (d) 18 + 32 = 50	M1 A1	Correct substitution. B1 for 3×6 + 4×8 gets M1, A0. Substitutions like 36+48 OR 18A +32B get M0, A0.
Parts (a) – (b) marked at the same time 2. (a) Premier 8, Championship 11, Other 7, None 4 Both axes labelled, e.g. frequency along one axis and P(remier), C(hampionship), O(ther),N(one) along other axis. Anywhere within the base (inc.) of the corresponding bar. Uniform scale for the frequency axis starting at 0. Four bars at correct heights. Can be in any order. Bars must be of equal width. Penalise –1 for each different width bar. (b) Championship OR C	✓ B2 B2 B2 B1	Part (a) only ✓ B1 for any two/three correct frequencies If frequencies score 0, then give B1 for all 4 correct tallies. B1 if no scale but allow one square to represent 1 OR B1 if not labelled as 'frequency' or similar. If frequency scale starts with 1 at the top of the first square the starting at 0 will be implied for this axis. Condone frequency numbers alongside squares instead of at the top of squares. F.T. their table of frequencies B1 for any 2 or 3 correct bars on F.T. If no frequencies given in their working, penalise -1 for each incorrect frequency on their bars up to -4 (First and third B2s) F.T. Accept 11 and C or Championship, but B0 for 11 only **F.T. their frequencies**
3. Evidence of square counting 69 – 73 345 – 365	M1 A1 B1	 F.T. 5 × 'their area'
4. Selvy must have 1 and 3 (4) Megan must now have 2 and 6 (8) David must now have 4 and 7 (11) Roberta must now have 5 and 10 (15)	✓ B1 B1 B1 B1	F.T. wrong choices, but cards can only be used once.
Use overlay 5. (a) Angle BAD (67º) AD = 7.5cm Angle ABC (106º) BC = 10cm	 B1 B1 B1 B1	 Allow ± 2º Allow ±2mm Allow ± 2º Allow ±2mm B4 only if quadrilateral is completed.
5. (b) 3 arcs for bisector and the line	B2	B1 for the first arc crossing both arms. Watch out for equal arcs from P and R.

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2013 June UNIT 3 (Calculator allowed) Foundation Tier	Marks	FINAL MARK SCHEME Comments
6. (a) 2.31	B2	B1 for 2.30(71805857...) All places given must be correct.
6. (b) 39.10	B2	B1 for 39.1(02183...) All places given must be correct.
7. (a) 491	B1	
7. (b) Sum of the numbers (1784) Sum/8 223	M1 M1 A1	For attempt to add the numbers For a division by 8 of a number in the range 1200 − 2300 C.A.O.
7. (c) (19 74 122) <u>162 206</u> (272 419 510) 184	M1 A1	For ordering the numbers in descending or ascending order. OR showing 162 and 206 only.
8. (a) 55 (miles)	B1	
8. (b) 35 (miles)	B1	
8. (c) 48 (minutes)	B1	
8. (d) Correct line drawn to (14:18, 48)	B2	B1 for a line to (..., 48) and later than 13:00 OR for a line to (14:18, ...). (14:18, 48) without the line gets B1.
9. **<u>Use angle measuring tool</u>** 3 or 4 angles correct and correctly labelled. 3 or 4 angles correct, labels not fully correct. 2 angles correct and correctly labelled. 2 angles correct, labels not fully correct. 1 angle correct and correctly labelled. OR <u>If 0 OR 1 for their diagram or no diagram,</u> 360/240 Angles are 165, 105, 57 and 33	 B4 OR B3 B3 B2 B1 M1 A1	 Correct labels (Words NOT the frequency OR angle). 3 correct labels is enough. If only B1 is scored for the diagram, and all the angles given correctly, then cancel the B1 and award M1, A1 for 2 marks. If B0 scored for the diagram, check the angles and the method to see if the M1 and the A1 can be awarded. (1 is) 1½ ° gets the M1. OR SC1 for all correct percentages: 45.8, 29.2, 15.8, 9.2
10. EITHER ¼ + ⅓ M1 = 7/12 A1 leaving 1 – 7/12 M1 = 5/12 A1 OR ¼ of (£)1200 = (£)300 ⅓ of (£)1200 = (£)400 Leaving 500 5/12	✓ B1 B1 M1 A1	 M1 for implementing the addition of the fractions by a correct method. This M1 is F.T. in both methods C.A.O.
Look for • Spelling • Clarity of text explanations, e.g. food, rent • The use of notation – watch for '=','£', 'p' being used appropriately. QWC2: Candidates will be expected to • present work clearly, with words explaining their processes or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer QWC1: Candidates will be expected to • present work clearly, with words explaining their processes or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer	QWC 2	 QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR Evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation and grammar.

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2013 June UNIT 3 (Calculator allowed) Foundation Tier	Marks	FINAL MARK SCHEME Comments
All parts (a) – (d) marked at the same time **Use Overlay**		
11. (a) All points correctly plotted	B2	Mark intention B1 for any 4 points correctly plotted
11. (b) Reasonable (straight) line of best fit	B1	In an appropriate direction, fit for purpose, with some points above and some points below the straight line. Intention to be 'straight', accept without a ruler Do not accept line drawn corner to corner
11. (c) Positive	B1	Do not accept descriptions
11. (d) Their maximum width read from their line of best fit for a maximum length of 5cm	B1	Accuracy of reading within 1 square small If no line of best fit then B0
12. (Cost of torch and battery) (£)4.14 (Cost of battery =) 4(.)14/9 46(p) or (£)0.46	B1 M2 A1	 FT their 4.14 provided 20–15.86 attempted M1 for realising this is '9× the cost of the battery', e.g. $x + 8x = 4(.)14$, or $9\times\ldots. = 4(.)14$ If units are given they must be correct (B1 and) also possible SC1 from ÷8 leading to an answer of 51(.75p), 52(p), (£)0.51(75) or (£)0.52
13. Evidence of 240×1.4/100 or equivalent + 240 (=243.36) + 80 (£)323.36	✓ M1 m1 M1 A1	 Accept 12×20 for 240 Accept 12×20 for 240 *OR award M1, m1 for 240 × 1.014* Accept 4×20 for 80. FT for idea to add 80 to an amount > 'their 12×20' CAO. Accept (£)323. Mark final answer. If units are given they must be correct
14. $6x – 21 = 2x + 9$ $4x = 30$ $x = 30/4$ OR 7½ OR 7.5	B1 B1 B1	Clearing bracket correctly F.T. until 2nd error 6x – 21 need not be in an equation. Gathering terms on both sides F.T. $ax = b$ ($a \neq 1$)
15(a). Perpendicular bisector of BC ± 2° Arc centre A with radius 4cm +2mm (As on the overlay) Correct region identified	B1 B1 B1	 FT for a similar region (i.e. correct but outside tolerances)
15(b). Drawing the line BD OR considering the area of one of 2 right angled triangles ABD or BCD Area ΔABD = ½ ×12 ×5 OR Area ΔBCD = ½ ×7.8×10.4 Area ΔABD = 30 (cm^2) Area ΔBCD = 40.56 (cm^2) Sum of their 2 areas evaluated 70.56 (cm^2)	S1 M1 A1 A1 A1	 For ½ base×height used for one of the right angled triangles F.T. provided M1 awarded

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Higher Tier GCSE Mathematics Unit 3 June 2013	Marks	FINAL MARK SCHEME Comments
1. (Cost of torch and battery) (£)4.14 (Cost of battery =) 4(.)14/9 46(p) or (£)0.46	B1 M2 A1	 FT their 4.14 provided 20-15.86 attempted M1 for realising this is '9× the cost of the battery', e.g. $x + 8x = 4(.)14$, or $9\times\ldots. = 4(.)14$ If units are given they must be correct (B1 and) also possible SC1 from ÷8 leading to an answer of 51(.75p), 52(p), (£)0.51(75) or (£)0.52
2.(a) All points correctly plotted	B2	Mark intention B1 for any 4 points correctly plotted
2.(b) Reasonable (straight) line of best fit	B1	In an appropriate direction, fit for purpose, with some points above and some points below the straight line. Intention to be 'straight', accept without a ruler Do not accept line drawn corner to corner
2.(c) Positive	B1	Do not accept descriptions
2.(d) Their maximum width read from their line of best fit for a maximum length of 5cm	B1	Accuracy of reading within 1 square small If no line of best fit then B0
3.(a) $12x(x - 4)$ (ISW)	B2	B1 for 1 slip inside bracket or partially factorised,
3.(b) -250	B1	CAO
3.(c) E.g. (25 - - 3)/56 28/56 0.5	M1 A1 A1	 Decimal answer required *If no marks:SC1 for answer 0.392857… rounded or truncated from (25-3)/56, or* *for 28/'their 56' where 8×7 has not been evaluated correctly, with the answer evaluated correctly as a decimal*
4. *Iona* (a)(i) Mid points (2.5,) 7.5, 12.5, 17.5 (, 22.5) (7.5×5 + 12.5×9 + 17.5×17) (=447.5) /31 14(.435….°C)	 B1 M1 m1 A1	 FT their midpoints if within or at bounds FT their Σfx ÷ 31 Ignore further rounding
4(a)(ii) Explanation, e.g. 'most common', 'more data than in other groups'	E1	
4(a)(iii) 15 (°C)	B1	Accept 14.9(99…)
4.(b)(i) Reason, e.g. 'uses all data', 'mean is a single value (whereas the mode is in a group)'	E1	Do not accept 'more accurate' without a reason
4.(b)(ii) Reason, e.g. 'range doesn't tell you how hot it is', 'you don't know if it is cold looking at the range'	E1	Accept 'extreme value might impact on the range more than on the mean' Do not accept 'mean gives you one value where as the range does not', 'range only considers largest and smallest values'
4.(c) Correct frequency polygon	B2	Ignore bars drawn as working. B1 correct except that the polygon has been translated by 0.5, OR B1 4 of the 5 points plotted correctly and a polygon formed, OR B1 for the plots at 7.5, 12.5 and 17.5 plotted correctly and these plots joined by straight lines (ignore extra spurious lines), OR B1 for correct plots but not joined or joined by a curve

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Higher Tier GCSE Mathematics Unit 3 June 2013	Marks	FINAL MARK SCHEME Comments
5. Evidence of 240×1.4/100 or equivalent + 240 (=243.36) + 80 (£)323.36 Look for • organised layout • spelling • clarity of text explanations, • the use of notation and units QWC2: Candidates will be expected to • present work clearly, with words explaining process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer • QWC1: Candidates will be expected to • present work clearly, with words explaining process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer	M1 m1 M1 A1 QWC 2	Accept 12×20 for 240 Accept 12×20 for 240 *OR award M1, m1 for 240 × 1.014* Accept 4×20 for 80. FT for idea to add 80 to an amount > 'their 12×20' CAO. Accept (£)323. Mark final answer. If units are given they must be correct QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar . OR Evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation and grammar.
6.(a) Perpendicular bisector of BC ±2° and ±2mm Arc centre A with radius 4cm ±2mm Correct region identified	B1 B1 B1	 FT for a similar region (i.e. correct but outside tolerances)
6.(b) Drawing the line BD OR considering the area of one of 2 right angled triangles ABD or BCD Area ΔABD = ½ ×12 ×5 OR Area ΔBCD = ½ ×7.8×10.4 Area ΔABD = 30 (cm^2) Area ΔBCD = 40.56 (cm^2) Sum of their 2 areas evaluated 70.56 (cm^2)	S1 M1 A1 A1 A1	 For ½ base×height used for one of the right angled triangles F.T. provided M1 awarded
7.(a) x/1.5= 3.6/2 OR x = (3.6/2)× 1.5 OR x = 1.8× 1.5 x = 2.7 (cm) y/4.5 = 2/3.6 OR y = (2/3.6) ×4.5 OR y = 4.5÷1.8 y = 2.5 (cm)	M1 A1 M1 A1	
7.(b) In either order Option: 'Length of the third side', 'another side' Option: 'Included angle', 'size of angle between two sides'	E1 E1	Accept 'SSS' Do not accept 'all the sides are different lengths' Must refer to 'included' angle in some way. Accept 'SAS' *Read descriptions, they must not contradict!*

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Higher Tier GCSE Mathematics Unit 3 June 2013	Marks	FINAL MARK SCHEME Comments
8.(a) $(2x + 5)(3x – 5)$	B2	B1 for $(2x … 5)(3x … 5)$
8.(b) Method of clearing all 3 fractions Correctly collecting like terms LHS, i.e. $(16x + 2 – 12x – 21 = 3$ leading to) $4x – 19 = 3$ $x = 22/4$ or equivalent (11/2 or 5.5 or 5 ½)	M2 A1 A1	M1 for clearing 2 of the 3 fractions. 'Clearing' implies that the denominator is 1 FT provided at least M1 already awarded FT provided at least M1 already awarded Mark their final answer *If no marks SC1 for sight of (4x-19)/6*
9.(a) Strategy, sketch with tanker to boat (3.2km) and lighthouse to boat (4.5km)perpendicular $d^2 = 3.2^2 + 4.5^2$ 30.49 Distance 5.5(2… km)	S1 M1 A1 A1	 FT from their sketch interpretation *If no marks, 45 as hypotenuse, then SC1 for an answer of 3.16…(km)* *Do not accept scale drawings*
9.(b) Calculating an angle in their right angled triangle, e.g. tanBOL=4.5/3.2 or sinBOL=4.5/5.5 or CosBOL=3.2/5.5, OR accept tanBLO=3.2/4.5, or sinBLO=3.2/5.5, or CosBLO=4.5/5.5 Appropriate sketch with an angle of 54(°) to 55(°) Bearing (rounds to) 305(°) to 306(°)	M1 A2 B1	FT their distance '5.5'  OR for appropriate angle that if continued would give the correct bearing (see sketch above) A1 for $\tan^{-1}1.4…$ or $\sin^{-1}0.8…$ or $\cos^{-1}0.58..$, OR answer 35(°) to 36(°) or inappropriate 54(°) to 55(°) CAO *Do not accept scale drawings*
10. $x(x + 5) = 2100$ or $x^2 + 5x – 2100 = 0$ $x = \{-5 \pm \sqrt{(5^2 - 4\times1\times-2100)}\}/ 2$ $= (-5 \pm \sqrt{8425})/ 2$ Width 43.4 (cm)	S1 M1 A1 A1	Brackets must be intended Allow 1 slip in substitution. FT for their quadratic with no zero terms and with sight of 2100 and 5 in the equation FT from S0, M1 CAO. Ignore -48.4 as not required Must be from evidence of using the quadratic formula
11.Use of ½ absinC ½ ×3.4×2.7×sin123° 3.8(49…cm^2)	M1 A1 A1	 Accept 3.9 or 4(cm^2) from appropriate working
12.(a)(i) Idea of frequency density × 10 (2+4+6+10+8+10) × 10 400 (people)	S1 M1 A1	 Allow 1 error CAO. Must be from correct working for 2nd August SC1 for an answer of 400 from reading 2nd September
12.(b)Reason, e.g. 'only know total time', '**only** shows the amount of time'	E1	
12.(c) Implies 'Grant correct' AND reason, e.g. 'can only estimate from the group', 'yes as the histogram only gives 120 to 140 minutes'	E1	
12.(d) Frequency densities: 3, 8, 9, 10, 9,6.5, 11, 3.5 Correct histogram	M2 A1	Watch last 3.5 height is of width 140 - 180 M1 for any 4 correct frequency densities CAO
13.(a) Calculation of at least 3 of the coordinates Plotting at least 5 correct points accurately Correct curve through all 6 correct points	B1 P1 C1	(-2,0) (-1,4) (0,6) (1,6) (2,4) (3,0) Do not accept drawn with straight lines, or a 'flat' part
13.(b)(i) -2 and 3	B1	FT their curve provided it crosses y=0 at least twice, all values must be given
13.(b)(ii) Considering y = 2 Two x-values from their graph	M1 A1	FT their curve FT for all possible values, provided at least 2solutions
13.(c) Split into areas by ordinates given & attempt to sum Use of (0,6) (1,6) (2,4) (3,0) Correct substitution into trapezium rule 13	M1 B1 m1 A1	FT from (a) Or correct calculations shown for the area (6+5+2)

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Higher Tier GCSE Mathematics Unit 3 June 2013	Marks	FINAL MARK SCHEME Comments
14. Correct placement of <ABD= 134° $AD^2 = 5.6^2 + 26.8^2 - 2\times5.6\times26.8\times\cos134$ $AD^2 = 958.1(0865\ldots)$ AD = 30.9(533… m) or 31(m)	S1 M1 A1 A1	Or 46° if appropriate for their alternative calculations FT their 134° provided it is an obtuse angle for possible M1 and final A1 only (use of 140° leads to 31.297…)
15. 195° or 345° Then: 345° or 195° with no other values	B1 B1	Answers from calculations that strictly round or truncate to those given FT 540 – their first answer. Do not FT from multiples of 90° *Accept sight of -15° as working not as another value answer*

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Surname	Centre Number	Candidate Number
Other Names		0

WJEC CBAC

GCSE

4353/02

MATHEMATICS (UNITISED SCHEME)

UNIT 3: Calculator-Allowed Mathematics HIGHER TIER

A.M. THURSDAY, 17 January 2013

$1\frac{3}{4}$ hours

ADDITIONAL MATERIALS

A calculator will be required for this paper.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

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 continuation page at the back of the booklet, taking care to number the question(s) correctly.

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 **6**.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	**5**	
2	**5**	
3	**5**	
4	**2**	
5	**4**	
6	**9**	
7	**6**	
8	**5**	
9	**6**	
10	**4**	
11	**4**	
12	**3**	
13	**8**	
14	**10**	
15	**5**	
16	**7**	
17	**2**	
TOTAL MARK		

4353 020001

J A N 1 3 4 3 5 3 0 2 0 1

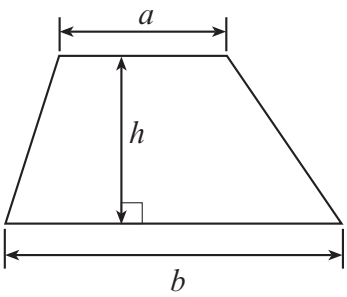
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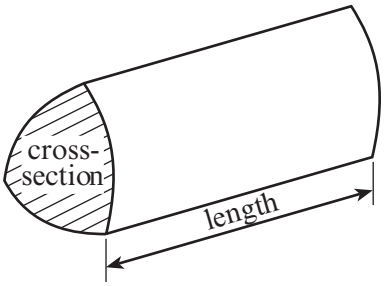
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Formula List

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

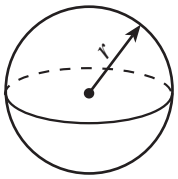


Volume of prism = area of cross-section × length



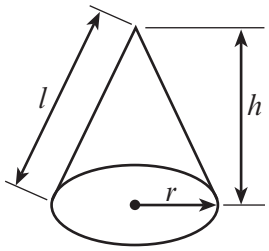
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

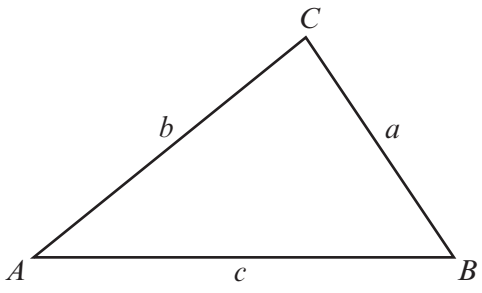


In any triangle ABC

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

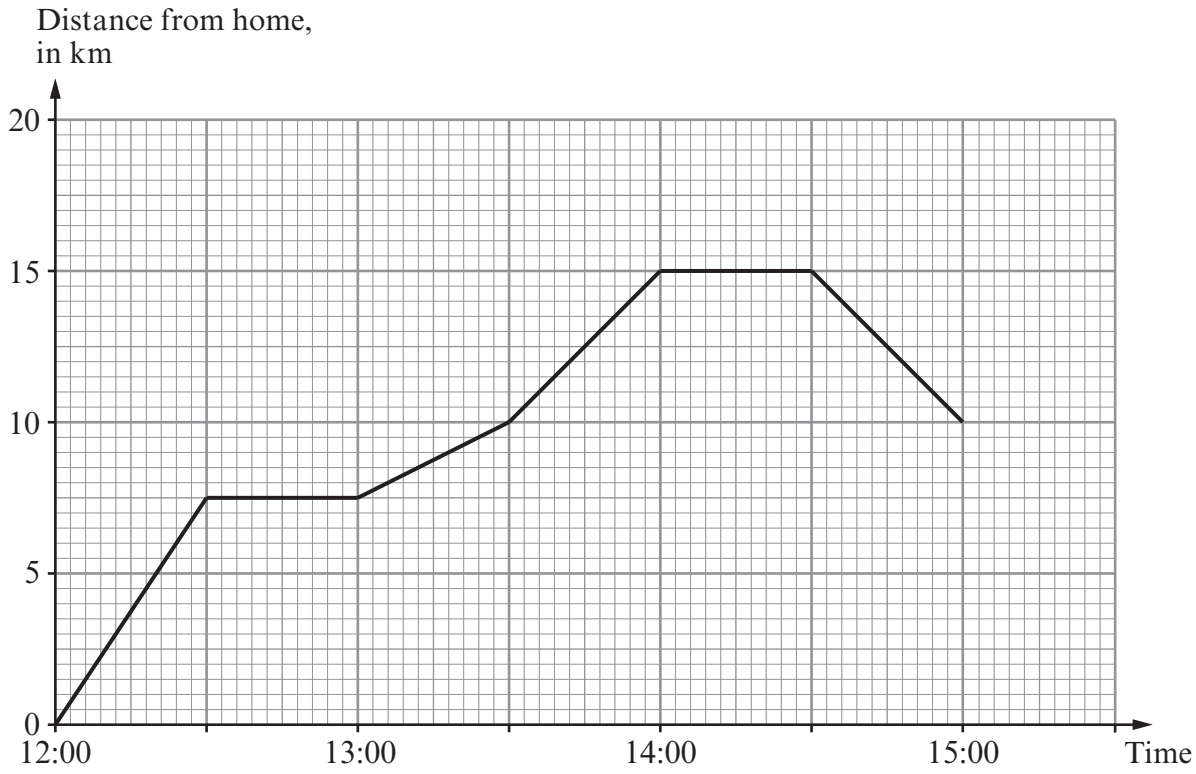
$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

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1. The travel graph below represents Scot's bike ride, starting from home.



(a) Between which two times was Scot furthest away from home?

Between ..... and .....

[1]

(b) Scot started his bike ride at 12:00.
He has a cycle computer that shows the distance he rides.
He had two half-hour rests, but otherwise kept on cycling.
He set his cycle computer to zero when he left home.
What distance did his cycle computer show at 15:00?

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.....

[1]

(c) What was Scot's average speed between 13:00 and 13:30?
You must give the units of your answer.

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.....

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[3]

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2. A tile maker needs to make an accurate drawing of a regular hexagon.
The length of each side of the hexagon is 4 cm.
Draw the hexagon accurately below.
You must mark on your drawing the size of each angle.

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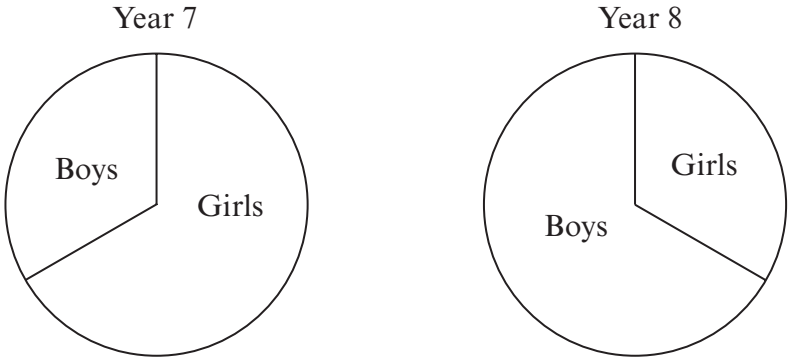
[5]

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3. The pie charts below represent the number of boys and the number of girls in two year groups.



There are 150 pupils in Year 7.
There are 40 more boys in Year 8 than there are boys in Year 7.

How many girls, in total, are there in Year 7 and Year 8?

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[5]

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4. Toby and his sister share £42.21 in the ratio of 1 : 6.
Calculate how much each of them will receive.

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[2]

5. A solution to the equation $x^3 + 2x - 25 = 0$ lies between 2 and 3.
Find this solution correct to 1 decimal place.

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[4]

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

Cerys makes hats for a living.



Each hat she makes needs 0·45 m^2 of fabric, costing £3.40 per m^2, and 50 cm of ribbon.
Cerys pays herself £12.60 per hour.
She can make 3 hats in two hours.
There are no other costs or outgoings.
Cerys sells each hat for £10.25, which exactly balances the costs and outgoings.

Calculate how much the ribbon costs per metre.
You must show all your working.

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[9]

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7. Factorise each of the following expressions.

(a) $6x^3 - 12x^2$

.....

.....

[2]

(b) $x^2 - x - 42$

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.....

[2]

(c) $15x^2 + 31x + 14$

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[2]

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8. *(a)* Solve $2x + 5 = 5(x + 1)$.

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[2]

(b) Solve $\frac{1}{3}(2x + 3) + 4x = 8$.

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[3]

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9. *(a)*

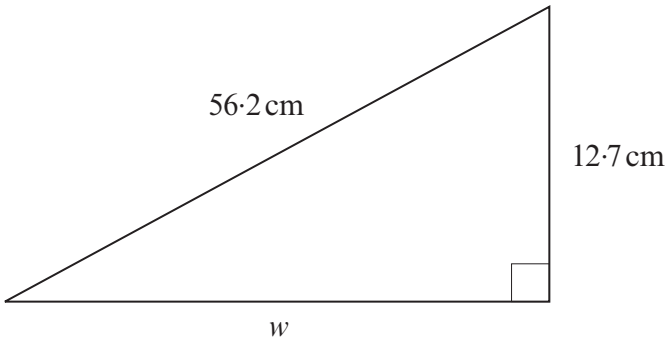


Diagram not drawn to scale

Calculate the length *w*.

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[3]

(b)

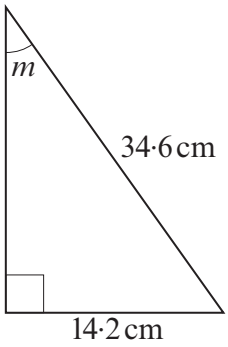


Diagram not drawn to scale

Calculate the size of angle *m*.

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[3]

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10. Triangle ABC is similar to triangle DEF.

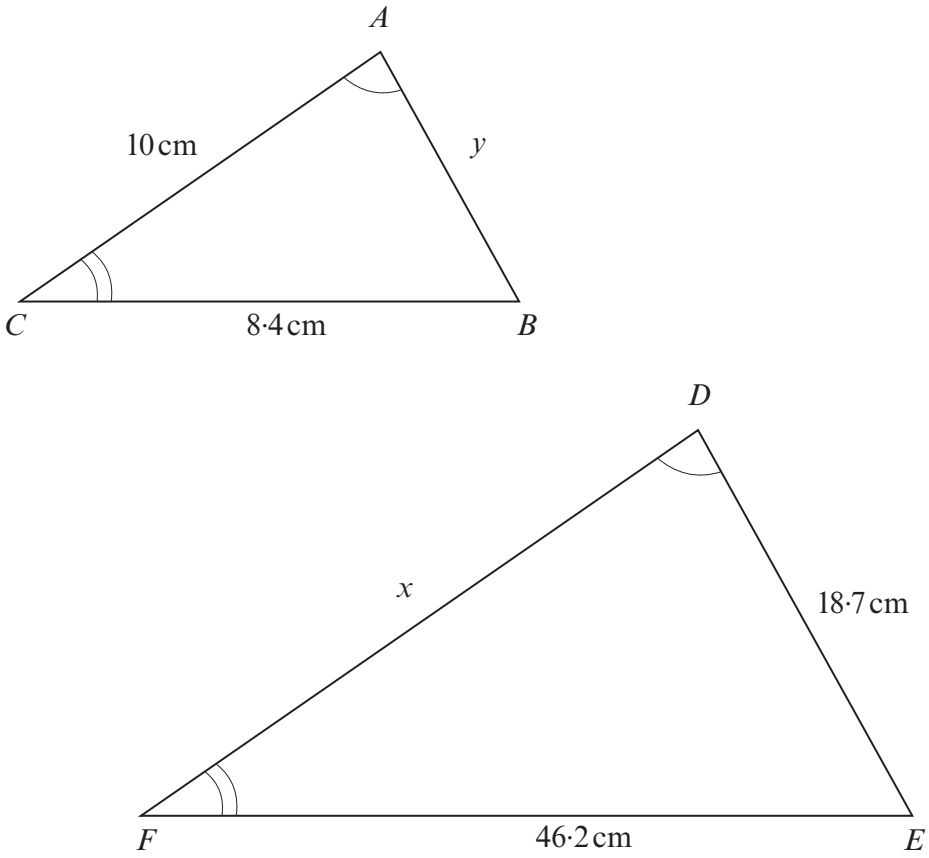


Diagram not drawn to scale

Calculate the lengths x and y.

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[4]

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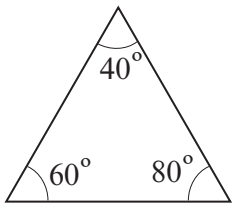
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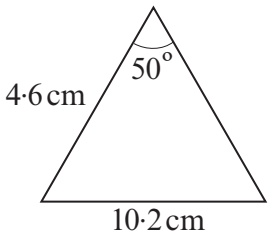
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11. Select two different pairs of congruent triangles from the diagrams below.
Give a reason why each of the pairs of triangles are congruent.

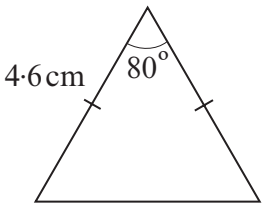
A



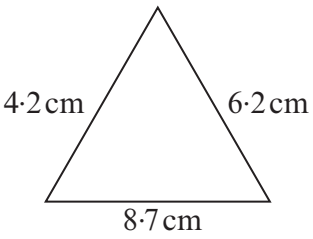
B



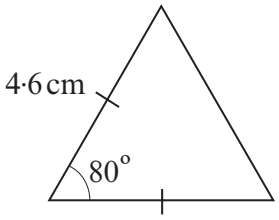
C



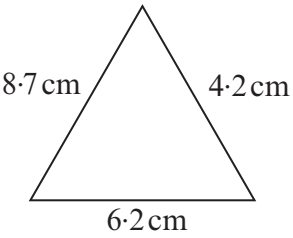
D



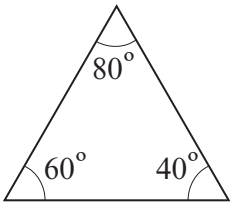
E



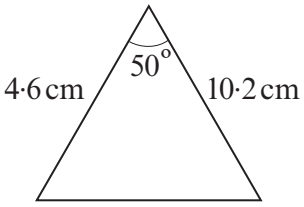
F



G



H



Diagrams not drawn to scale

Triangle ..... is congruent to triangle .....

Reason

.....

.....

[2]

Triangle ..... is congruent to triangle .....

Reason

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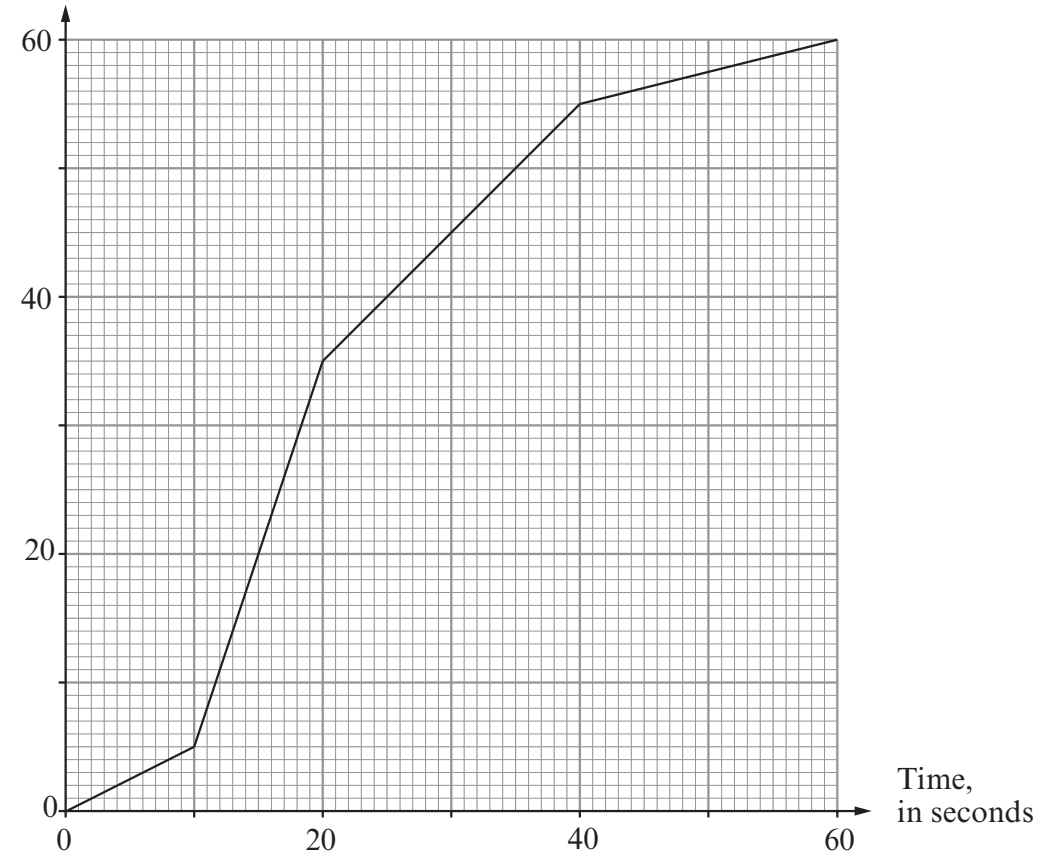
[2]

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12. A timekeeper has recorded the times taken by a number of children to complete a task.
All of the children completed the task.
The results are shown in the following cumulative frequency diagram.



In order to compare with another task, the timekeeper needs to know the interquartile range.

(a) Calculate an estimate for the interquartile range.

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[2]

(b) The same children completed a different task of similar difficulty.
The interquartile range for this task was 30 seconds.
More children finished with a time closer to the median in one of the tasks.
Which task was this, the first task or the second task?
Give a reason for your answer.

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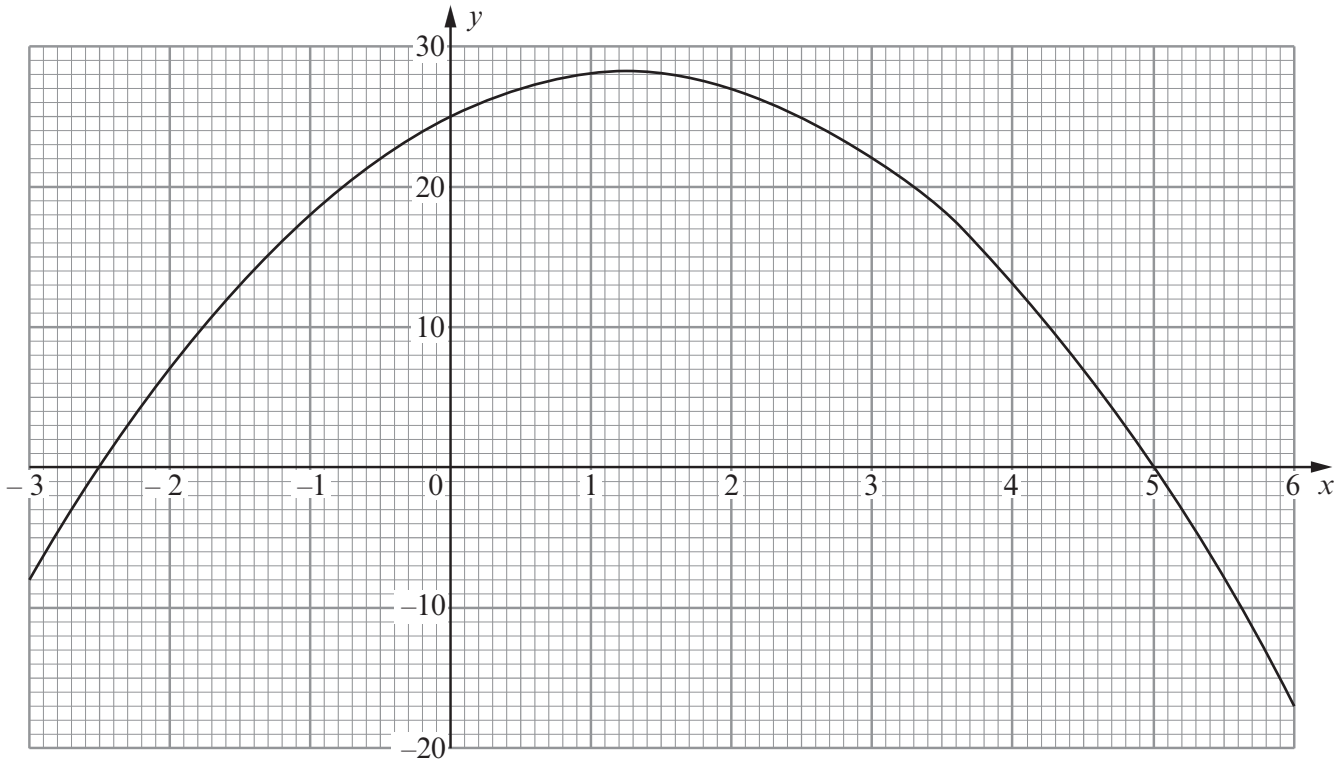
[1]

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13. The graph of $y = -2x^2 + 5x + 25$ for values of x from –3 to 6 is shown below.



(a) Use the graph to solve each of the following equations.

(i) $-2x^2 + 5x + 25 = 0$

.....

[1]

(ii) $-2x^2 + 5x + 20 = 0$

.....

.....

.....

[2]

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(b) Find the coordinates of the points of intersection of the graph of $y = -2x^2 + 5x + 25$ and the graph of $y = x^2 - 2x - 3$.

[5]

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14. Fifty people took part in a charity walk.
The table shows a grouped frequency distribution of the amounts of money raised, to the nearest £.

Amount a, in £	Number of people
$10 \leqslant a \leqslant 19$	2
$20 \leqslant a \leqslant 29$	18
$30 \leqslant a \leqslant 39$	29
$40 \leqslant a \leqslant 49$	1

(a) Calculate an estimate for the mean amount of money raised per person.

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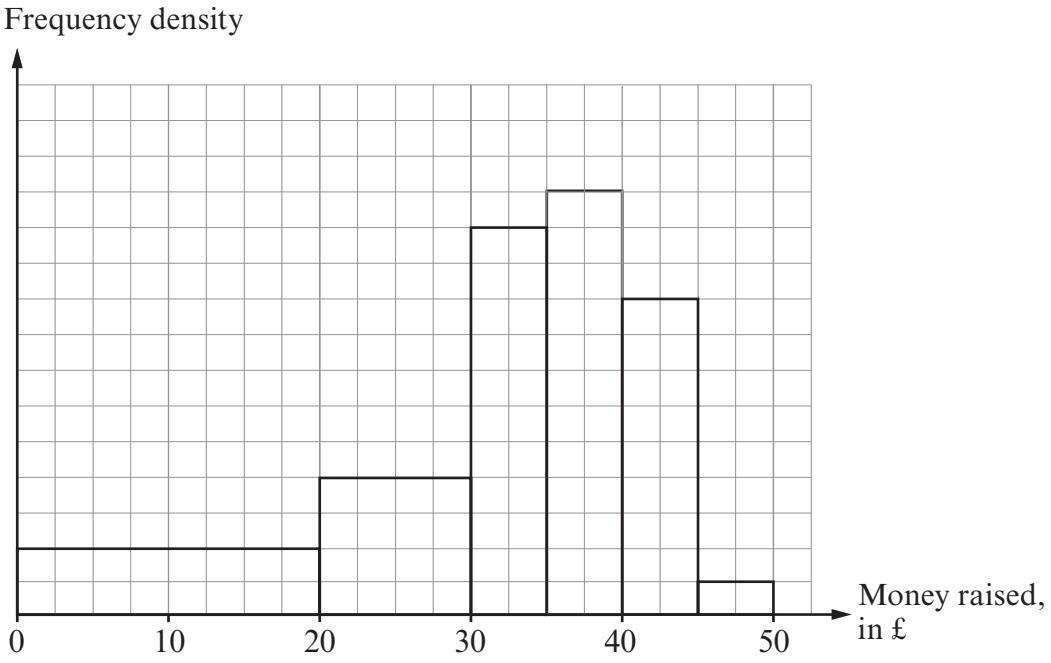
[4]

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(b) Morgan arranged a charity run to raise money.
She had drawn a histogram to show the distribution of money raised from the charity run.



Morgan has forgotten to write the scale on the vertical axis.
She remembers that 16 people raised £30 or less.
Calculate an estimate for the total money raised.

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[6]

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15. Given that g is directly proportional to t^2, and that $g = 450$ when $t = 7{\cdot}5$,

(a) find an expression for g in terms of t,

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[3]

(b) use the expression you found in *(a)* to complete the following table.

g		450	800
t	2·5	7·5	

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[2]

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16. A surveyor has recorded some measurements of a field on a sketch, as shown in the diagram.

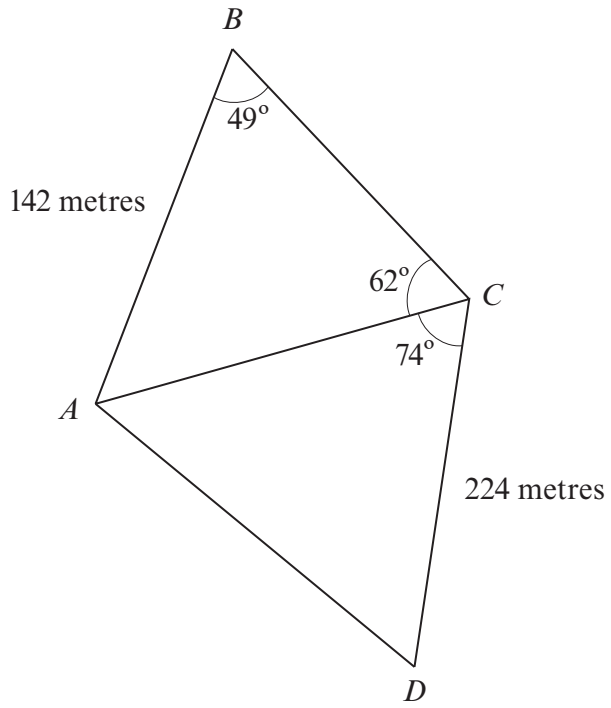


Diagram not drawn to scale

The surveyor needs to know the length of the side AD in order to arrange for a drain to be installed.
Calculate the length AD.

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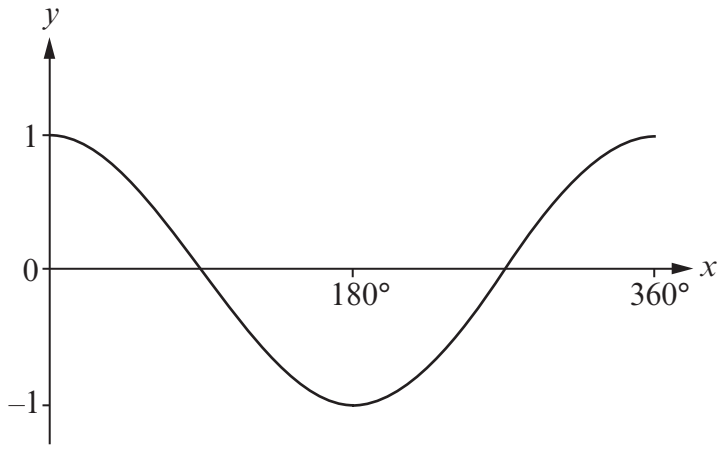
[7]

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17. The diagram shows a sketch of $y = \cos x$ for the values of x from 0° to 360°.



Solve the equation $\cos x = 0{\cdot}342$ for all values of x from 0° to 360°.

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[2]

END OF PAPER

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GCSE MARKING SCHEME

MATHEMATICS - UNITISED

JANUARY 2013

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2013 examination in GCSE MATHEMATICS - UNITISED. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

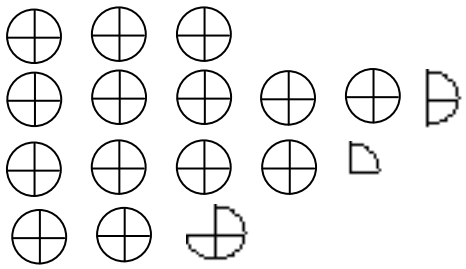
It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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Unit 1 – Higher Tier	4
Unit 2 – Foundation Tier	7
Unit 2 – Higher Tier	10
Unit 3 – Foundation Tier	14
Unit 3 – Higher Tier	17

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UNIT 3 - FOUNDATION TIER

UNIT 3 (Calculator allowed) Foundation Tier	Marks	Final Mark Scheme Comments
All parts (a) – (c) marked at the same time 1. (a) (i) 19.70 (meat) 12.56 (bread) 11.62 (milk) 4.92 (cereal) 48.8(0) 1. (a) (ii) (£) 60 – (£)48.8(0) =(£)11.2(0) 1. (a) (iii) Points = 4×5 = 20	 B1 B1 B1 B1 M1 A1 M1 A1	 F.T. their figures for 1 error F.T. their '48.80'
1. (b) (i) 5.32	B1	
1. (b) (ii) 75	B1	B0 for any decimal places e.g. 75.0 and 75.00 etc get B0
1. (b) (iii) 66000	B1	
All parts (a) – (b) marked at the same time **Indirect marking - Tick marked** 2. (a)  (b) Weeks 1,2,3, 4 along one axis Uniform scale for the frequency axis starting at 0 and labelled Four bars at correct heights (bars must be of equal width). Can be in any order.	✓ B1 B1 B1 B1 B1 B1 B2	 Anywhere within the base (inc.) of the corresponding bar. If no scale then B0, but allow one square to represent 20. If frequency scale starts with 20 at the top of the first square the starting at 0 will be implied for B1. Condone frequency numbers alongside square instead of at the top of the squares. B1 for any 2 or 3 correct bars on F.T.
3. Evidence of square counting 42 – 48 inclusive area = 420 – 480 (m^2)	M1 A1 B1 3	 F.T. 10 times their 'square count'
All parts (a) – (b) marked at the same time 4. (a) 26 m (b) 8 × 5 = 40	 B1 U1 M1 A1 4	 Independent of other marks

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UNIT 3 (Calculator allowed) Foundation Tier	Marks	Final Mark Scheme Comments
5.(a) 38 – 16 = 22	M1 A1	
5. (b) 26	B1	
5. (c) Total = 138 /5 27.6	M1 m1 A1	Allow up to 2 errors in their readings for the M1 C.A.O.
Use Overlay 6. (a) $A\hat{B}C = 73°$ $A\hat{C}B = 55°$ Completed triangle	 B1 B1 B1	 Allow ± 2º Allow ± 2º Only if at least one B1 awarded. Complete reflection of the triangle gets B2
Use Overlay 6. (b) Arcs for first step Line drawn	 B1 B1	
Use Overlay 6. (c) Arcs for 60° Bisecting 60° arcs step 1 Bisecting 60° arcs step 2 and line drawn.	 B1 B1 B1	
7. (a) 5/8 – 2/8 = 3/8	M1 A1	Accept decimals, e.g. (0).625 – (0).25 = (0).375
(b) 3x = 15 x = 5	B1 B1	 F.T. ax = b, a≠1
(c) 32 = 3×6 + 2W 2W = 14 W = 7	B1 B1 B1	Correct substitution Isolating the W F.T. if ax = b (a≠1)
8. (a) 1.829	B2	B1 for 1.82(8836..) OR 1.83 All places given must be correct rounded or truncated.
8. (b) 30.74	B2	B1 for 30.74(1781...) All places given must be correct rounded or truncated
9. Adults (£) 668 + 668 (1336) Cost per child = 668/2 + 150 Children 484 × 3 (1452) Sea view 10 × 5 × 14 (700) Balcony 6 × 5 × 14 (420) Total (£)3908 Look for • spelling • clarity of text explanations, • the use of notation (watch for the units £) QWC2: Candidates will be expected to • present work clearly, with words explaining process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their final answer QWC1: Candidates will be expected to • present work clearly, with words explaining process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their final answer	B1 B1 B1 B1 B1 B1 QWC 2	Using the adult and child prices consistently from another row of the table gets MR–1. OR B1 for 50 AND 30 OR B1 for 140 AND 84 F.T. for one error (i.e. if B4 awarded from first five B1s). QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR Evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation and grammar.

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UNIT 3 (Calculator allowed) Foundation Tier	Marks	Final Mark Scheme Comments
10. (a) (Between) 14(:)00 and 14(:)30 or equivalent	B1	If am/pm used it must be correct, i.e. pm. Do not accept ½ hour or 30 minutes
10. (b) 20 (km)	B1	Ignore sight of incorrect units
10. (c) 2 ½ (km) / 30(minutes) OR 2 ½ / 0.5 OR equivalent 5 km/h	M1 A1 U1	Accept statement '2 ½ (km) in half hour' or similar (OR 5000) Independent of other marks (OR ……. m/h) Accept k(m)ph
Indirect marking - Tick marked 11. 1 hat made in 2/3 hour or 40 minutes Pay per hat (2/3 of £12.60) (£)8.4(0) (Cost of fabric) 0.45 × 3.4(0) (= £)1.53 (Total costs excluding ribbon £) 8.4(0)+ 1.53 (=£9.93) (Ribbon cost per hat) (£)10.25 – (£)9.93 (= £0.32 or 32p) (Ribbon costs) 64(p) (per metre)	 B1 B1 M1 A1 m1 m1 A1	*If units are given they must be correct, penalise once only* FT 'their 1.53' provided M1 awarded and 'their £8.40' provided ≠£12.60 FT 10.25 – 'their 9.93', provided it includes pay and fabric costs CAO *Alternative:* *(Cost of fabric for 3 hats) 3×0.45×3.4(0) M1* *= (£)4.59 A1* *(or M1, A1 for cost of fabric for 1 hat £1.53)* *(Pay for 3 hats in 2 hours 2×£12.60 = £)25.2(0) B1* *(Sales of 3 hats 3 ×10.25 = £)30.75 B1* *(Cost of ribbon for 3 hats)* *(£)30.75 – (£)4.59 –(£)25.2(0) (=96p) m1* *FT provided first M1 and includes pay and sales* *(Cost ribbon per hat or per metre) ÷3 (×2) m1* *FT provided first M1 and includes pay and sales* *(Cost of ribbon per metre)* *64(p) or (£)0.64 A1 CAO*
12. (a) 6x + 7 = 4x +24 2x = 17 x = 8.5 OR 8½ (b) $\frac{x}{5} = 9$ OR x + 20 = 65 x = 45	B1 B1 B1 B1 B1	Correctly clearing brackets F.T. until second error Collecting terms F.T. ax = b with a≠1 Accept embedded answers such as 45/5 = 9 for B2, but if they go on to write x=13 for example then B1 only.
13. One correct evaluation, $2 \le x \le 3$ 2 correct evaluations, 2.55 ≤x ≤2.75, one either side of 0 2 correct evaluations, 2.65 ≤ x ≤2.75, one either side of 0 2.7 *No calculations shown: accept "too high", ">", etc.*	B1 B1 M1 A1	x $x^3 + 2x - 25$ 2 -13 2.1 -11.5.. 2.2 -9.95.. 2.3 -8.2.. 2.4 -6.37.. 2.5 -4.37.. 2.55 -3.318.. 2.6 -2.2.. **2.65 -1.09..** **2.7 0.083** 2.75 1.29.. 2.8 2.55.. 2.9 5.18.. 3 8

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UNIT 3 - HIGHER TIER

Unit 3 Higher Tier	Mark	Final Mark Scheme Comments
1(a) (Between) 14(:)00 and 14(:)30 or equivalent	B1	If am/pm used it must be correct, i.e. pm. Do not accept ½ hour or 30 minutes
1(b) 20 (km)	B1	Ignore sight of incorrect units
1(c) 2 ½ (km) / 30(minutes) OR 2 ½ / 0.5 OR equivalent 5 km/h	M1 A1 U1	Accept statement '2 ½ (km) in half hour' or similar (OR 5000) Independent of other marks (OR ……. m/h) Accept k(m)ph
2. 360/6 OR 4 × 180/6 OR 720/6 60(° exterior) OR 120(° interior) **4** (of the 5) sides to be drawn forming a polygon drawn all of length 4cm (±2mm) **4** (of the 6) angles drawn correctly (within 2° tolerance) A correct hexagon, within tolerances allowed	M1 A1 B1 B1 B1	Need not be associated with interior or exterior angle Accept in working, or 120(°) **implied** in the drawing, Do not accept if incorrectly labelled on a drawing, e.g 120° drawn but incorrectly labelled 60°, allow M1, A0. Allow unless contradicted Irrespective of angles See overlay *Penalise drawing polygons with number of sides 5, 7, 8, … as -1 then FT,*
3. Strategy: measure angles 120°, 240° in both pie charts, or appropriate 1:2 ratio, or sight of appropriate ⅓ to ⅔, or appropriate use of ratio for 1 pie chart 50 boys **and** 100 girls in year 7 90 boys in Year 8 90/2 or 45 girls in Year 8 (Total number of girls) 145	S1 B1 B1 B1 B1	Accept sight of '120 and 240', or '120(°/360°) is ⅓' or '240(°/360°) is ⅔' May be in different sections of working and implies S1 FT 'their 50' + 40 provided S1 awarded and 'their 50'≠120 FT 'their 90'/2 provided S1 awarded CAO *If incorrect angles used, they must total 360°, then mark as follows:* *S0, FT to possible B1, B1, then B0, B0*
4. (£) 42.21/7 (£)6.03 and (£)36.18	M1 A1	
5. One correct evaluation, $2 \le x \le 3$ 2 correct evaluations, $2.55 \le x \le 2.75$, one either side of 0 2 correct evaluations, $2.65 \le x \le 2.75$, one either side of 0 2.7 *No calculations shown: accept "too high", ">", etc.*	B1 B1 M1 A1	x $x^3 + 2x - 25$ 2 -13 2.1 -11.5.. 2.2 -9.95.. 2.3 -8.2.. 2.4 -6.37.. 2.5 -4.37.. 2.55 -3.318.. 2.6 -2.2.. **2.65** **-1.09..** **2.7** **0.083** 2.75 1.29.. 2.8 2.55.. 2.9 5.18.. 3 8

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Unit 3 Higher Tier	Mark	Final Mark Scheme Comments
6. 1 hat made in 2/3 hour or 40 minutes Pay per hat (2/3 of £12.60) (£)8.4(0) (Cost of fabric) 0.45 × 3.4(0) (= £)1.53 (Total costs excluding ribbon £) 8.4(0)+ 1.53 (=£9.93) (Ribbon cost per hat) (£)10.25 – (£)9.93 (= £0.32 or 32p) (Ribbon costs) 64(p) (per metre) QWC2 requires sight of the majority of the process steps shown, labelled, with units and money expressed correctly, with a clear final answer QWC1 requires at least 2 of the process steps, which are labelled and units correct in a labelled final answer OR QWC1 majority of process steps shown with units correct in a labelled final answer Look for • spelling • clarity of text explanations, • the use of notation (watch for the units and '0' for unit pence when using £) QWC2: Candidates will be expected to • present work clearly, with words explaining process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their final answer QWC1: Candidates will be expected to • present work clearly, with words explaining process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their final answer	 B1 B1 M1 A1 m1 m1 A1 QWC 2	*If units are given they must be correct, penalise once only* FT 'their 1.53' provided M1 awarded and 'their £8.40' provided ≠£12.60 FT 10.25 – 'their 9.93', provided it includes pay and fabric costs CAO *Alternative:* *(Cost of fabric for 3 hats) 3×0.45×3.4(0)* *M1* *= (£)4.59 A1* *(or M1, A1 for cost of fabric for 1 hat £1.53)* *(Pay for 3 hats in 2 hours 2×£12.60 = £)25.2(0) B1* *(Sales of 3 hats 3 ×10.25 = £)30.75 B1* *(Cost of ribbon for 3 hats)* *(£)30.75 – (£)4.59 –(£)25.2(0) (=96p) m1* *FT provided first M1 and includes pay and sales* *(Cost ribbon per hat or per metre) ÷3 (×2) m1* *FT provided first M1 and includes pay and sales* *(Cost of ribbon per metre)* *64(p) or (£)0.64 A1 CAO* QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR Evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation and grammar.
7(a) $6x^2(x - 2)$	B2	B1 for correct partial factorisation, OR B1 for correct highest common factor and 1 term in brackets correct
7(b) $(x - 7)(x + 6)$	B2	Mark final answer. B1 for (x … 7)(x … 6)
7(c) $(3x + 2)(5x + 7)$	B2	Mark final answer. B1 for (3x + 7)(5x + 2) or (3x … 2)(5x … 7) or 5x(3x +2) + 7(3x + 2) or equivalent
8(a) 2x + 5 = 5x + 5 x = 0	M1 A1	Or 3x = 0 Accept 0 = x. Do not accept x = 0 from incorrect working, if M0 seen, then A0
8(b) 2x + 3 + 3×4x = 8×3 or 2x/3 + 1 + 4x = 8 14x = 21 or 14x/3 = 7 x = 3/2 or 1.5 or equivalent	B1 B1 B1	Sight of ⅔ written as 0.6 is an error. FT until 2nd error Mark final answer
9(a) $w^2 + 12.7^2 = 56.2^2$ or $(w^2 =) 56.2^2 - 12.7^2$ $w^2 = 2997.15$ or $(w =) \sqrt{2997.15}$ 54.7(46… cm) or 55 (cm)	M1 A1 A1	

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Unit 3 Higher Tier	Mark	Final Mark Scheme Comments
9(b) sin m = 14.2/34.6 m = 24(.23…°)	M1 A2	A1 for m = $\sin^{-1}0.4(104…)$
10. (x =) (46.2/8.4) × 10 (OR 5.5 × 10) (=) 55(cm) (y =) 18.7 ÷ (46.2/8.4) (OR 18.7/5.5) (=) 3.4(cm)	M1 A1 M1 A1	Or alternative full method to find x, x not implicit Or alternative full method to find y, y not implicit Alternatively candidates may refer to scale factor 5.5 throughout
11. In either order: D with F, in any order Reason: 3 sides or SSS C with E, in any order Reason: 2 sides and <u>included</u> angle or SAS	 B1 E1 B1 E1	E marks depend on B marks
12(a) Intention to subtract horizontal values on x-axis for vertical axis reading across at 45 and 15 (= 30 – 13 to 14) IQR answers in the range 16 to 17 12(b) Indicates the first task due to smaller IQR	M1 A1 E1	 FT for 'their IQR' comparison with conclusion
13(a)(i) -2.5 **and** 5	B1	
13(a)(ii) Sight of y=5, in working or on graph -2.2 to -2.1AND 4.6 to 4.7	M1 A1	
13(b) Strategy, set up a table or list to calculate values for $y=x^2$ -2x -3 with at least 1 point correct, or equate $-2x^2+5x+25=x^2-2x-3$ At least 3 values in their table or list correct **and** plotted, OR $3x^2-7x-28=0$ with substitution into quadratic formula (allow 1 slip) All necessary correct points plotted joined with **correct curve drawn** to intersections, OR x ={7±√385}/6 Intersection approximately at x = 4.4 and x = -2.1 x = 4.4, y = 7.8 and x = -2.1, y = 5.6	S1 M1 A1 A1 A1	 x: -3, -2, -1, 0, 1, 2, 3, 4, 5, 6 y: 12, 5, 0, -3, -4, -3, 0, 5, 12, 21 CAO. Not a FT from incorrect points, then FT for possible A marks FT from points plotted but not joined FT provided M1 FT their graph, or their x calculation to evaluate y correctly
14(a) Mid points 14.5, 24.5, 34.5, 44.5 2×14.5 + 18×24.5 + 29×34.5 + 1×44.5 (=1515) $\sum fx$ / 50 (£) 30.3(0)	B1 M1 m1 A1	 FT for their mid points from within group FT for correct sum of their *fx* terms /50 FT their $\sum fx$ / 50 correctly evaluated Accept (£)30 provided correct working seen
14(b) Strategy, e.g. noticing 0 to 20 same area as 20 to 30, or noticing first 2 rectangles are of equal area 20× frequency density = 8, or equivalent, or 16 people split 8 people and 8 people for first 2 rectangles Uniform scale, implied or shown (height of first rectangle is 0.4, 2nd height is 0.8, etc.) 8×10+8×25+11×32.5(0)+12×37.5(0)+9×42.5(0)+1×47.5(0) OR 20×0.4×10 + 10×0.8×25 + 5×2.2×32.50 + 5×2.4×37.50 + 5×1.8×42.50 + 5×0.2×47.50 (£)1517.5(0)	S1 B1 B1 M2 A1	Or £20 with 8 people, or 32 squares for £30, or 32 squares for 16 people, or 16 squares for 8 people Or sight of 0.4 Award of this B1 implies S1 also Or sight of 0.4 and 0.8 appropriately, or 'each person 2 squares', or sight of 8, 8,11,12, 9,1or sight of any 4 of 10, 25, 32.5(0), 37.5(0), 42.5(0), 47.5(0) Award of this B1 implies S1 and previous B1 also *If M1 or M2 are awarded,* *this implies previous S1, B1 and B1* <u>Do not FT from incorrect frequency density scale</u> M1 for • any 3 correct products within the overall sum • the appropriate sum of products but with bounds used instead of mid points, or • use of mid points 10, 25, 32.5(0), 37.5(0), 42.5(0) and 47.5(0) within a product sum CAO. Mark final answer

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<table>
<tr><th>Unit 3
Higher Tier</th><th>Mark</th><th>Final Mark Scheme
Comments</th></tr>
<tr><td>15(a) $g \propto t^2$ or $g = kt^2$
$450 = k \times 7.5^2$
$g = 8t^2$
15(b)
<table><tr><td>g</td><td>50</td><td>450</td><td>800</td></tr><tr><td>t</td><td>2.5</td><td>7.5</td><td>(±) 10</td></tr></table></td><td>B1
M1
A1

B2</td><td>Ignore incorrect use of ‘=’ or ‘α’ throughout
FT from non linear only
May be implied in (b)

B1 for each value.
FT non linear expressions for SC1 only if both FT answers accurately evaluated</td></tr>
<tr><td>16. Use of sine rule followed by cosine rule
AC/sin49 = 142/sin62
AC = sin49 × 142/sin62
AC = 121 or 121.3(76…) or 121.4 (metres)
$AD^2 = AC^2 + 224^2 - 2 \times AC \times 224 \times \cos 74$
$AD^2 = 49875.25$ to 49922.816..
AD = 223(.3…. metres)</td><td>S1
M1
A1
A1
M1
A1
A1</td><td>

FT their AC provided ≠142 or ≠224 or spurious

Depends on previous M1 and A1</td></tr>
<tr><td>17. 70(°) and 290(°) with no other values</td><td>B2</td><td>B1 for either value</td></tr>
</table>

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Surname	Centre Number	Candidate Number
Other Names		0

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GCSE

4353/02

MATHEMATICS (UNITISED SCHEME)

UNIT 3: Calculator-Allowed Mathematics

HIGHER TIER

A.M. MONDAY, 12 November 2012

$1\frac{3}{4}$ hours

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

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 **10**.

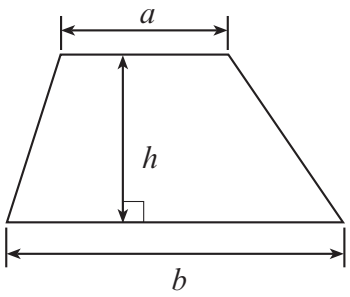
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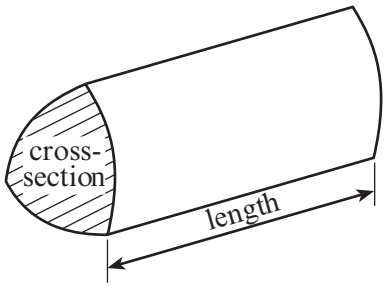
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Formula List

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

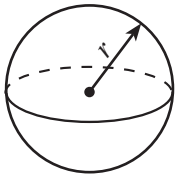


Volume of prism = area of cross-section × length



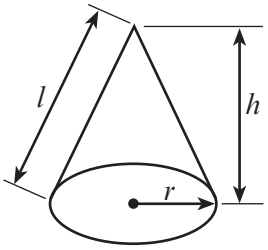
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

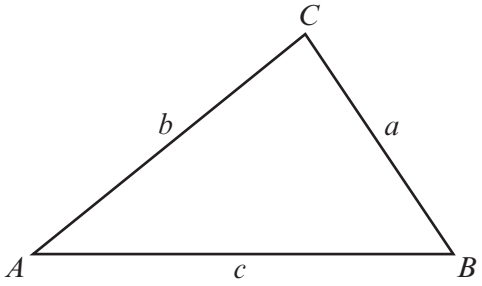


In any triangle ABC

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

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

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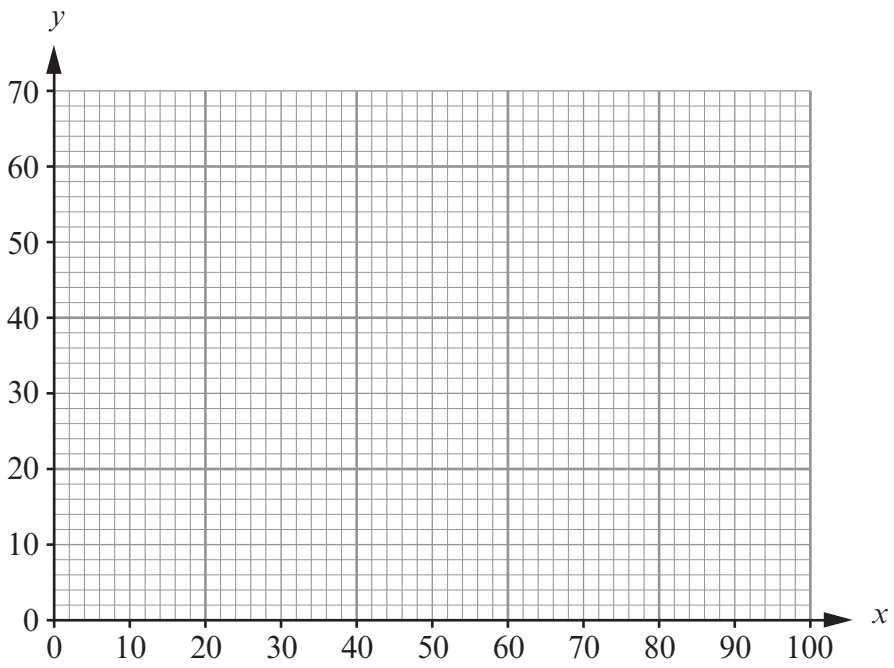
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1. In an experiment, values of x and y are recorded to look for a possible relationship. The table below shows the results.

x	20	50	80	90	60	40	100	70	0	30
y	26	38	56	64	46	36	62	48	14	20

(a) On the grid below, draw a scatter diagram to show the results.



[2]

(b) The mean of the x values is 54.
Calculate the mean of the y values and then draw the line of best fit on your scatter diagram.

.....

.....

[4]

(c) Which type of correlation does your scatter diagram show?

.....

[1]

(d) Using your line of best fit, find an approximate value of y when x is 35.

.....

[1]

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2. *(a)* When $r = 6{\cdot}2$ and $t = -3{\cdot}1$, find the value of $5r - 2t$.

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[2]

(b) When $x = \frac{1}{2}$ and $y = \frac{3}{4}$, find the value of $x^2 + 7y$.

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[2]

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3. *(a)* The mean of 5 numbers in a list is 24.
When two extra numbers are added to the list, the mean increases by four.
What does this tell you about the values of the two extra numbers?

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[3]

(b) Four numbers are listed in ascending order.
The mode of the four numbers is 3.
No number in the list is greater than 3.
The range of the four numbers is 5.
The median of the four numbers is 2.
Find the four numbers.

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[3]

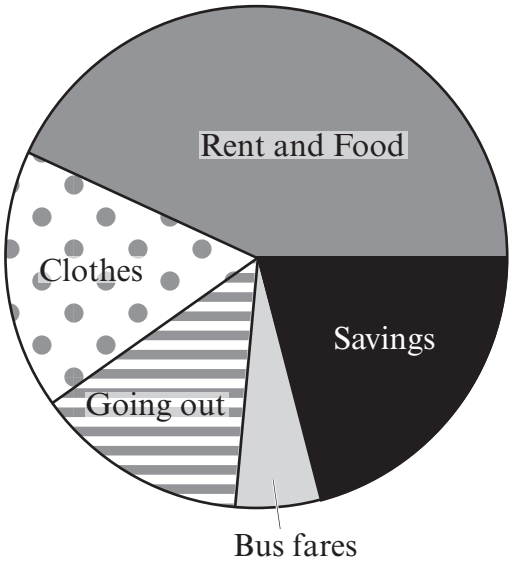
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4. The pie chart shows what Maria plans to do with her first month's salary of £1620.



(a) Calculate the amount Maria plans to spend on clothes from her first month's salary.

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[3]

(b) How much more does Maria plan to spend, in the first month, on clothes than on bus fares?

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[2]

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(c) Mark finds a job with a lower first month's salary than Maria's first month's salary. He draws a pie chart that shows what he plans to do with his first month's salary.

The angle for 'going out' on Mark's pie chart is the same as the angle for 'going out' on Maria's pie chart.

Looking at Mark's pie chart, Maria states

"We will both have the same amount of money to spend on going out."

Explain, with reasons, whether Maria is correct or not.

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[2]

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5. *(a)* Use a ruler and a pair of compasses only to construct an accurate drawing of the rhombus described below.

Rhombus
- All sides are of length 6 cm
- The acute angles are 60°

You must show all your construction lines.

[4]

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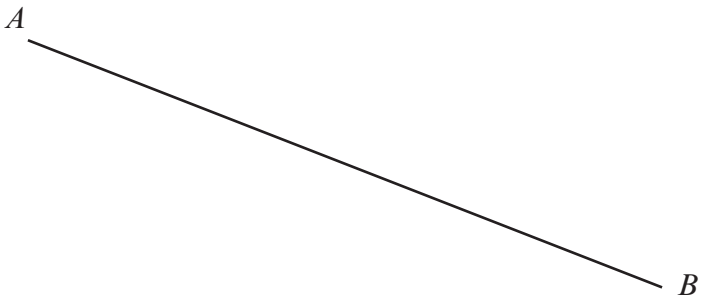
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(b) Shade the region that satisfies both of the following conditions.

(i) The points are less than 6·5 cm from A.
(ii) The points are nearer to B than to A.

[3]



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6. Boxes of raisins are sold in supermarkets.



The number of raisins per box in each of 100 boxes was counted.
The table below shows a summary of the results.

Number of raisins per box	Number of boxes
120 to 128	8
129 to 137	26
138 to 146	48
147 to 155	18

(a) Calculate an estimate for the mean number of raisins per box.

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[4]

(b) Which is the modal group for the number of raisins per box?

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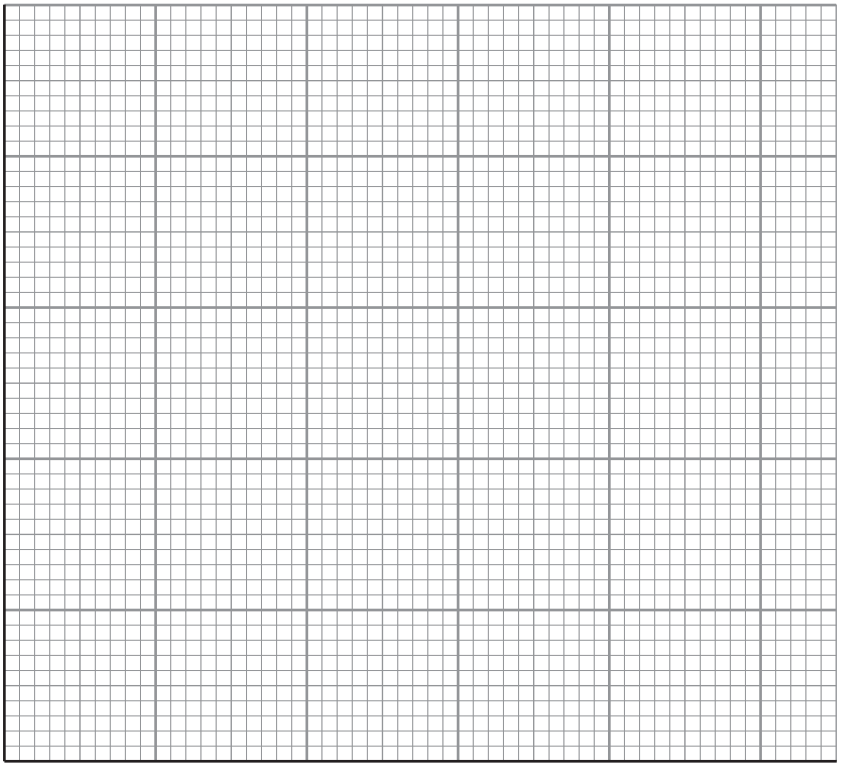
[1]

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(c) On the graph paper below, draw a frequency polygon to show the distribution of the number of raisins in each box.



[3]

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Turn over.

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7.

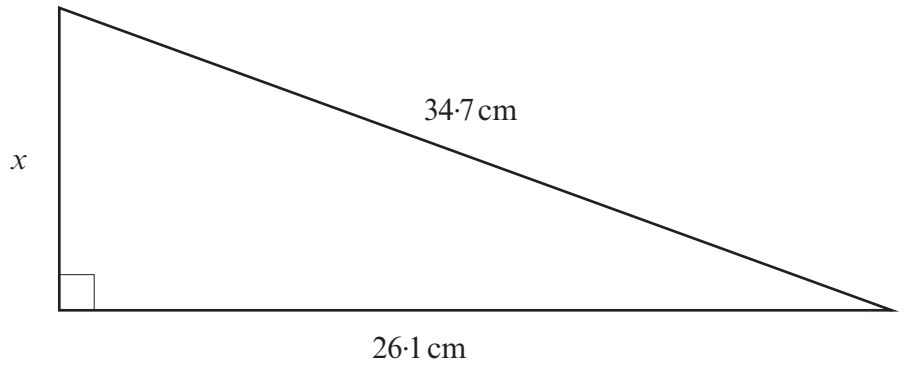


Diagram not drawn to scale

Calculate the length of the side marked x in the diagram.

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[3]

8. *(a)* Factorise $5x^2 - 10x$.

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[2]

(b) Solve $x^2 - 6x = 0$.

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[2]

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9. *(a)* Write down the value of $\frac{1}{2 \times 10^{-6}}$ in standard form.

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[2]

(b) Find, in standard form, the value of $(2{\cdot}3 \times 10^{-5}) + (7{\cdot}8 \times 10^{-6})$, giving your answer correct to two significant figures.

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[2]

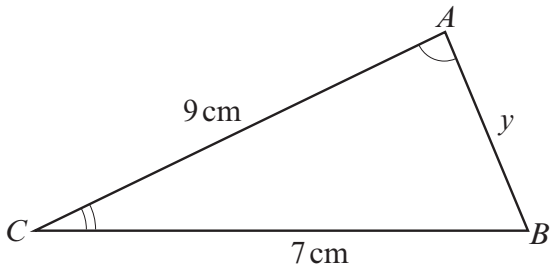
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10. *You will be assessed on the quality of your written communication in this question.*

Triangle *ABC* is similar to triangle *FGH*.



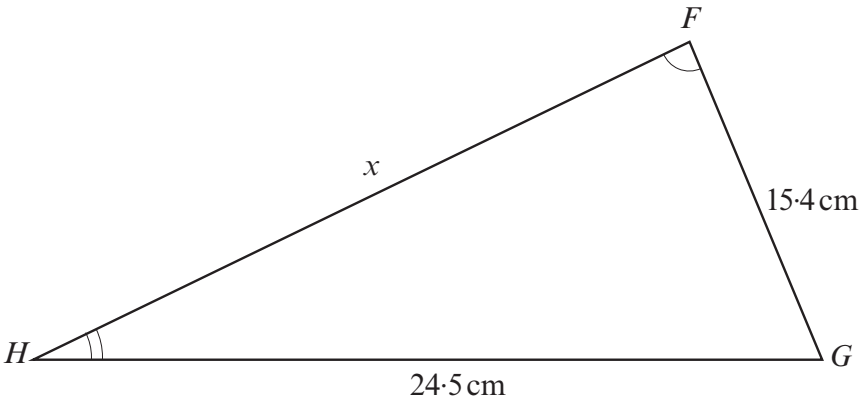


Diagram not drawn to scale

Calculate the lengths x and y.
You must show all your working.

[6]

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11. *(a)* Factorise $x^2 - 5x - 14$.

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[2]

(b) Solve $\frac{x+2}{3} + \frac{x-2}{2} = 3$.

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[4]

(c) Use the formula method to solve the equation $2x^2 + 3x - 3 = 0$, giving your solutions correct to two decimal places.

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[3]

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Turn over.

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12. A company needs to report the density of platinum in kg/m^3.
The company produces a platinum sphere with a radius of 3·4 cm.
The platinum sphere weighs 3509·6 g.
Calculate the density, in kg/m^3, of the platinum used to make the sphere.

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[6]

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13.

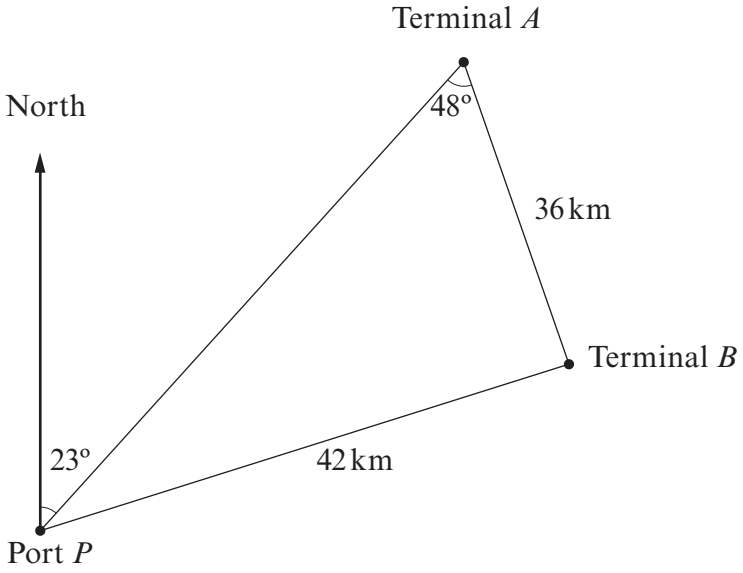


Diagram not drawn to scale

A tanker leaves Port *P* on a bearing of 023° to travel to Terminal *A*.
At Terminal *A*, the tanker changes direction to travel to Terminal *B*.
From Terminal *B* the tanker returns to Port *P*.
Given this information and the information shown on the diagram, calculate the bearing of Terminal *B* from Port *P*.

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[5]

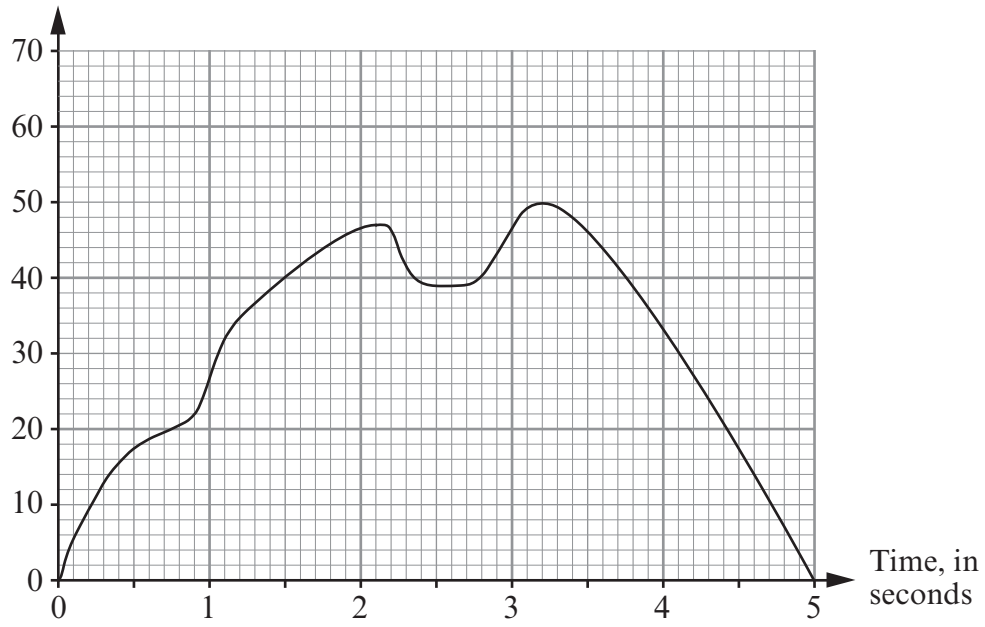
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14. An engineer carried out an experiment.
He recorded the velocity of a particle during the first 5 seconds of the experiment.



(a) Calculate the acceleration of the particle at 3 seconds.
You must state the units of your answer.

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[4]

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(b) (i) Calculate an estimate for the area enclosed by the x-axis and the curve shown in the graph.

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[4]

(ii) Write down an estimate for the distance travelled by the particle in the 5-second period.

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[1]

TURN OVER

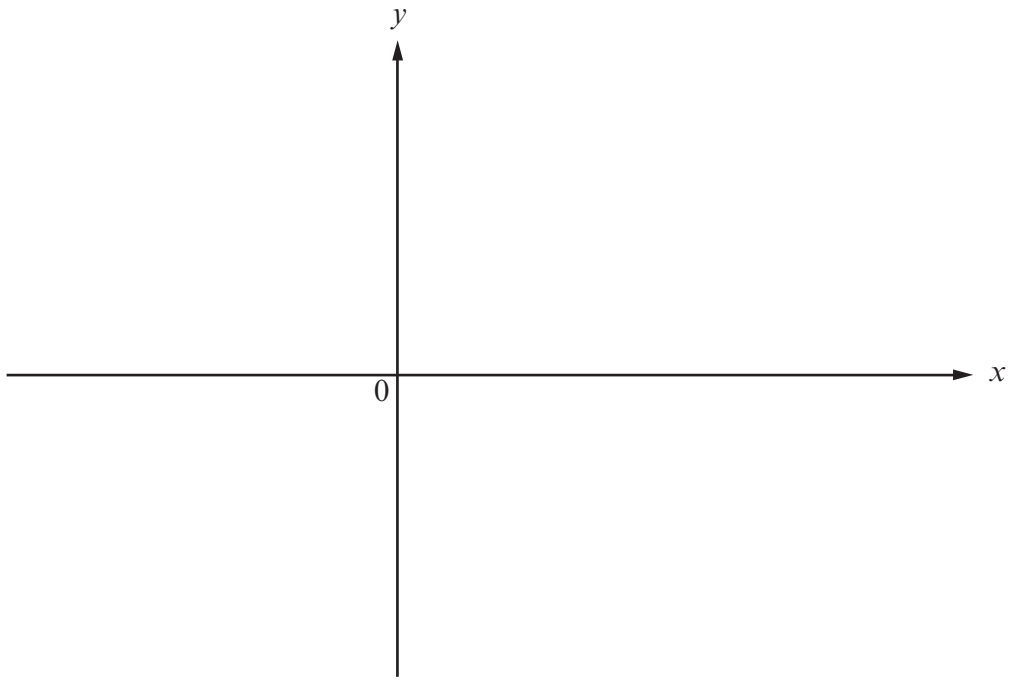
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15. *(a)* Using the axes below, **sketch** the graph of $y = \sin x$ for values of x from -180° to 180°.

[2]



(b) Find all solutions of the following equation in the range -180° to 180°.

$$\sin x = -0{\cdot}4542$$

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[2]

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GCSE MARKING SCHEME

MATHEMATICS - UNITISED

NOVEMBER 2012

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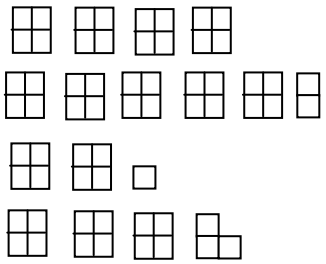
INTRODUCTION

The marking schemes which follow were those used by WJEC for the November 2012 examination in GCSE MATHEMATICS - UNITISED. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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UNIT 3 (Calculator allowed) Foundation Tier	Mark	FINAL MARK SCHEME Comments
1. (a)(i) 21.65 (meat) 5.11 (cheese) 9.84 (drinks) (£) 36.6(0) (ii) 10% = (£) 3.66 5% = (£) 1.83 OR 183 **(p)** Pays (£) 34.77 (b) (i) 256.7 (ii) 257 (iii) 300	B1 B1 B1 B1 M1 A1 B1 B1 B1 B1 10	 F.T. their figures for 1 error Unsupported 36.6(0) gets B4. Any valid method **for finding 5%** F.T. their total Unsupported (£)1.83 gets the M1, A1. F.T. their total and discount
2. (a)  (b) Summer	B1 B1 B1 B1 B1 5	 Accept any orientation of the rectangle Accept any orientation of the 3 squares joined together B0 for 550, but B1 for Summer and 550
3. Evidence of square counting 59 – 65 590 – 650	M1 A1 B1 3	 F.T. 10 × 'their area' Unsupported answers in the range 590 – 650 get all 3 marks
Use overlay allow ± 2mm 4. (a) XZ=9.6cm Angle ZXY (63º) Completed triangle (b) Arc through both arms of the angle centre B Arcs to give bisector and line drawn. (c) 2 arcs for 120° Bisecting 60° and 120° arcs Drawing the 90°	 B1 B1 B1 B1 B1 B1 B1 B1 8	 Allow ±2mm Allow ± 2º as on overlay Only if at least one B1 awarded. **Complete reflection of the triangle gets B2**
5. Reading at the end of the period 48576 Reading at the beginning of the period 48262 Number of units used 314 314 × 24 (÷ 100) 75.36 Charge: 35p per day for 90 days 31.5(0) Total cost 106.86	 B1 M1 A1 B1 B1 5	 Must be in £s for the A1. **Pence gets A0.** F.T. their figures.

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UNIT 3 (Calculator allowed) Foundation Tier	Mark	FINAL MARK SCHEME Comments
6. (a) 9×6 $= 54$ cm^2 (b) 30 (cm)	M1 A1 U1 B1 4	 Independent of other marks
7. (a) 27 (b) 14	B2 B2 4	B1 for 12 OR 15 B1 for – 3 OR (9 and 8)
8. (a) 1.17 (b) 40.1	B2 B2 4	B1 for 1.174(96423) All places given must be correct rounded or truncated B1 for 40.13(10429) All places given must be correct rounded or truncated
9. (a) Plotting at (20, 1) Horizontal line 10 minutes long Plotting the point 30 minutes along and 10km above the end of their horizontal line OR at (60, 11) (b) 10 km in ½ hour = 20 (km/h) (c) 3.3 to 3.4 (km)	B1 B1 B2 M1 A1 B1 7	 F.T. 'their bus stop' plot The line must be drawn for the B2. B1 for each **OR B1 for a plot at (60,10) and the line drawn.** F.T. their graph. **Difference between distances from 'their school' position and where their line cuts time = 50 secs.**
10. (a) Tablet A runs out after $40/(2+2)$ $= 10$ (days) Tablet B runs out after 20 days Tablet C runs out after 30 days Look for • Spelling • Clarity of text explanations • The use of notation – watch for kg,'=','£', 'p' being used appropriately. QWC2: Candidates will be expected to • present work clearly, with words explaining their processes or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer QWC1: Candidates will be expected to • present work clearly, with words explaining their processes or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer (b) Tablets A and B will run out after 20 days (c) All 3 tablets will run out after 60 days	M1 A1 B1 B1 QWC 2 <

UNIT 3 (Calculator allowed) Foundation Tier	Mark	FINAL MARK SCHEME Comments
11. (a) Interpretation of the two extra numbers, e.g. 'the total of the 2 numbers is 76', or 'mean of the two extra numbers is 38'	B3	B2 for 7×28=196 and 5×24= 120 with difference 76, or "each number is 38", OR B1 for 5×24= 120 or 7×28=196 or sight of 7×28 - 5×24, or statement such as 'mean of the two numbers is greater than 24' B0 if reference in a statement only to one of the extra numbers
(b) -2, 1, 3, 3 given in any order	B3	B2 for satisfying 3 of the 4 conditions, e.g. greatest number 3 and more than one three with smallest number -2, OR B1 for satisfying 2 of the 4 conditions, e.g. greatest number 3 and more than one three, or for the greatest 3 and smallest -2 *Conditions to check for 'their numbers':* *Mode 3, No number>3, Range 5, Median 2* *B2 for 3 conditions satisfied* *B1 for 2 conditions satisfied*
H3	6	
12.(a) Accurate rhombus drawn within tolerances with all appropriate construction arcs shown (6 cm ± 2mm, 60°±2°, 120°±2°)	B4	B3 for sides all correct lengths (±2mm) and evidence of suitable construction for either a 60°±2° or a 120°±2°with arcs shown, OR B2 for a least 2 sides shown correct (±2mm) and either 60°±2° or 120°±2° constructed correctly with arcs shown, OR B1 for knowing the rhombus has angles 60°, 60°, 120°±2° and 120° ±2°(may be a correct rhombus drawn), or for a construction of 60°±2° or 120°±2° with appropriate arcs, or a construction of a rhombus with sides 6cm showing arcs
(b)Correct region shaded	B3	Mark intention. B1 for line, B1 for arc, B1 for shading (FT arc centre A and a line crossing AB). Shading needs to be on both sides of AB. Remember arc centre B is MR-1 continue to mark *If 2 arcs are drawn, with shading ambiguous then mark the straight line only, B0, B1, B0*
H5	7	
13.(a) Angle 60° (±2°) or sight of ⅙ or equivalent	B1	
60/360 × 1620	M1	Not for 60/360 of 1620, need to see (or imply) "×"
(£)270	A1	FT from their angle , fraction or percentage
b) Complete method, e.g. 2/3 × 270	M1	FT from (a). For bus fares accept 20°(±2°), or 0.05 to 0.06, or 5% to 6%
(£)180	A1	Mark final answer. If no marks SC1 for (£)90 *Errors of premature approximation are penalised -1 in (a) & (b)* *Do not credit 'spurious correct' answers from incorrect working*
(c) Explanation that shows clear understanding that the pie charts are based on different amounts so the angles cannot be directly compared, with a conclusion that Maria is wrong, e.g. 'Maria is wrong as the same angle means that the same proportion of money is spent, not the same amount of money, as Maria has more to spend'	E2	Accept explanations that imply that Maria is wrong. E1 for statement, e.g, 'Maria is wrong, as Mark has less to start with', or 'Mark has a lower first month salary than Maria, so Maria is wrong', OR E1 for understanding shown but no conclusion *Accept errors in calculation if process and idea correct*
H4	7	

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UNIT 3 - HIGHER

UNIT 3 Higher Tier	Mark	FINAL MARK SCHEME Comments
1.(a) All points plotted correctly (b)(i) (26+38+56+64+46+36+62+48+14+20)/10 41 (ii) Line of best fit through means (c) Positive (d) From their line of best fit (reading to 1 small square)	B2 M1 A1 B2 B1 B1 8	B1 for 5 correct, or reverse correct for 7 or 8 points 410/10. Allow 1 slip in y-values used For intention to add y-values and divide by 10 CAO Tolerance within half square, excluding 40 and 42. B1 for a straight line of best fit, with points above and below, OR for straight line of best fit through the means but skewed FT from straight lines or curves. If no line, B0
2.(a) 5×6.2 - 2×-3.1 37.2 (b) 1/4 + 7×3/4 22/4 or equivalent (5.5)	M1 A1 M1 A1 4	31 + 6.2 If no mark SC1 for 24.8 ½ needs to be squared within a correct substitution with an attempt to add Mark final answer, if 22/4 incorrectly simplified A0
3.(a) Interpretation of the two extra numbers, e.g. 'the total of the 2 numbers is 76', or 'mean of the two extra numbers is 38'   (b) -2, 1, 3, 3 given in any order   <

UNIT 3 Higher Tier	Mark	FINAL MARK SCHEME Comments
5.(a) Accurate rhombus drawn within tolerances with all appropriate construction arcs shown (6 cm $\pm$ 2mm, 60°$\pm$2°, 120°$\pm$2°)	B4	B3 for sides all correct lengths ($\pm$2mm) and evidence of suitable construction for either a 60°$\pm$2° or a 120°$\pm$2°with arcs shown, OR B2 for a least 2 sides shown correct ($\pm$2mm) and either 60°$\pm$2° or 120°$\pm$2° constructed correctly with arcs shown, OR B1 for knowing the rhombus has angles 60°, 60°, 120°±2° and 120° ±2°(may be a correct rhombus drawn), or for a construction of 60°±2° or 120°±2° with appropriate arcs, or a construction of a rhombus with sides 6cm showing arcs
(b)Correct region shaded	B3 7	Mark intention. B1 for line, B1 for arc, B1 for shading (FT arc centre A and a line crossing AB). Shading needs to be on both sides of AB. Remember arc centre B is MR-1 continue to mark *If 2 arcs are drawn, with shading ambiguous then mark the straight line only, B0, B1, B0*
6.(a) Mid points 124, 133, 142, 151 $\frac{124\times8 + 133\times26 + 142\times48 + 151\times18}{100}$ (OR13984) = 139.8(4) or 140 (b) 138 to 146 (c) Suitable uniform scales with axes labelled Correct frequency polygon	B1 M1 m1 A1 B1 B1 B2 8	Two shown is sufficient if no error Attempt $\sum$fx for their mid-points, FT provided their mid points are within interval including bounds Attempt their$\sum$ fx divided by 100. Depends on M1 Allow 139 and accept 140 from correct working Do not accept 142 alone Number of boxes vertical, Raisins horizontal Mid-points uniformly spaced, irrespective of (0,0) *FT their scales if possible* *FT reversed axes for appropriate plots* B1 for frequency polygon with one error in plotting, or for a translated polygon, or correct points plotted (but not joined with straight lines (curves or not joined)) *Ignore frequency diagram if polygon seen.*
7. Correct statement of Pythagoras' Theorem with values given, e.g. $34.7^2 - 26.1^2$ $x^2 = 522.88$ or x = $\sqrt{522.88}$ x = 22.866569… or 22.9 or 22.87 (cm)	M1 A1 A1 3	1204.09 – 681.21 Accept 22.8, 22.86 (cm) *Alternative:* *Full method using trigonometry and/or Pythagoras' Theorem* *M1* *Accurate intermediate answer* *A1* *Correct response* *A1*
8.(a) 5x(x - 2) (b) x(x – 6) (=0) x = 0 AND x =6	B2 M1 A1 4	B1 for 5x(x …) or 5x(… -2) or correct partially factorised
9.(a) 5×10^5 (b) 3.1×10^{-5}	B2 B2 4	B1 for 500 000 B1 for 3.08×10^{-5} or 0.0000308 or 0.000031 *Penalise incorrect notation only once, -1*

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UNIT 3 Higher Tier	Mark	FINAL MARK SCHEME Comments
10. (x =) (24.5/7) × 9 (OR 3.5 × 9) (=) 31.5(cm) (y =) 15.4 ÷ (24.5/7) (OR 15.4/3.5) (=) 4.4(cm) Look for: QWC1: Calculations shown in full QWC2: Labelled calculations shown in full with units and labelled (x and y) in final answers with correct use of '=' QWC2: Candidates will be expected to • present work clearly, use of '=' and cm AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer QWC1: Candidates will be expected to • present work clearly, use of '=' and cm OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer	M1 A1 M1 A1 QWC 2 6	Or alternative full method to find x, x not implicit Or alternative full method to find y, y not implicit Alternatively candidates may refer to scale factor 3.5 throughout *If no marks SC1 for sight of scale factor 3.5 or equivalent* QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR Evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation and grammar.
11.(a) (x – 7)(x + 2) (b) 2(x+2) + 3(x-2) = 3×2×3 OR equivalent 2x + 4 + 3x – 6 = 18 OR 5x = 20 OR equivalent x = 4 (c) x = { -3 $\pm\sqrt{}$(3^2 – 4 . 2 . -3)} / 2×2 = [-3 $\pm\sqrt{}$33] /4 0.69 and -2.19	B2 M2 A1 A1 M1 A1 A1 9	B1 for (x … 7)(x … 2) Penalise any further incorrect work -1 (e.g. 'solve') M1 for 2 of the 3 terms correct FT from M1 for both A marks equivalent difficulty Depends on previous A1 and must be simplified form Allow one slip CAO. Must be correct to 2 decimal places
12.Attempt Volume = 4/3 π 3.4^3 (OR 4/3 π 0.034^3) 164(.636.. cm^3) (OR 0.000164(…m^3)) Answers in range 164(.55 to 164.70…) or 165 (cm^3) Use of conversion 1m^3 = 1 000 000cm^3 3509.6g converted to 3.5096(kg), or implied Use of mass / their volume Answers when rounded to 3sig.figs give 21300 (kg/ m^3)	M1 A1 B1 B1 M1 A1 6	Accept incorrect place value for digits 3 4 for M1 FT incorrect place value 3 4, correct evaluation OR for sight of 0.034^3, not for 3.4 cm = 0.034m 'Their volume', i.e. must have attempted use of formula dimensionally correct Do not award A1 for correct response from compensating errors in place value
13.Realising the aim is to find angle in triangle at P sin P = (36 × sin 48)/42 (=0.636981….) Angle at P = 39.567…(°) 062.5(67°) to 063°	S1 M2 A1 B1 5	M1 for sin P/ 36 = (sin 48)/42 or equivalent Answers from 39.5 to 39.6 or 40. Do not accept 39 FT "23 + their P" provided leading zero given for the bearing and that at least M1 awarded

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UNIT 3 Higher Tier	Mark	FINAL MARK SCHEME Comments
14.(a) Reasonable tangent drawn	S1	
Gradient = difference v / difference t	M1	With or without tangent
Calculated gradient for **their tangent**	A1	(Answers may be in the range 25 to 37)
Units given m/s^2 or ms^{-2}	U1	Independent of other marks
(b)(i) Attempt to find area by splitting up or trapezium rule	S1	
Suitable area sections with at least 2 correct areas OR using trapezium rule correct substitution for the majority of areas	M2	M1 Suitable area sections with at least 1 correct area OR an attempt to use the trapezium rule (correct rule, but with a slip). *Allow tolerance in reading the velocity, as estimation required.*
Answers in the range 134 to 158 from correct working	A1	Units not required
(ii) FT from their answer in (b)	B1	FT irrespective of their answer not being within the range required in (a) If an incorrect unit is given, then B0 *e.g. 5 areas of width 1 seconds, heights are 26, 46 to 47, 46 to 48, 32 to 33, min area 150, max area 154* *2 areas split at 2.5 seconds gives 97.5*
	9	
15.(a) Sin curve, through the origin	M1	
± 1 shown, and $\pm 180^0$ shown or implied	A1	
(b) -27^0 and -153^0 with no other angles	B2	B1 for a correct angle. Accept unrounded values and embedded answers
	4	

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Surname	Centre Number	Candidate Number
Other Names		0

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GCSE

4353/02

MATHEMATICS (UNITISED SCHEME)
UNIT 3: CALCULATOR-ALLOWED MATHEMATICS
HIGHER TIER

P.M. TUESDAY, 19 June 2012

$1\frac{3}{4}$ hours

ADDITIONAL MATERIALS

A calculator will be required for this paper.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

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 continuation page at the back of the booklet, taking care to number the question(s) correctly.

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 **7**.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	**5**	
2	**8**	
3	**5**	
4	**8**	
5	**3**	
6	**4**	
7	**8**	
8	**9**	
9	**4**	
10	**6**	
11	**8**	
12	**2**	
13	**5**	
14	**6**	
15	**4**	
16	**5**	
TOTAL MARK		

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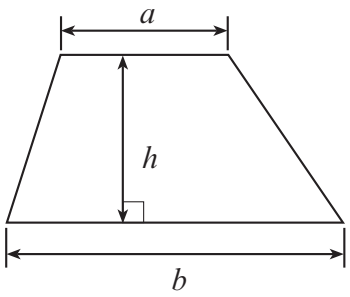
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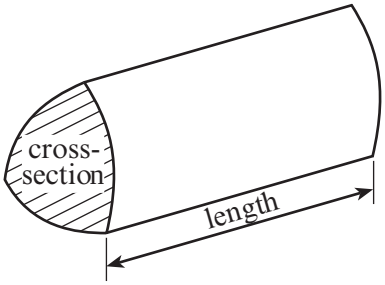
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Formula List

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

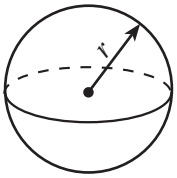


Volume of prism = area of cross-section × length



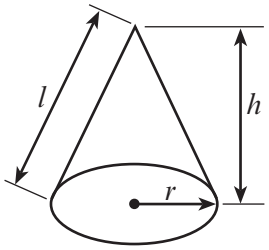
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

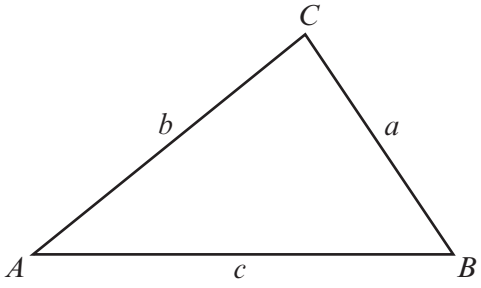


In any triangle ABC

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

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

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1. *(a)*

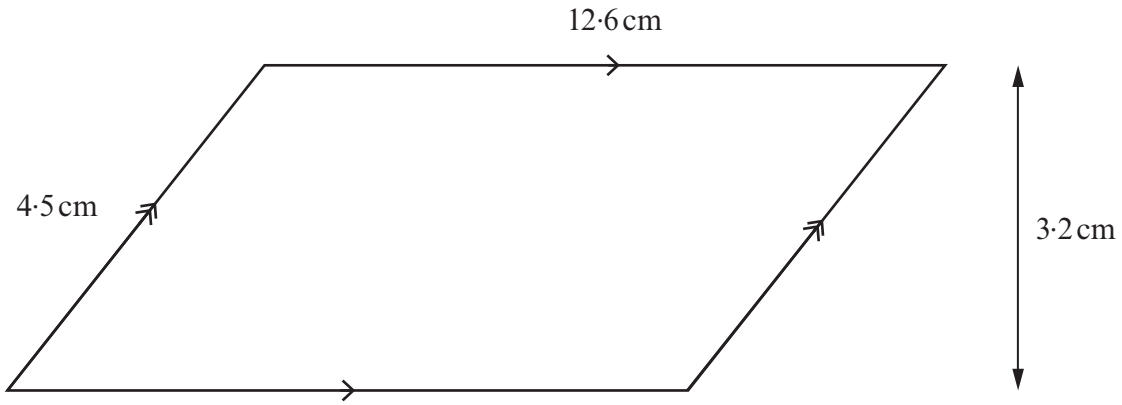


Diagram not drawn to scale

Calculate the area of the parallelogram.

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[2]

(b) A regular polygon has an exterior angle of 22·5°.
How many sides does this regular polygon have?
You must show all your working.

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[3]

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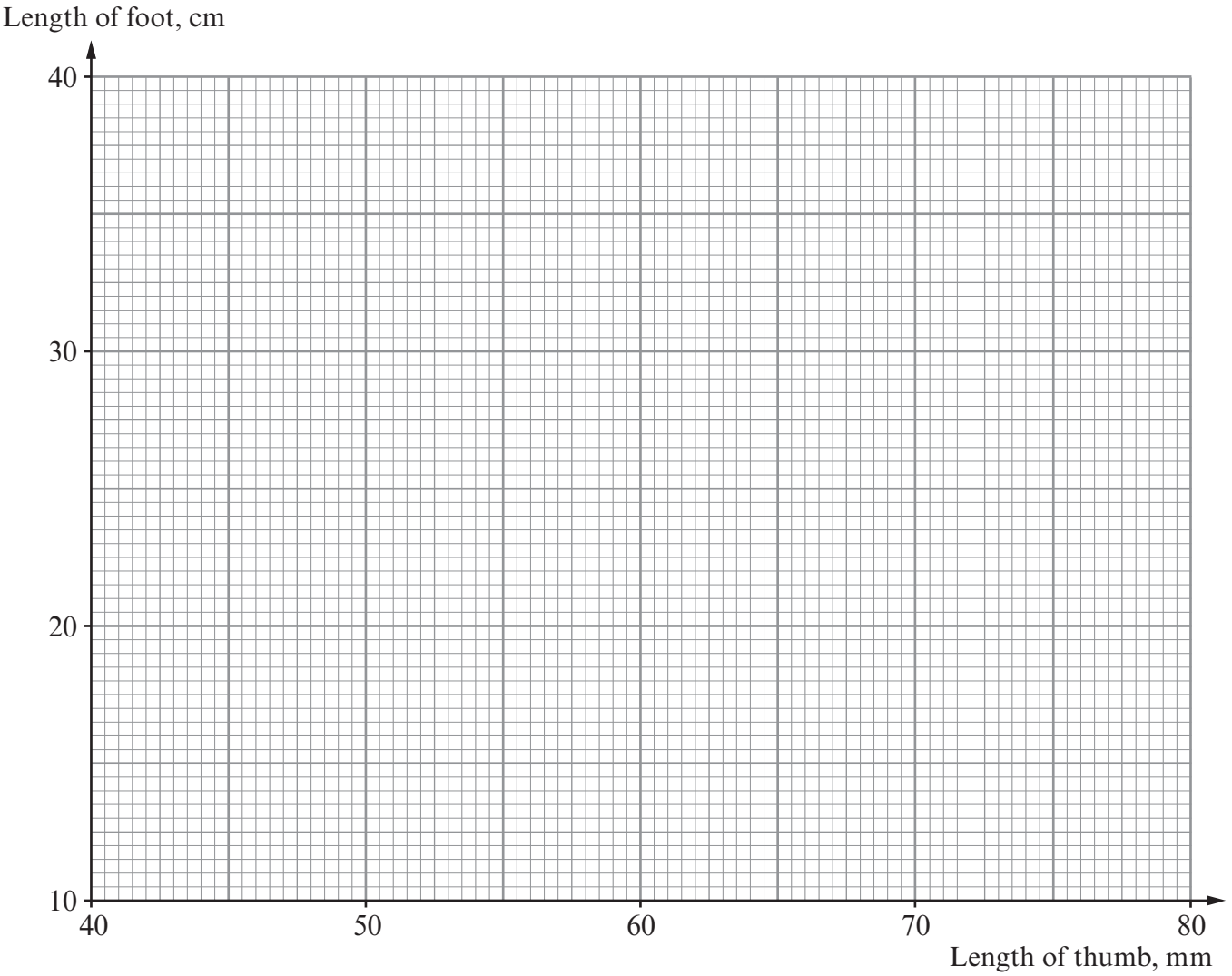
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2. A number of students measured the length of their thumb in millimetres and the length of their foot in centimetres.

Thumb, mm	56	70	48	54	62	64
Foot, cm	24	36	20	22	28	32

(a) Draw a scatter diagram to display these measurements.

[2]



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(b) (i) For the given data, find one point that the line of best fit needs to pass through.

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[2]

(ii) Draw a line of best fit on your scatter diagram. [2]

(c) State the type of correlation shown in your scatter diagram.

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[1]

(d) Give a possible reason why the graph was drawn with neither scale starting at zero.

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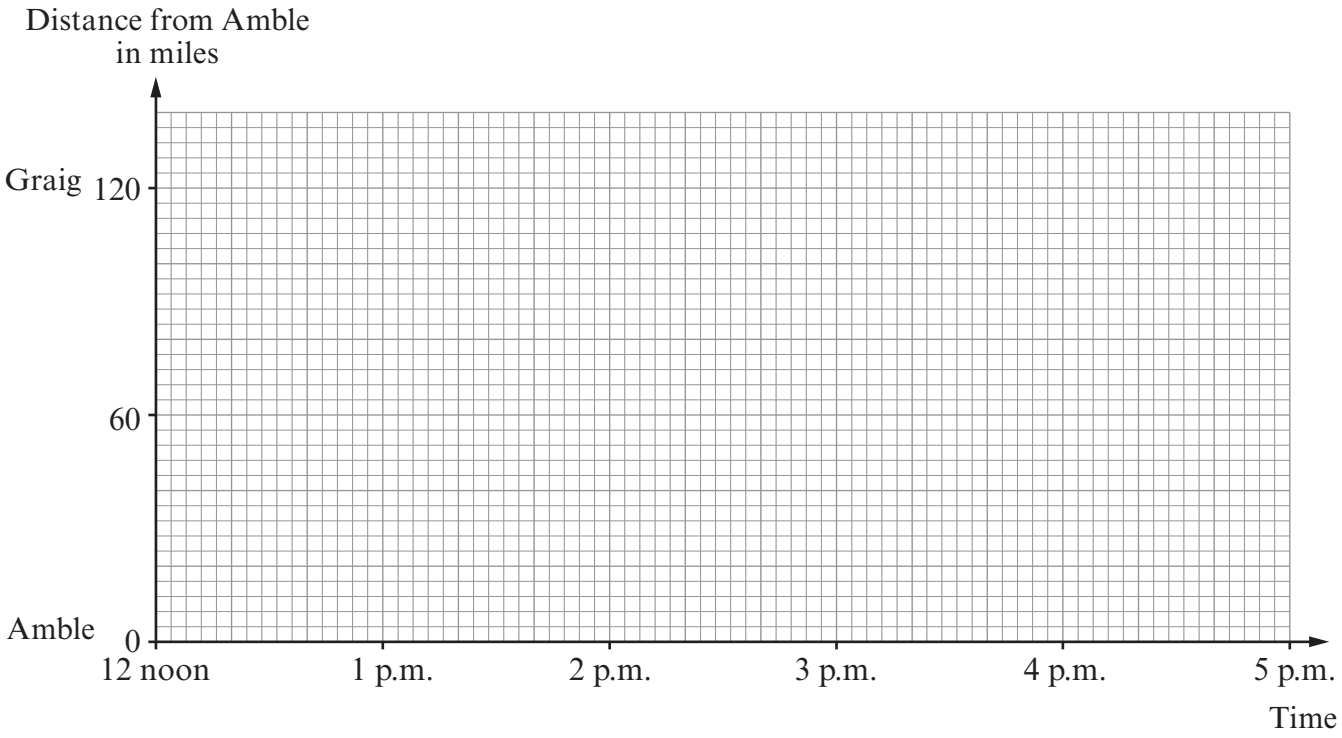
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3. *(a)* Use the graph paper to illustrate the journey described below.

Fiona travels from Amble to Graig, a distance of 120 miles.
She sets out at 12 noon from Amble.
Her average speed for the first 60 miles of her journey is 40 mph.
After travelling the first 60 miles, she stops for lunch for 30 minutes.
She then continues her journey to Graig, arriving at 5 p.m.



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[3]

(b) Calculate Fiona's average speed, in m.p.h., for the complete journey from Amble to Graig.

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[2]

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4. *(a)* Factorise $15x^2 - 45x$.

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[2]

(b) Solve $\frac{2}{3}x + 6 = 10 - \frac{1}{3}x$.

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[2]

(c) Find the value of y^3 when $y = -4$.

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[1]

(d) Given that $a = 3$, $b = -7$ and $c = 10$, evaluate $\frac{2a^2 - b}{5c}$.

Express your answer as a decimal.

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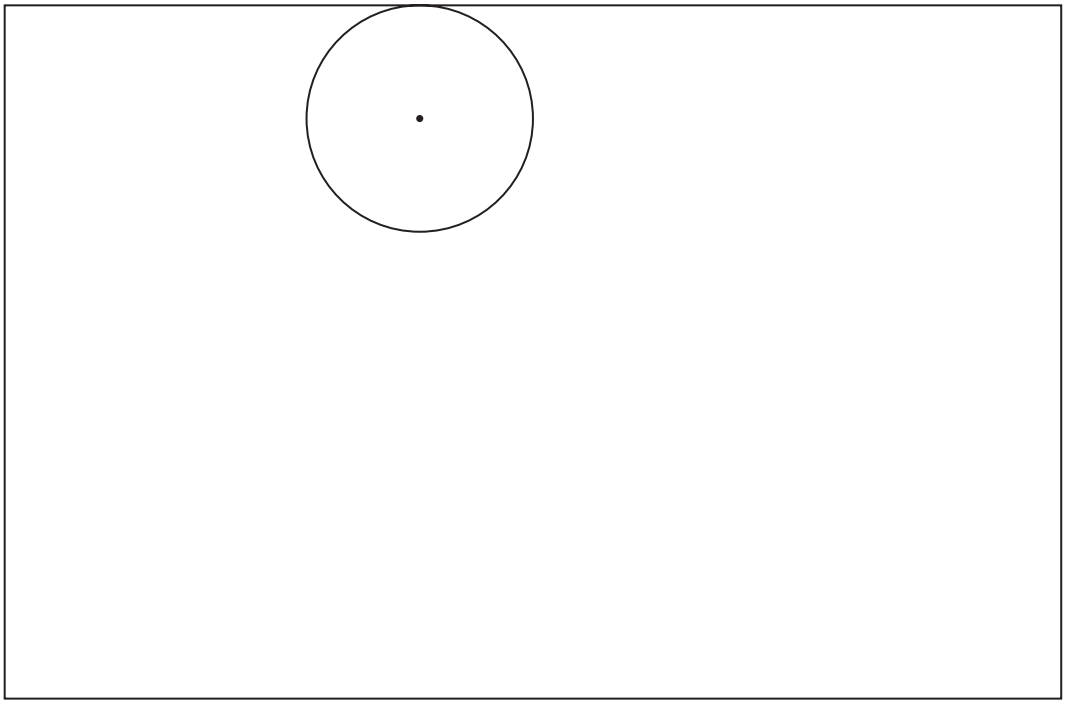
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5. The diagram shows the aerial view of a ball in a box.
The centre of the ball is marked on the diagram.
The ball must remain in contact with at least one side of the box.
Draw the locus of the set of points where the centre of the ball could be inside this box.



[3]

6. A solution to the equation $x^3 - x - 5 = 0$ lies between 1 and 2.
Find this solution correct to 1 decimal place.

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[4]

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7. *The quality of your written communication will be assessed in this question.*

A shop's prices for paint and the paint shades they can mix for customers are shown below.

Paint price list	
Colour	**Price per 100 ml**
White	£1.20
Blue	£1.30
Red	£1.35

Paint mixing chart	
Shade	**Recipe**
Hint of pink	4 parts white and 1 part red
Hint of blue	17 parts white and 2 parts blue
Hint of purple	20 parts white, 3 parts blue and 2 parts red

Jenny is asked to mix paint for a customer. The customer has ordered 1 litre of "hint of pink" paint and 5 litres of "hint of purple" paint. Calculate the cost of the customer's order for paint.

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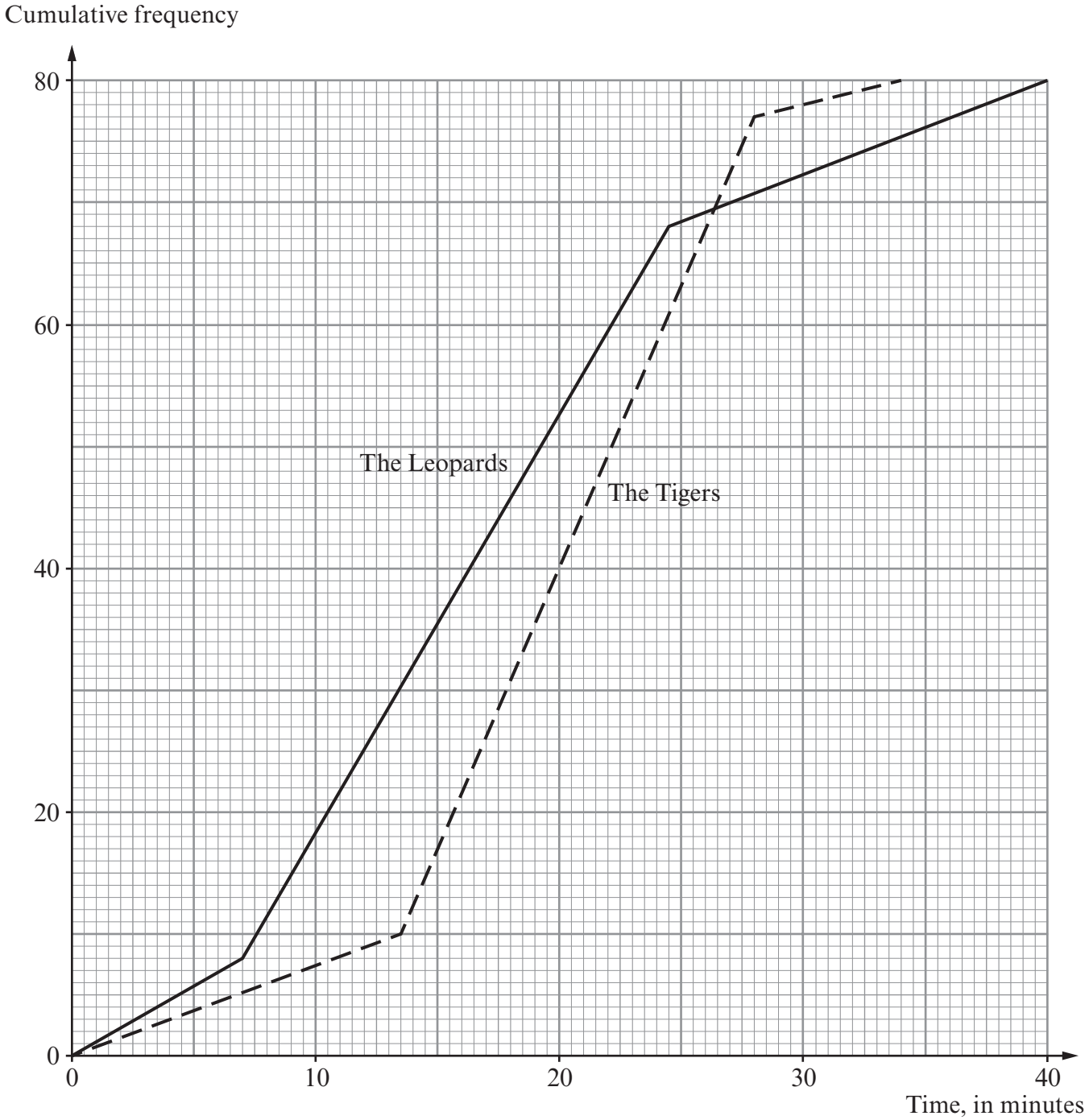
[8]

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8. The cumulative frequency diagram shows the times taken by the members of two different clubs, The Leopards and The Tigers, to complete a fitness course.
Each club has 80 members.



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(a) Find the median and inter-quartile range for **The Tigers**.

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Median .....

Inter-quartile range .....

[3]

(b) State which club, The Leopards or The Tigers, was slower on average at completing the fitness course. Give a reason for your answer.

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[2]

(c) The times taken by another group of students to complete the fitness course are shown in the grouped frequency distribution table below.

Time, t minutes	Number of students
$0 \leqslant t < 10$	2
$10 \leqslant t < 20$	30
$20 \leqslant t < 30$	45
$30 \leqslant t < 40$	3

Calculate an estimate for the mean time taken by these students.

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[4]

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9. Solve $\frac{8x-5}{3}+\frac{4x+5}{4}=\frac{149}{12}$.

[4]

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10. The diagram shows a cross-section of the roof of a building, with the base BCD being horizontal and AC representing a vertical support.

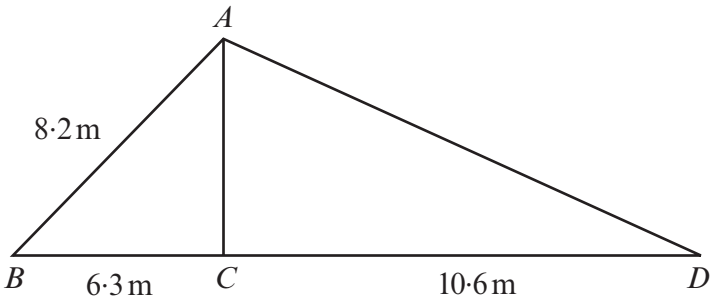


Diagram not drawn to scale

Calculate the size of the angle that the roof AD makes with the horizontal.

[6]

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11. *(a)* Calculate the volume of a sphere with radius 8 cm.

[2]

(b) The volume of a pyramid is one third of the area of the base multiplied by the vertical height.
A pyramid has a rectangular base with length $(3x + 1)$ cm and width x cm and a vertical height of 24 cm. The volume of the pyramid is 192 cm^3.
Find the dimensions of the base of the pyramid.

[6]

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12. The radius of the circle below is 3·6 cm.

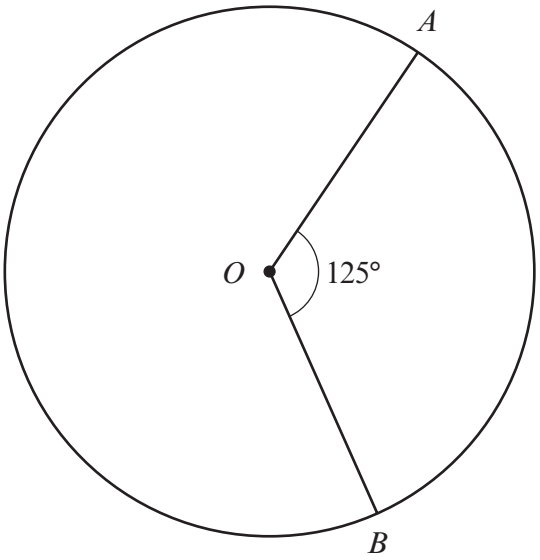


Diagram not drawn to scale

Calculate the length of the minor arc AB.

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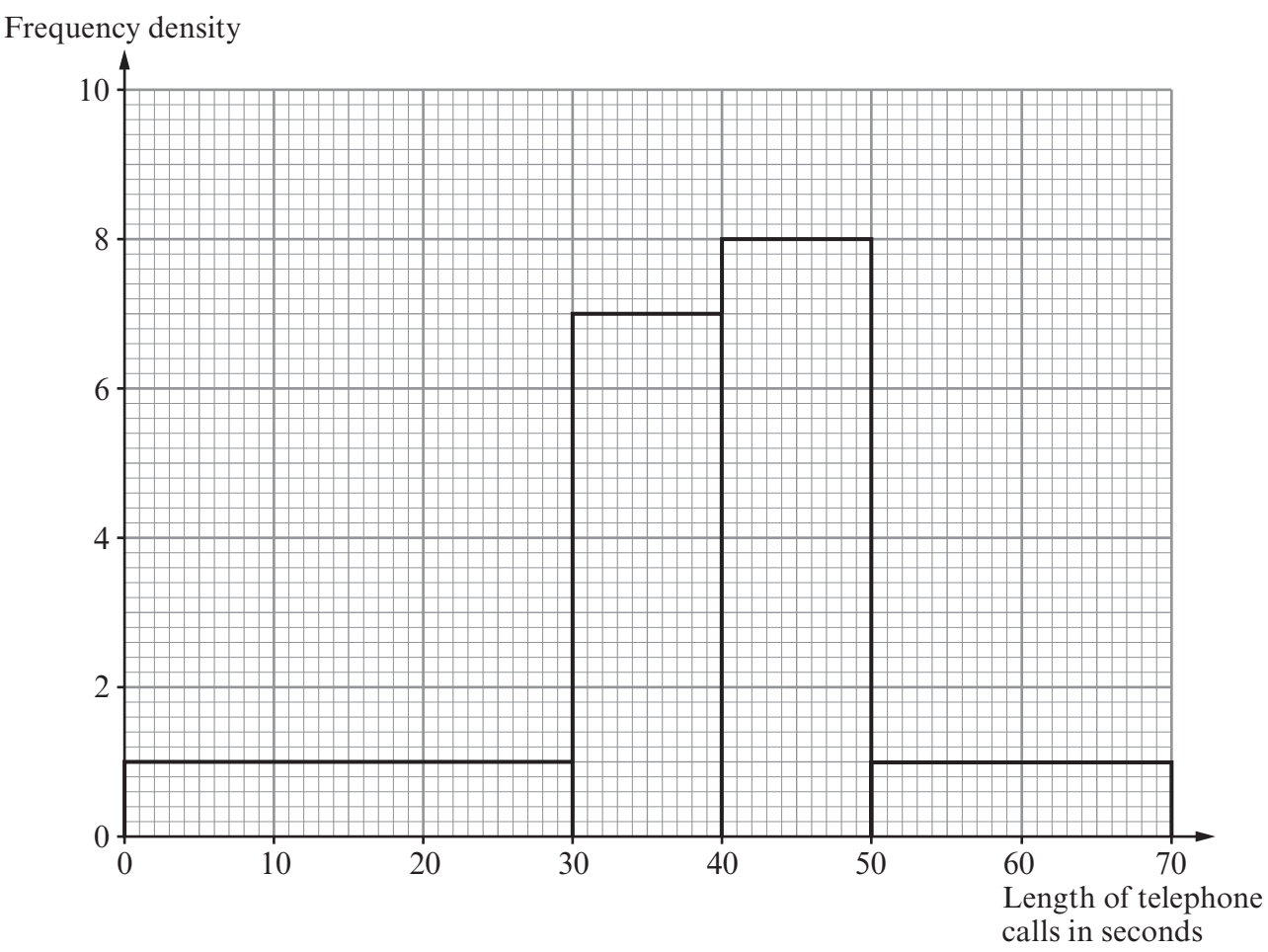
[2]

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13. The histogram illustrates the lengths of telephone calls made to a computer helpline during one Tuesday evening.



(a) Calculate how many telephone calls were made to the computer helpline during the Tuesday evening.

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[3]

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(b) Estimate the median length of a telephone call made to the computer helpline during the Tuesday evening.

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[2]

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14. In an experiment, a scientist found that the force, F, between two particles was inversely proportional to the square of the distance, d, between them.
The units of force are newtons and the units of distance are millimetres.

When the particles were 5 mm apart the force between them was 8 newtons.
How far apart were the particles when the force between them was 12·5 newtons?

[6]

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15. A sketch of $y = 9 - x^2$ is shown below for values of x from 0 to 3.

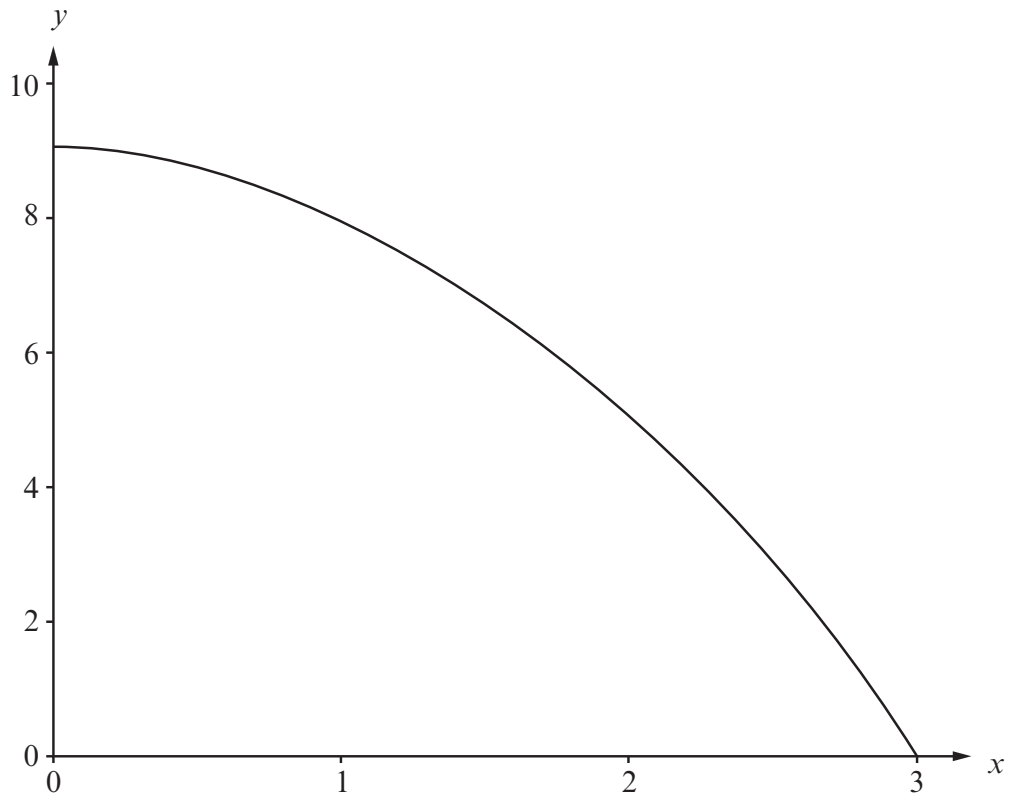


Diagram not drawn to scale

Use the trapezium rule, with the ordinates $x = 0$, $x = 1$, $x = 2$ and $x = 3$, to estimate the area of the region enclosed by the curve, the x-axis and the y-axis.

[4]

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Turn over.

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16.

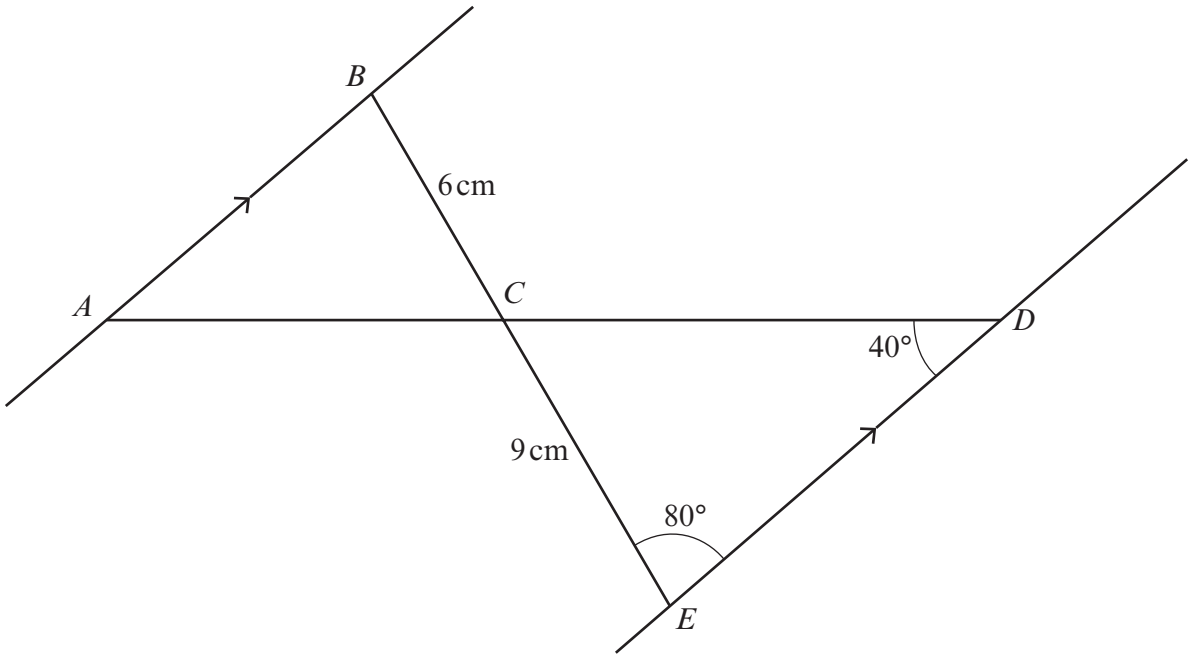


Diagram not drawn to scale

Given that AB is parallel to ED, calculate the length of AB.

[5]

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

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GCSE MARKING SCHEME

MATHEMATICS - UNITISED

SUMMER 2012

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCSE MATHEMATICS - UNITISED. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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JUNE 2012 UNIT 3 (Calculator allowed) Foundation Tier	Marks	FINAL MARK SCHEME Comments
1. (a) 66.48 (plants) 79.8(0) (roses) 49.92 (compost) 196.2(0)	B1 B1 B1 B1	 F.T. their figures for 1 error Unsupported 196.2(0) gets B4.
1. (b) (i) 19 × 5 = 95 (reward points)	M1 A1	Any valid method F.T. their total Unsupported 95 gets the M1, A1. SC1 for 85 F.T. their (6+7+4)×5 **OR F.T. 'their tens, 190' from part (a) ÷2**
1. (b) (ii) (£)3.8(0)	B1	F.T. their total
1. (c) (i) 16800	B1	
1. (c) (ii) 17000	B1	
1. (d) 46	B1	B0 for 46.0 or 46.00
1. (e) 40 + 12 = 52	M1 A1	Correct substitution
2. (a) 8 6 12 14	B2	B1 for any two/three correct frequencies If frequencies score 0, then give B1 for all 4 correct tallies.
2. (b) 4 OR Sky	B1	F.T. their table of frequencies B0 for 14, but B1 for 4 (or Sky) and 14
2. (c) Both axes labelled, e.g. frequency along one axis and BBC1 (1), BBC2 (2), ITV (3), SKY (4) along other axis anywhere within the base (inc.) of the corres. bar. and uniform scale for the frequency axis starting at 0 and labelled 'frequency' OR 'Number'. Four bars at correct heights (bars must be of equal width)	B2 B2	B1 if no scale, but allow one square to represent 1 OR B1 if not labelled as 'frequency' or similar. If frequency scale starts with 1 at the top of the first square the starting at 0 will be implied for this axis. F.T. their table of frequencies B1 for any 2 or 3 correct bars on F.T. Bars must have same width
3. Evidence of square counting 48 – 52 240 – 260	M1 A1 B1	 **Numbers in this range get the M1, A1** F.T. 5 × 'their area' **Numbers in this range get the 3 marks**
4. Reading at the end of the period 24387 Reading at the beginning of the period 23754 Number of units used 633 633 × 16 (÷ 100) 101.28 Charge: 30p per day for 90 days 27.00 Total cost 128.28	 B1 M1 A1 B1 B1	 C.A.O. F.T. their number of units Must be in £s for the A1 **OR for 2700 if working in pence** F.T. their figures.
5. (a) Angle BAC (40º) Angle ABC (76º) Completed triangle	B1 B1 B1	Allow ± 2º Allow ± 2º Only if at least one angle correct. **Complete reflection of the triangle gets B2**
5. (b) Two appropriate arcs Angle of 60º	M1 A1	Allow construction of 60° at the other end of the line for M1 and A1 Allow ± 2 º
5. (c) Intersecting arcs of equal radii above and below the given line. Line bisector	M1 A1	

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JUNE 2012 UNIT 3 (Calculator allowed) Foundation Tier	Marks	FINAL MARK SCHEME Comments
6. (a) 18 25 37 <u>49</u> 53 62 71 49	M1 A1	**<u>For ordering all 7 numbers</u>**
6. (b) Sum of the numbers (315) Sum/7 45	M1 m1 A1	For attempt to add the numbers For a division by 7 of a number in the range 240−390 C.A.O. (25 + 49 + 62 + 18 + 53 + 37 + 71)/7 gets M1,m1
6. (c) 53	B1	
7. (a) 5·47	B2	B1 for 5.46(6844830) All places given must be correct **<u>rounded or truncated</u>**
7. (b) 18.20	B2	B1 for 18·19(890107) All places given must be correct **<u>rounded or truncated</u>** **<u>B1 for 18.2</u>**
8. (a) 34 (miles)	B1	
8. (b) 50 (miles)	B1	
8. (c) 144 (minutes) OR 2 hours 24 minutes	B1	Accept 2:24 or 2.24
8. (d) Correct line drawn to (118, 17:24)	B1	Allow ± ½ square, but line must stop at his point.
9. Angles are 144°, 96°, 78° and 42° **<u>A</u>** **<u>B</u>** **<u>C</u>** **<u>D</u>** 3 or 4 angles correct and correctly labelled. 3 or 4 angles correct, labels not fully correct. 2 angles correct and correctly labelled. 2 angles correct, labels not fully correct. 1 angle correct and correctly labelled. OR <u>If 0 OR 1 for their diagram or no diagram,</u> 360/240. Look for the angles 144°, 96°, 78° and 42° calculated correctly for this M1, A1.	 B4 OR B3 B3 B2 B1 M1 A1	 Correct labels (Words NOT the frequency OR angle)**.** 3 correct labels is enough. If only B1 is scored for the diagram, and all the angles given correctly, then cancel the B1 and award M1, A1 for 2 marks. If B0 scored for the diagram, check the angles and the method to see if the M1 and the A1 can be awarded. (1 is) 1½ ° gets the M1. OR SC1 for all correct percentages: 40, 26·7, 21·7, 11·7
10. Total cost of carrots = £27.63 – 12·6 × 1.85 = (£) 4.32 OR 432(p) Carrots cost per kg = 4.32/5·4 = 80 (p) OR (£) (0)·8(0) Look for • Spelling • Clarity of text explanations • The use of notation – watch for kg,'=','£', 'p' being used appropriately. QWC2: Candidates will be expected to • present work clearly, with words explaining their processes or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer QWC1: Candidates will be expected to • present work clearly, with words explaining their processes or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar and include units in their final answer	M1 A1 M1 A1 QWC 2	(£)27.63 – (£)23.31 F.T. 'their 4.32', but not £27.63. Final answer must be in correct money format QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR Evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation and grammar.

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JUNE 2012 UNIT 3 (Calculator allowed) Foundation Tier	Marks	FINAL MARK SCHEME Comments
11.(a) All points correctly plotted	B2	Ignore any attempt to draw a line of best fit. B1 for 3, 4 or 5 points correctly plotted, not joined. B1 if all points plotted correctly but joined.
(b)(i) Method of finding the mean for thumb or foot, sum of 6 appropriate measurements and intention to divide their sum by 6	M1	(354/6 or 162/6)
Thumb 59 (mm) Foot 27 (cm)	A1	Does not need to be expressed as coordinates Sight of thumb 59 (mm) or foot 27 (cm) implies M1 Statement that the line passes through mean without any attempt at calculation is M0, A0
(ii) Appropriate straight line of best fit through Thumb 59 (mm), Foot 27 (cm), with some values above and some values below the line on each side of the mean point	B2	Need to check passes through (59, 27) even if not calculated. Accept line of best fit that passes through (40,10) FT from (i) for B2 if reasonable; however if their means produce an unreasonable line but it is drawn through the point then award B1 only. B1 straight line through the mean point but not a reasonable line of best fit B1 reasonable straight line of best fit but not through the mean point
(c) Positive	B1	
11.(d) Explanation, e.g. "otherwise points would be squashed", "no small values", "efficient use of the graph paper", "a clearer display", 'no one had thumb and feet measurements below those shown", " it would be a waste of graph paper", "too big a gap between zero and the data range"	E1	Do not accept "no zig-zag (to show a missing part of the axes)", or "can't have zero length thumb or foot", "can't have zero length of thumb or foot", without further explanation Do not accept if only referring to the point (0,0)
12. (a) 12.6×3.2 $40(cm^2)$ or $40.3(cm^2)$ or $40.32(cm^2)$	M1 A1	Accept an unsupported correct answer
13. Strategy: length + width = 10 OR $2 \times$ length + width = 17 OR length = 17 – 10	S1	Strategy for finding the dimensions of a rectangle
Length = 7cm	B1	
Width = 3 cm	B1	
Area = $4 \times 7 \times 3$	M1	F.T. 'their 7' and 'their 3'
= 84	A1	
cm^2	U1	

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JUNE 2012 UNIT 3 (Calculator allowed) Foundation Tier	Marks	FINAL MARK SCHEME Comments
14. Understanding that 1litre = 10×100 ml or 1litre =1000ml	B1	May be seen or implied
Hint of pink: 800ml white, 200ml red	B1	Or sight of 8:2, or sight of 4/5 white with 1/5 red, or white and red quantities in the correct ratio seen but NOT 4 (100ml),1 (100ml)
Hint of purple: 4000ml white, 600ml blue, 400ml red	B1	Or sight of 40:6:4, or sight of 20/25 white with, 3/25 blue and 2/25 red or equivalent, or white, blue and red quantities in the correct ratio seen but NOT 20(100ml), 3(100ml), 2(100ml) (Maybe ½ these values, then doubled)
Method of costing, e.g. costing correctly expressed for hint of pink or hint of purple, or equivalent or 1 correct product in the sum of 3, or 2 correct products in the sum of 5 combined calculations shown below. 48×1.2(0) + 6×1.3(0) + 6×1.35 (need 1 correct product in a sum of 3, using all correct paint prices) OR 8×1.2(0) + 2×1.35 + 40×1.2(0) + 6×1.3(0) + 4×1.35 (need 2 correct products in a sum of 5, using all correct paint prices)	M1	N.B. The cost of hint of pink or hint of purple may be found within a combined calculation, this gets M1 (Hint of pink (£)12.3(0), hint of purple (£)61.2(0)) (Note: sight of, for example (£)12.30, triggers: B1 (1000ml = 1 litre), B1 Hint of pink ratio, and M1 for stage correct towards an overall calculation)
48×1.2(0) + 6×1.3(0) + 6×1.35, OR 8×1.2(0) + 2×1.35 + 40×1.2(0) + 6×1.3(0) + 4×1.35	A1	(57.6(0) + 7.8(0) + 8.1(0)) (9.6(0) + 2.7(0) + 48 + 7.8(0) + 5.4(0))
(£)73.5(0)	A1	CAO *SC1 for £36.75, with possible first B1 for unit conversion if seen* **Treat working with hint of blue with one of the other shades of paint as MR-1 then FT for all marks** (Cost of 1litre of hint of blue is £12.11, so 5litres is £60.55)

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UNIT 3 (HIGHER TIER)

JUNE 2012 UNIT 3 Higher		FINAL MARK SCHEME Comments
1.(a) 12.6×3.2 $40(cm^2)$ or $40.3(cm^2)$ or $40.32(cm^2)$	M1 A1	Accept an unsupported correct answer
1.(b) Sight of 360(°) $360 \div 22.5 =$ 16 (sides)	B1 M1 A1	Award all marks for an unsupported answer of 16 *Interior angle methods:* *M1 Use of 157.5 as an interior angle with,* *For example 157.5 = 180(n – 2)/n* *A1 157.5n = 180n – 360 or n = 360/22.5* *A1 16 (sides)* *M1 Attempt use a trial & improvement, with 2 appropriate trials using, for example:* *(Number of triangles × 180) /(number of triangles +2)* *A2 16 (sides) or A1 for two correct trials, one leading to $\geq$157.5(°) and one leading to $\leq$157.5(°)*
2.(a) All points correctly plotted and not joined	B2	Ignore any attempt to draw a straight line of best fit. B1 for 3, 4 or 5 points correctly plotted, not joined. B1 if all points plotted correctly but joined.
(b)(i) Method of finding the mean for thumb or foot, sum of 6 appropriate measurements and intention to divide their sum by 6	M1	(354/6 or 162/6)
(Thumb) 59 (mm) (Foot) 27 (cm)	A1	Does not need to be expressed as coordinates Sight of thumb 59 (mm) or foot 27 (cm) implies M1 Statement that the line passes through mean without any attempt at calculation is M0, A0
(ii) Appropriate straight line of best fit through Thumb 59 (mm), Foot 27 (cm), with some values above and some values below the line on each side of the mean point	B2	Need to check passes through (59, 27) even if not calculated. Accept line of best fit that passes through (40,10) FT from (i) for B2 if reasonable; however if their means produce an unreasonable line but it is drawn through the mean point then award B1 only. B1 straight line through the mean point but not a reasonable line of best fit B1 reasonable straight line of best fit but not through the mean point
(c) Positive	B1	
2.(d) Explanation, e.g. "otherwise points would be squashed", "no small values", "efficient use of the graph paper", "a clearer display", 'no one had thumb and feet measurements below those shown", " it would be a waste of graph paper", "too big a gap between zero and the data range"	E1	Do not accept "no zig-zag (to show a missing part of the axes)", "can't have zero length of thumb or foot", without further explanation Do not accept if only referring to the point (0,0)
3.(a) A line from (0,0) to (1 30 pm, 60) Horizontal line joining the first line, for period 30 minutes From end of horizontal line to (5 p.m., 120)	B1 B1 B1	Points need to be joined, not necessarily a straight line FT from their first line FT from the end of their second line. Points need to be joined, not necessarily a straight line
(b) 120 / 5 24 (mph)	 M1 A1	Only FT their travel graph provided at least B1 in (a) Accept 120/4.5 leading to an answer of 26.6(6…) or 26.7 or 27 (mph) *SC1 for an answer of 27.9(0…) from a calculation 120/4.3*

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JUNE 2012 UNIT 3 Higher		FINAL MARK SCHEME Comments
4(a) $15x(x - 3)$	B2	B1 for $15x(x \ldots.)$ or $15x(\ldots - 3)$ or correct partial factorisation
4(b) $2/3\ x + 1/3\ x = 10 - 6$ OR $2x + 3\times6 = 3\times10 - x$ $x = 4$	B1 B1	FT until 2nd error Do not accept 12/3 as a final answer. Final answers must be simplified if possible $2x + 6 = 10 - 1x$ is 2 errors, hence B0, B0
4(c) -64	B1	CAO
4(d) E.g. $(2\times9 - - 7)/50$ 25/50 0.5	M1 A1 A1	Substitution with at least two steps of calculation '—7' written as '+7' is one step of calculation Decimal answer required. FT provided M1 awarded *If no marks: SC1 for answers 0.22, 0.38 or 18.14 following evidence of substitution*
5.Lines or unambiguous set of points parallel to all sides of the box, radius width from the box Intention of all lines in the correct position that **stop** and intention to meet at right angles at all four corners of the box	B2 B1	Mark the intention, $\pm$2mm B1 for one set of points or lines parallel to the box, radius width from the box If sets of points are shown there needs to be sufficient evidence to show the intention of parallel lines and the 4 right angles *A set of points implies at least 3 points, which may include the one given in the question* *Ignore extra additional arcs or lines used to develop a method* *Ignore any regions shaded*
6. One correct evaluation, $1 \le x \le 2$ 2 correct evaluations, $1.85 \le x \le 2$, one either side of 0 2 correct evaluations, $1.85 \le x \le 1.95$, one either side of 0 OR correct evaluation of 1.95 if previous B1 awarded 1.9 *No calculations shown: accept "too high", ">", etc.*	B1 B1 M1 A1	x $x^3 - x - 5$ 1 -5 1.1 -4.769 1.2 -4.472 1.3 -4.103 1.4 -3.656 1.5 -3.125 1.6 -2.504 1.7 -1.787 1.8 -0.968 **1.9** **-0.041** 2 1 1.85 -0.518375 1.91 0.057871 1.92 0.157888 1.93 0.259057 1.94 0.361384 **1.95** **0.464875**

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JUNE 2012 UNIT 3 Higher		FINAL MARK SCHEME Comments
7. Understanding that 1litre = 10×100 ml or 1litre =1000ml	B1	May be seen or implied
Hint of pink: 800ml white, 200ml red	B1	Or sight of 8:2, or sight of 4/5 white with 1/5 red, or white and red quantities in the correct ratio seen but NOT 4 (100ml),1 (100ml)
Hint of purple: 4000ml white, 600ml blue, 400ml red	B1	Or sight of 40:6:4, or sight of 20/25 white with, 3/25 blue and 2/25 red or equivalent, or white, blue and red quantities in the correct ratio seen but NOT 20(100ml), 3(100ml), 2(100ml)
Method of costing, e.g. costing correctly expressed for hint of pink or hint of purple, or equivalent or 1 correct product in the sum of 3, or 2 correct products in the sum of 5 combined calculations shown below. 48×1.2(0) + 6×1.3(0) + 6×1.35 (need 1 correct product in a sum of 3, using all correct paint prices) OR 8×1.2(0) + 2×1.35 + 40×1.2(0) + 6×1.3(0) + 4×1.35 (need 2 correct products in a sum of 5, using all correct paint prices)	(Maybe ½ these values, then doubled) M1	N.B. The cost of hint of pink or hint of purple may be found within a combined calculation, this gets M1 (Hint of pink (£)12.3(0), hint of purple (£)61.2(0)) (Note: sight of, for example (£)12.30, triggers: B1 (1000ml = 1 litre), B1 Hint of pink ratio, and M1 for stage correct towards an overall calculation)
48×1.2(0) + 6×1.3(0) + 6×1.35, OR 8×1.2(0) + 2×1.35 + 40×1.2(0) + 6×1.3(0) + 4×1.35	A1	(57.6(0) + 7.8(0) + 8.1(0)) (9.6(0) + 2.7(0) + 48 + 7.8(0) + 5.4(0))
(£)73.5(0)	A1	CAO
QWC2 requires process steps for both colours linked with appropriate text and correct use of units, with the £ symbol given inthe final answer. If the candidate has not engaged with the complexity of the question, then maximum QWC1 if process steps for both colours is linked with appropriate text, units are generally used and £ symbol given in the final answer Must be relevant work for the problem, otherwise QWC0 Look for • relevance • spelling • clarity of text explanations, • the use of notation (watch for the units and '0' for unit pence when using £) QWC2: Candidates will be expected to • present work clearly, with words explaining process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their final answer QWC1: Candidates will be expected to • present work clearly, with words explaining process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their final answer	Q W C 2	*SC1 for £36.75, with possible first B1 for unit conversion if seen* **<u>Treat working with hint of blue with one of the other shades of paint as MR-1 then FT for all marks</u>** (Cost of 1litre of hint of blue is £12.11, so 5litres is £60.55) QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar. OR Evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation and grammar.
8.(a) Median 20 Interquartile range: (24 to 24.5) – (15.5 to 16) Answers in the range 8 to 9 inclusive	B1 M1 A1	 Intention to subtract must be clear Must FT from their calculation if shown *Treat working with The Leopards as MR-1 only if consistent for median and inter-quartile range* *Leopards: Median 16 to 16.5* *IQR (22 to 22.5) - 10.5 = 11.5 to 12*

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JUNE 2012 UNIT 3 Higher		FINAL MARK SCHEME Comments
8.(b) Valid reason e.g., 'median is higher', 'median is slower than The Leopards', 'greater number of players took longer to finish', 'most of the data times for The Tigers is behind The Leopards' The Tigers	M1 A1	Selecting The Leopards is M0, A0 Must be with a valid reason *N.B. remember slower times are to the right of the diagram*
8.(c) Mid points 5, 15, 25, 35 5×2 + 15×30 + 25× 45 + 35×3 $\sum fx$ /80 (= 1690/80) 21(.125)	B1 M1 m1 A1	 FT for their mid points from within group (including bounds) FT their $\sum fx$ / 80 Accept 21.13 *Unsupported 21.12(5) or 21.13 awarded all 4 marks.*
9. 4(8x – 5) + 3(4x + 5) = 149 44x – 5 = 149 x = 154/44 (=3.5)	M2 A1 A1	For correctly clearing all 3 fractions, OR M1 for clearing 2 fractions FT from M1 (for all further marks), for their equation, for correct expansion of bracket(s) and collection of like terms on LHS Ignore incorrect cancelling
10. Strategy, using Pythagoras' Theorem then trigonometry $8.2^2 = 6.3^2 + AC^2$ $AC = \sqrt{(8.2^2 - 6.3^2)}$ (=√27.55) AC = 5.248…. Tan D = AC / 10.6 Answers in the range 26.1…(°) to 26.35(°)	S1 M1 A1 A1 M1 A1	Needs to involve working towards use of triangle ADC FT candidates AC Allow rounded or truncated answers in working throughout, but the final answer must be in the given range to award the final A1 *Alternative:* *S1 Complete strategy* *M1 method for both of the first 2 stages* *A1 for first stage answer* *A1 for second stage answer* *M1 method for the third stage* *A1 Answers in the range 26.1…(°) to 26.35(°)* *For example:* *S1 Strategy, using trigonometry – cos ratio, cosine rule and sine rule* *M1 cosB = 6.3/8.2* ***AND*** $AD^2 = 8.2^2 + 16.9^2 - 2\times8.2\times16.9\times\cos B$ *A1 Angle B = 39.799…. rounded or truncated* *A1 AD = 11.828… rounded or truncated* *M1 sinD/8.2 = sinB/11.8 FT candidates angle B* *A1 Answers in the range 26.1…(°) to 26.35(°)*
11.(a) Volume = 4/3 ×Π ×8^3 Answers in the range 2143 to 2146 (cm^3) inclusive	M1 A1	

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11.(b) Strategy, attempt to form an equation using the product of at least 3 of the given: ⅓, 24, x, (3x + 1), and showing '=192' 1/3(3x+1)×*x*×24 (= 192) $24x^2 + 8x - 192 = 0$ or $3x^2 + x - 24 = 0$ (3*x* … 8)(*x* … 3) (= 0) *x* = 8/3 (and *x*=-3) Dimension of the base 8/3 (cm) and 9 (cm)	S1 M1 A1 M1 A1 B1	Not for an expression Correct expression or equation Collecting terms and equate to zero FT their quadratic equivalent difficulty FT for correct solution of their quadratic FT only if there is a need to discard one negative answer and provided previous M1 awarded *For formula method, last 3 marks:* *Correct substitution in formula with correct evaluation of b^2-4ac M1, then possible A1 & B1 as main method* *For a trial & improvement method* *S1 As main method* *M1 Implied as main method* *A1 Implied as main method, but may be trials towards 192* *M1 Two correct trials, one either side of 192, or including 192* *A1 8/3 (cm) or 2.6666….(cm) (Accept 2.67, do not accept 2.6, 2.7 or 3)* *B1 Dimension of the base 8/3 (cm) and 9 (cm) (only FT provided previous M1 awarded)* ***Watch for correct answers from incorrect methods, do not automatically award 6 marks for sight of correct answers***
12. 2× (125/360)×Π ×3.6 = 7.85(398… cm) or 7.9 (cm)	M1 A1	
13.(a) Method of finding an area 2 correct areas AND intention to add all areas 200	M1 M1 A1	 Areas are 30+70+80+20 CAO
13.(b) Identifying the 100, 100 split 40 (seconds)	 M1 A1	Must be from 200, not FT May be indicated on the histogram. Accept sight of 200÷2 = 100 CAO. Check (a), if working is shown it must be from the 100, 100 split, not a 10, 10 split. *Unsupported 40, is M1, A1*
14. $F = k/d^2$ or $F \propto 1/d^2$ $8 = k/5^2$ k = 200 or $F = 200/d^2$ $12.5 = k/d^2$ $d^2 = 16$ d = 4 **mm**	M1 M1 A1 M1 A1 A1	 FT only non linear FT their k, and their non linear if possible CAO with unit mm
15. Finding y=8 when x=1 **and** y=5 when x=2 Split into 3 areas and attempt to sum, or 1 slip in stating **OR** substitution into trapezium rule Correct substitution into trapezium rule 17.5	B1 M1 M1 A1	 FT their values for y at x=0, 1, 2 & 3. Must be clearly working with area, may be incorrect formula for trapezium (8.5+6.5+2.5) Or equivalent. FT their values for y at x=1&2, OR 2 areas correct in sum of 3 CAO

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16. Strategy: use of similar triangles with sine rule or parallel lines with sine rule	S1	
Use of scale factor 1.5 or 2/3 as appropriate, or angles in ABC correctly as (60,) 80 and 40	M1	
DE/sin 60 = 9/sin 40 or AB/sin60 = 6/sin40	M1	
DE = 9 × sin60/sin40 or AB = 6 ×sin60/sin40	m1	(DE = 12(.126 cm))
AB = 8(.084 cm) or 8.1(cm)	A1	CAO *Alternative:* *S1 Strategy: sine rule, similar triangles and cosine rule OR parallel lines, sine rule and cosine rule* *M1 CD/sin80 = 9/sin40 or CD = sin80×9/sin40* *OR AC/sin80 = 6/sin40 or AC = sin80×6/sin40* *M1 AC = ⅔CD or AC =9.19 (CD=13.79)* *m1 $AB^2 = 6^2 + AC^2 - 2\times6\times AC\times\cos60$* *(FT their AC but not their CD used)* *A1 AB = 8(.084cm) or 8.1(cm) CAO* Unsupported 8(cm) gets no marks

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