WJEC GCSE MATHEMATICS (LINEAR)

MATHS



EXAM QUESTION PACK

PAPER 2 HIGHER TIER 4370 PAPERS

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4370/06

S16-4370-06

MATHEMATICS – LINEAR
PAPER 2
HIGHER TIER

A.M. THURSDAY, 9 June 2016

2 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 **8**.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**2**	
3.	**4**	
4.	**6**	
5.	**5**	
6.	**8**	
7.	**6**	
8.	**7**	
9.	**4**	
10.	**9**	
11.	**2**	
12.	**6**	
13.	**5**	
14.	**2**	
15.	**3**	
16.	**2**	
17.	**3**	
18.	**3**	
19.	**4**	
20.	**8**	
21.	**7**	
Total	**100**	

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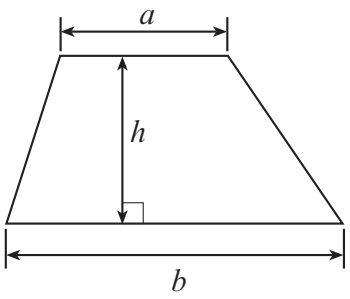
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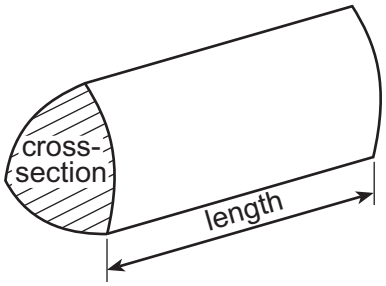
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Formula List

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

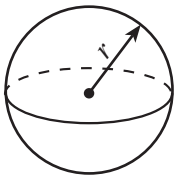


Volume of prism = area of cross-section × length



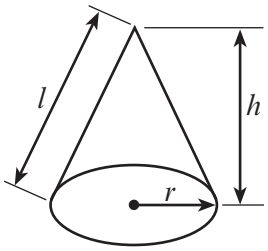
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

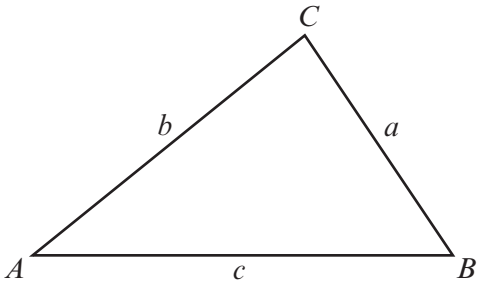


In any triangle ABC

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. Given that $k = -3$, $m = 7$ and $p = 10$, find the value of the following expressions.

(a) $\dfrac{5(k^2 - m)}{p}$ [2]

(b) $(2m)^3$ [2]

2. Find the larger share when £1400 is shared in the ratio of 1 : 4. [2]

Larger share is £ .....

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3. In 2014, the average amount of paper used per person in China was 74 kg, and in the USA it was 228 kg.

(a) Insert a value, correct to 2 significant figures, in the following statement. [2]

'In 2014, on average, each person in the USA used ..... times as much paper as each person in China.'

.....

.....

(b) Between 55% and 60% of the paper used in the USA is recycled paper.
Insert values, correct to the nearest kg, in the following statement. [2]

'In 2014, of the average 228 kg of paper used by each person in the USA,

between ..... kg and ..... kg of this was recycled paper.'

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4. *(a)*

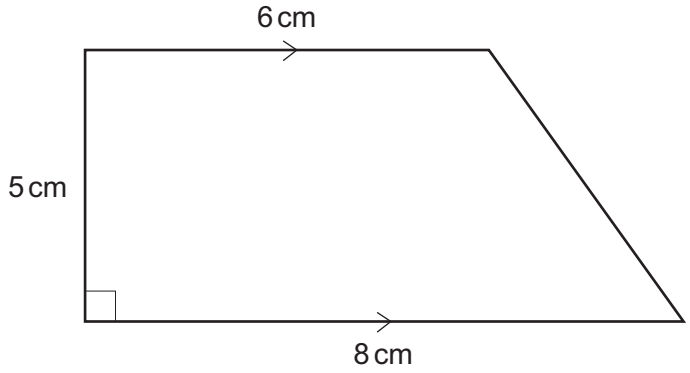


Diagram not drawn to scale

Calculate the area of the trapezium. [2]

Area = ... cm^2

(b) Each exterior angle of a regular polygon is 30°.
How many sides are there in this regular polygon? [2]

Number of sides = ...

(c) A cylinder has a radius of 4 cm and a height of 9 cm.
Calculate the volume of the cylinder. [2]

Volume = ... cm^3

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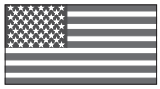
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5. Some measures for mass are the same in the USA as they are in the UK.
Some measures are different.

A **pound** is the same measure in both the USA and the UK.
The measures known as **hundredweights** and **tons** are different in the USA and the UK.

1 ton = 20 hundredweight in both the USA and the UK.

USA 	UK 
1 hundredweight = 100 pounds	1 hundredweight = 112 pounds

(a) Complete the statement, [1]

43·5 tons = ... hundredweight

.....

(b) A truck in the USA carries a load of 28 USA tons. 

A lorry in the UK carries a load of 26 UK tons. 

Calculate the difference between the two loads **in pounds**.
Express this difference as a percentage of the load carried by the USA truck. [4]

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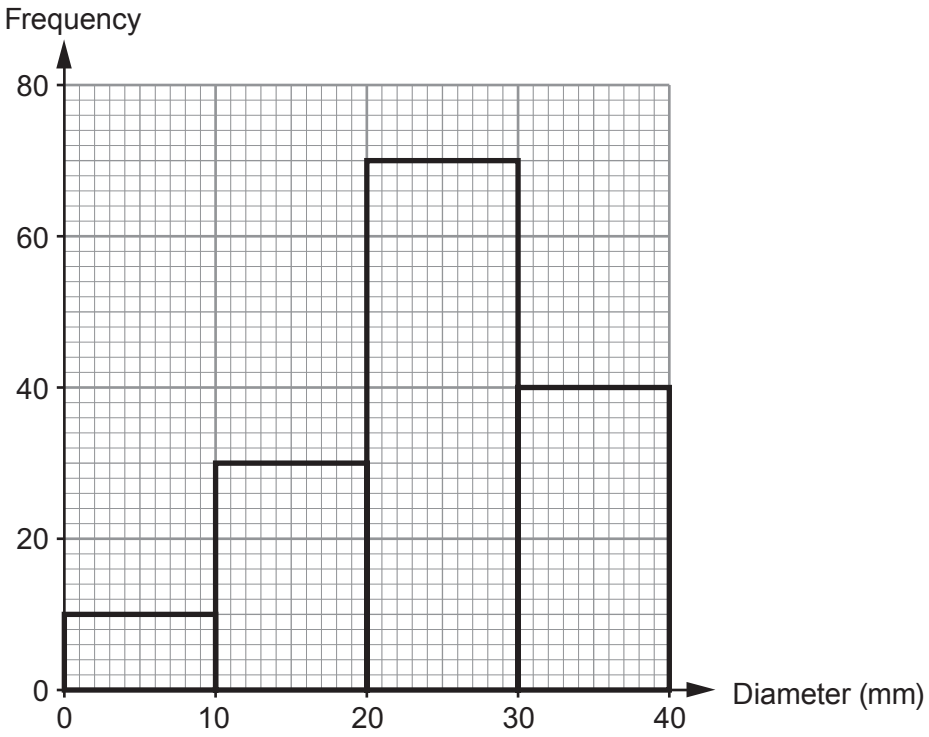
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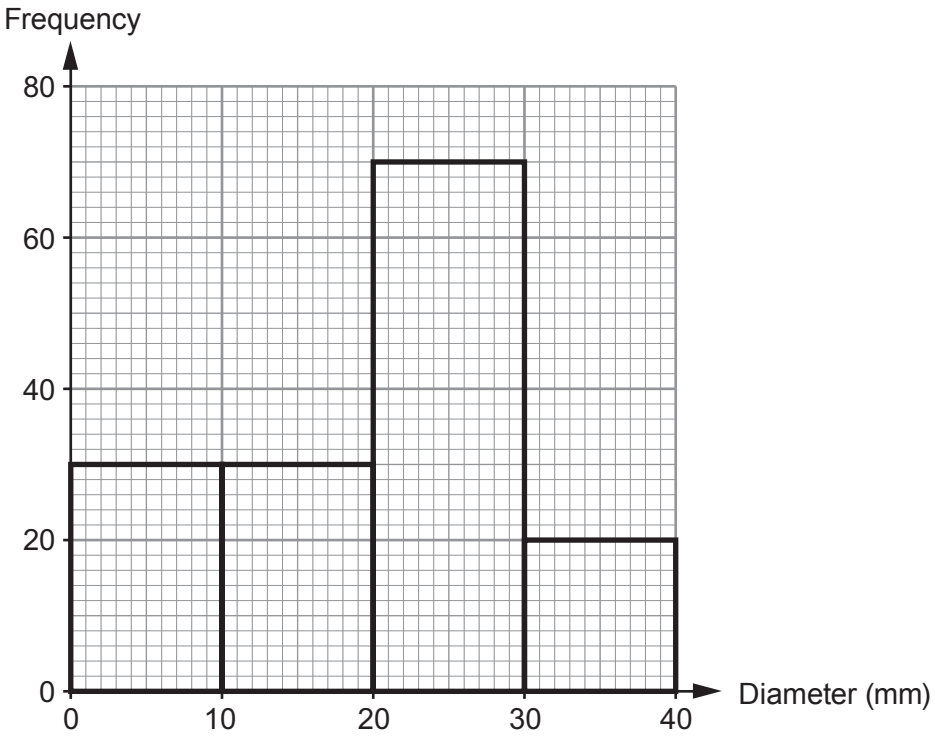
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6. One day in November, Bryn and Luke cut some branches off some trees.
The grouped frequency diagrams show the diameters of the branches they cut.

Branches cut by Bryn



Branches cut by Luke



(a) How many of the branches that Luke cut had diameters between 10 mm and 30 mm? [1]

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(b) Who cut more of the branches with the greater diameters on this day? Give a reason for your answer. [1]

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(c) Calculate an estimate for the mean diameter of all the branches that Bryn cut on this day. [5]

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(d) The median diameter of the branches cut by Bryn lies in the group 20 mm to 30 mm. Explain how this can be checked using the frequency diagrams. [1]

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7. The table shows some of the values of $y = 3x^2 + x + 2$ for values of x from –2 to 3.

(a) Complete the table by finding the value of y for $x = -1$ and $x = 2$. [2]

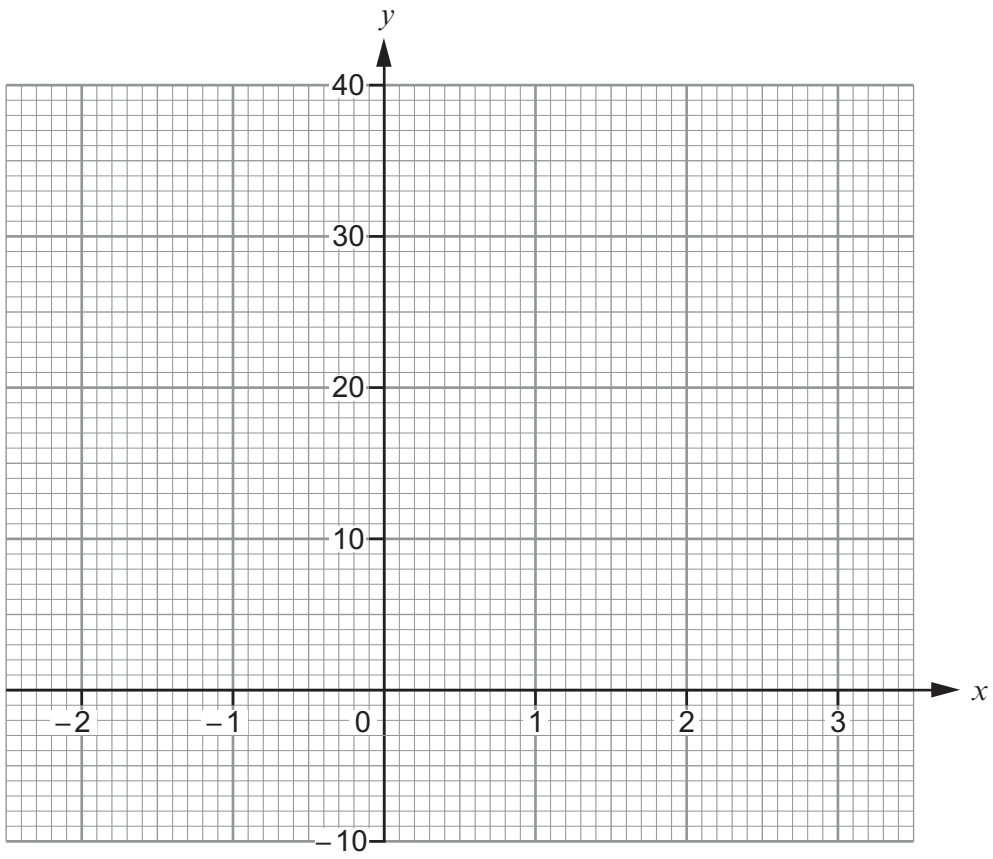
x	–2	–1	0	1	2	3
$y = 3x^2 + x + 2$	12		2	6		32

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



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(c) Use your graph to solve the equation $3x^2 + x + 2 = 7$. [2]

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

The currency in Brazil is known as the Brazilian Real, BRL.

		
Year	Pound (£)	Brazilian Real (BRL)
2010	1	2.86
2014	1	3.71

In 2010, Ava bought £3400 worth of Brazilian Real, BRL.
In 2014, Ava exchanged this money back into pounds.

Did Ava gain or lose money?
State how much money Ava gained or lost, giving your answer correct to the nearest pound.

[7]

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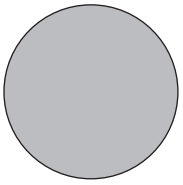
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9. Rayner plans to make a circular garden pond.



She has bought 10 metres of edging to place around the circumference of the pond.

Because of where the pond is to be placed, it must have a **diameter** that is a **multiple** of 0·9 m.
Rayner decides to make the largest pond she can with the edging she has bought.

What length of edging will she have left over?
Give your answer in metres, correct to 2 decimal places. [4]

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10. *(a)*

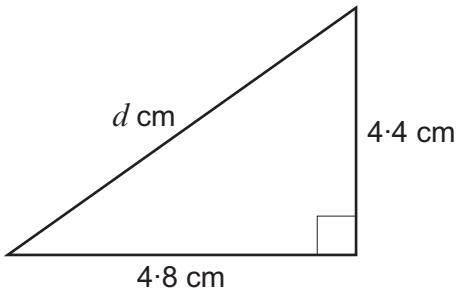


Diagram not drawn to scale

Calculate the value d. [3]

(b)

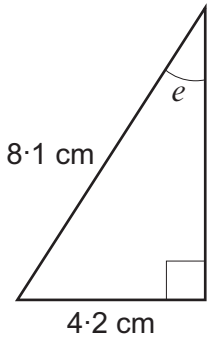


Diagram not drawn to scale

Calculate the size of angle e. [3]

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(c)

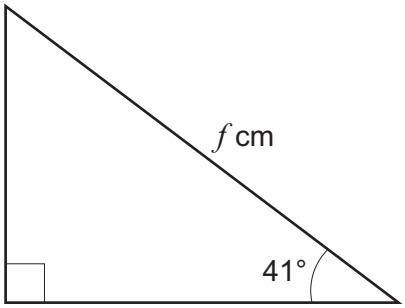


Diagram not drawn to scale

Calculate the value f. [3]

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11. Simplify $5a^2b^3 \times 3a^5b$. [2]

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12. The dimensions and perimeters of two rectangles, G and H, are shown below.

Rectangle G

$(3a + 5b)$ cm



$(2a + 3b)$ cm

Perimeter = 96 cm

Rectangle H

$(3a + b)$ cm



$(a + 3b)$ cm

Perimeter = 69·6 cm

Diagrams not drawn to scale

Freya has written an equation for rectangle G:

$$10a + 16b = 96$$

(a) Write down an equation for rectangle H. [1]

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(b) Use an algebraic method to calculate a and b.
Hence, calculate the dimensions of rectangle H. [5]

Length of rectangle H is ..... cm

Width of rectangle H is ..... cm

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13. Wood pulp is used to make paper.
In 2012, Brazil produced 14 million tons of wood pulp.

In each of the next 3 years, Brazil's production of wood pulp increased by 1·7% of the previous year's production.
After 2015, it is expected that the production of wood pulp will increase by 2% of each previous year's production.

What quantity of wood pulp would you expect Brazil to produce in 2017? [5]

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14. Evaluate the following.
Give your answer in standard form, correct to 2 significant figures. [2]

$$\frac{2{\cdot}4 \times 10^{5}}{3{\cdot}4^{3} + \sqrt{5{\cdot}6 \times 10^{-2}}}$$

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15. One of the two solutions of a quadratic equation is $x = -6$.
The quadratic equation is $x^2 + bx + 12 = 0$, where b is an integer.
Find the other solution of the equation.
You must show all your working. [3]

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16.

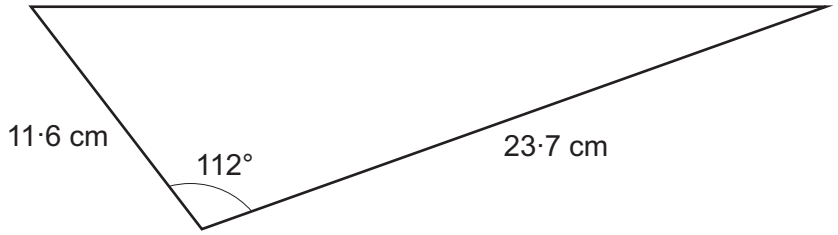


Diagram not drawn to scale

Calculate the area of the triangle. [2]

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17. The arrows shown below are similar.

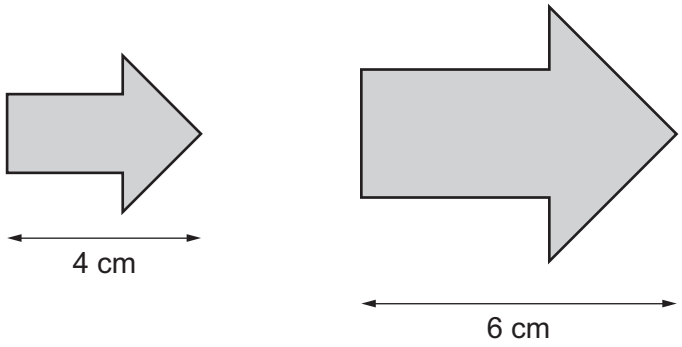


Diagram not drawn to scale

The area of the smaller arrow is $7{\cdot}6\,cm^2$.
Calculate the area of the larger arrow. [3]

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Area of the larger arrow is ..... cm^2

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18. Use the quadratic formula to solve the following equation.
Give your answers correct to 2 decimal places. [3]

$$4x^2 + 7x - 5 = 0$$

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19. *(a)* You are given that y is inversely proportional to x^2, and that $y = 50$ when $x = 3$. Find an expression for y in terms of x. [3]

(b) Use the expression you found in *(a)* to complete the following table. [1]

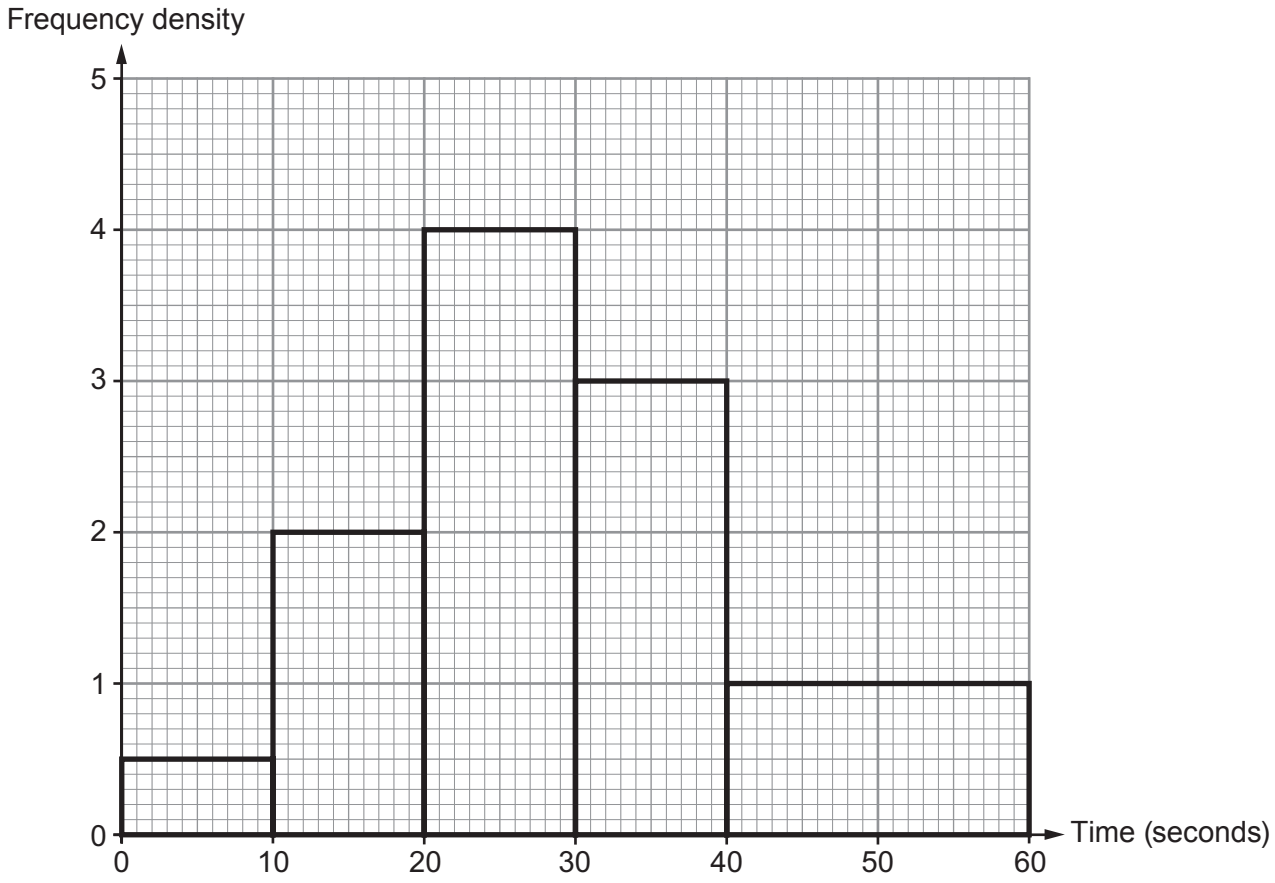
x	$\frac{1}{2}$	3
y		50

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20. A cinema investigates the time taken for people to be served at the pay desk.
They carried out a survey between 2 p.m. and 2:30 p.m. on a Thursday.
The histogram shows the results of the survey.



(a) How many people were served at the pay desk? [3]

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..... people

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(b) Calculate an estimate for the number of people who were served in less than 12·5 seconds. [2]

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..... people

(c) The cinema target is to serve 80% of people in less than 40 seconds per person. How many more people than the target were served in less than 40 seconds? [3]

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..... extra people above the target

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21.

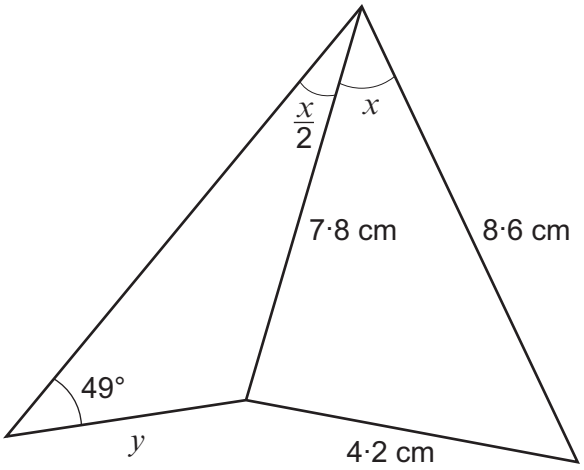


Diagram not drawn to scale

Calculate the length y. [7]

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

SUMMER 2016

GCSE MATHEMATICS - LINEAR PAPER 2
HIGHER TIER

4370/06

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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 - Linear Paper 2 Higher Tier
Summer 2016 Mark Scheme

Summer 2016 Linear Paper 2 Higher Tier Summer	Mark	Comments
1(a) 1	B2	B1 for sight of (9 – 7 =) 2 or (45 – 35 =) 10
1(b) 2744	B2	B1 for evidence of 14^3 or 2×7 × 2×7 × 2×7 or equivalent that should lead to a correct answer
2. 4 × 1400 ÷ 5 (£)1120	M1 A1	
3(a) 3.1	B2	B1 for evidence of 228÷74 or 3.08(1…) or 3 or 3.10
3(b) 125 (kg) and 137 (kg)	B2	B1 for 125.4 and 136.8, or 125 or 137
4(a) ½ × (6 + 8) × 5 or equivalent 35 (cm^2)	M1 A1	
4(b) 360(°) ÷ 30(°) 12 (sides)	M1 A1	Or equivalent **full** method Mark final answer. Do not ignore further working.
4(c) $\pi \times 4^2 \times 9$ Answers in the range 452 to 452.6(cm^3) or 144 π(cm^3)	M1 A1	
5(a) 870 (hundredweight)	B1	
5(b) (USA 28 tons) 28×20×100 (= 56 000 pounds) OR (UK 26 tons) 26×20×112 (= 58 240 pounds) OR (for sight of) 26×112 - 28×100 = 112	M1	*Appropriate working leading to 112 must be seen, e.g. 2912 – 2800 = 112, not for sight of the '112' given in the question*
(Difference in pounds 20 × 112 or 58240 – 56000 =) 2240	A1	CAO. Must be seen
(Percentage difference, compared with USA) (100 ×) 2240/56000 or (100 ×) 58240/56000 - 1 (× 100) or equivalent	M1	(Note: 58240 ÷ 56000 - 1 =1.04 – 1 = 0.04) FT their difference '58240-56000' correctly evaluated provided at least M1 previously awarded Allow M1 for (100 ×) 112/2800 (also FT for A1)
4(%)	A1	CAO, including FT from 100 × 112/2800 = 4(%) Award M1, A0, M1, A1 for an unsupported 4% (not from 3.9 rounded to 4, the later marks are M0, A0) ***Note to markers: Watch for answers that round to 4% from incorrect working, probably from a denominator of 58240, award finally M0, A0***

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Summer 2016 Linear Paper 2 Higher Tier Summer	Mark	Comments
6(a) 100	B1	Do not accept 30 + 70 as a final answer
6(b) Bryn, with a reason, e.g. 'Bryn has cut more (branches with diameters) between 30mm and 40mm', 'Bryn because he cut 40 of the thicker branches', 'Bryn because Luke only cut 20 of the thicker branches', 'Bryn because he cut 40 between 30mm and 40mm', 'Bryn because he cut 40, Luke only cut 20 (of the branches with diameter 30mm to 40mm)'	E1	Allow 'Bryn because more at 40(mm)', or 'Bryn because more at 30(mm), 'Bryn because more at 35(mm)', Bryn with a taller bar at the end of the graph'
6(c) Sight of mid points 5, 15, 25, 35 (Total number of branches is) 150 $10\times5 + 30\times15 + 70\times25 + 40\times35$ $(=50+450+1750+1400 \quad =3650)$ $\div150$ 24(.333…. mm)	B1 B1 M1 m1 A1	 Stated or implied. Accept embedded within incorrect working e.g. 150/4, or sight of 37.5 FT provided their mid points are within or at the bounds of the intervals *(all upper bounds used gives 4400÷150, all lower bounds used gives 2900÷150)* Intention to divide their Σfx by 'their 150' provided 'their 150' ≠4 ('their 150' from attempt 10+30+70+40, i.e. similar order) CAO *Luke selected, MR-1 then:* *Mid points 5, 15, 25, 35* *B1* *Total number of branches 150* *B1* *5×30 + 15×30 + 25×70 + 35×20* *M1* *÷ 150* *m1* *20(.33… mm)* *A1* *With appropriate FT*
6(d) Explanation that there is a need to find which group contains the 75(.5)th branch, they must mention or imply looking at the 75(.5)th branch OR Explanation such as 'less than half of the branches had diameters less than 20mm and less than half had diameters greater than 30mm, (so the median is between 20mm and 30mm)', 'there is equal area either side of 25mm'	E1	FT half 'their 150' (+0.5) provided this lies in the group 20mm to 30mm Allow '75(.5th) branch (is in the group 20mm to 30mm)', '75(.5th) value', '75(.5th) reading', '75 is halfway' Do not allow '75' without text Do not accept 'more branches are cut between 20mm and 30mm', or definition of the median without reference to the frequency diagram, or an answer of 25mm without relevant explanation or reason
7(a) 4 and 16	B2	B1 for either entry correct
7(b) Plots correct, allowing one error or the 2 omissions (x=-1 and x=2) All 6 points correct & joined with a curve	B1 B1	FT from (a) FT from (a). Need to have all 6 plots no omissions. If a point is clearly not on 'their curve' then accept 'their curve' without passing through this point
7(c) Sight of y = 7 including the intersection, or marking the intersection of y = 7 with a point, or a vertical line to a point of intersection with y = 7 (x =) -1.47 and 1.14 (tolerance ½ one small square)	M1 A1	FT their graph provided points are joined Unambiguous answer **on the graph** M1 may be awarded if only one point of intersection is given FT their graph but must be for 2 values Tolerance would be -1.4 to -1.5 and 1.1 to 1.2, but need to FT from their graph for 2 values Unsupported correct answers from their graph are awarded M1, A1

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Summer 2016 Linear Paper 2 Higher Tier Summer	Mark	Comments
8. (2010: £3400 to BRL) 2.86 × 3400 9724 (BRL) (2014: 9724 BRL to £) 9724 ÷ 3.71 (£)2621(.024..) (Ava makes a loss) Loss AND (£)779	M1 A1 M1 A1 A1	May be implied in later working FT 'their derived 9724', provided ≠ 3400 FT 3400 - 'their 2621(.024)' rounded to the nearest pound provided both M marks awarded A0 for sight of (£)778.98 or (£)778(.9…), or for (£)779 without indication of loss. *Alternative:* *(2010: £3400 to BRL) 2.86 × 3400* *M1* *9724 (BRL)* *A1* *(May be implied in later working)* *(2014: £3400 to BRL 3.71 × 3400 = 12614 BRL)* *(**AND** Difference in BRL 12614 – 9724 =)* ***2890 (BRL)*** *A1* *(FT 12614 - 'their derived 9724')* *(Difference in £ is) 2890 ÷ 3.71 (= 778.975…)* *M1* *(FT 'their 2890'* *(£)779 AND Loss* *A1* *OR* *(Difference in exchange rates) 3.71 – 2.86 (= 0.85)* *M1* *(Difference in BRL) 0.85 × 3400* *M1* *(FT 'their 3.71 – 2.86')* *2890 (BRL)* *A1 CAO* *(Difference in £ is) 2890 ÷ 3.71 (= 778.975…)* *M1* *(FT 'their 2890')* *(£)779 AND Loss* *A1* *If no marks award SC1 for interpretation GAIN **and** 1010 (from 3400 ÷ 2.86 × 3.71)*
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	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 or grammar.
9. $\pi \times d = 10$ or $2 \times \pi \times r = 10$ or sight of (maximum diameter) 3.18(…m) Diameter (of the pond is 3×0.9 =) 2.7 (Left over edging) $10 - \pi \times 2.7$ Answer 1.51 or 1.52 (metres)	B1 B1 M1 A1	OR a correctly evaluated trial for 1 of these values of d giving C **approximately** as given below: d: 0.9, 1.8, 2.7, 3.6, 4.5 C: 2.83, 5.65, 8.48, 11.31, 14.14 CAO. Must be 2 d.p., an answer not rounded to 2 d.p. implies previous marks, but is A0

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Summer 2016 Linear Paper 2 Higher Tier Summer	Mark	Comments
10(a) $(d^2 =) 4.8^2 + 4.4^2$ $d^2 = 42.4$ or $(d =) \sqrt{42.4}$ 6.5(… cm)	M1 A1 A1	 ISW. Accept 7(cm) from correct working
10(b) $\sin e = \frac{4.2}{8.1}$ 31(.23….°)	M1 A2	 A1 for $e = \sin^{-1}(4.2/8.1)$ $(=\sin^{-1} 0.518518….)$
10(c) $f = \frac{12.4}{\cos 41(°)}$ 16(.43…cm)	M2 A1	Or alternative full method M1 for $\cos 41(°) = \frac{12.4}{f}$
11. $15a^7b^4$	B2	B1 for $15a^7b^{\cdots}$ or $15a^{\cdots}b^4$ or $\ldots a^7b^4$ or $15\times a^7\times b^4$
12(a) $8a + 8b = 69.6$ or $a + b = 8.7$ or equivalent	B1	Accept unsimplified equations Mark final answer unless no other marks awarded in (b)
12(b) Method to equate coefficients (allow 1 slip) with attempt to subtract First variable Method to find second variable Second variable (Length of rectangle H is) 23.1 (cm) AND (Width of rectangle H is) 11.7 (cm)	M1 A1 m1 A1 B1	OR alternative algebraic method (not trial &improvement), e.g .a = 8.7-b or b = 8.7–a substituted into 10a + 16b = 96 FT for their equations in a similar format **a = 7.2 b = 1.5** Accept length and width in either order FT provided both answers are positive and only provided M1, m1 awarded (3a + b and a + 3b correctly evaluated) *(FT use of 4a + 4b = 69.6 leads to a = 30.4 and b = -13)*

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<table>
<tr><th>Summer 2016 Linear Paper 2
Higher Tier Summer</th><th>Mark</th><th>Comments</th></tr>
<tr><td>13.
14 (million) × 1.017³ (=14.726 206 782 million)

×1.02²

15 321 145(.54… tons) or 15.3(2… million tons)</td><td>M2

M2

A1</td><td>Penalise -1 incorrect place value for 14 million once only
Or equivalent to attempt 1.7% on 3 different values
M1 for 14 (million) × 1.017 or
14 (million) × 1.7/100 + 14(million) or equivalent
M1 only if additional years are included

Or equivalent to attempt 2% on 2 different values
FT from 'their 14.7… million' provided > 14 (million), i.e. an increased amount from the original
M1 for ‘…. × 1.02’ or ‘…×2/100 + …’ or equivalent
M1 only if additional years are included

CAO <u>from correct working</u>, although accept answers rounding to 15 300 000
Ignore any incorrect units given
An unsupported correct answer is awarded all 5 marks

Simple ‘compound’ working may be awarded both M1 marks (simple ‘compound’ answer is 15 302 560 tons), maximum mark possible is M1, M1, A0. Allow embedded working, e.g. ‘14(million) × 1.051’ or equivalent for M1 and ‘ … × 1.04’ or equivalent for M1.

Use of 1.17 and 1.2 is not a misread, however award SC1for an answer of 32 288 518(.08 tons) or 32 000 000

Note:
<table>
<tr><th>Year</th><th>Millions of tons</th><th>Tons</th></tr>
<tr><td>2013</td><td>14.238</td><td>14 238 000</td></tr>
<tr><td>2014</td><td>14.480046</td><td>14 480 046</td></tr>
<tr><td>2015</td><td>14.7262068</td><td>14 726 206.8</td></tr>
<tr><td>2016</td><td>15.0207309</td><td>15 020 730.9</td></tr>
<tr><td>2017</td><td>15.3211455</td><td>15 321 145.5</td></tr>
</table></td></tr>
<tr><td>14. 6.1×10^3</td><td>B2</td><td>B1 for the actual answer, or as given correct to 2 s.f. or as given in standard form, e.g, 6069.70…, 6069.(…), 6070, 6100, 61×10^2, 0.61×10^4, $6(.0697\ldots) \times 10^3$</td></tr>
<tr><td>15. (x + 2)(x + 6)

x = -2</td><td>B2

B1</td><td>B1 for (x …)(x + 6), or (substituting x = -6 to find) b = 8, or sight of $x^2 + 8x + 12 = 0$

Award B3 for a final answer of -2 with correct reasoning, e.g. sight of 12 ÷ -6 = -2 (i.e. use product of the 2 solutions = constant term)
Award B2 for a final answer of -2 without working
An answer of x = -2 from clearly incorrect or spurious working is B1 only</td></tr>
<tr><td>16. (Area =) ½ × 11.6 × 23.7 × sin112(°)
127(.45… cm^2)</td><td>M1
A1</td><td>
ISW</td></tr>
<tr><td>17. (Linear scale factor) 6/4 or 1.5 or equivalent seen
$7.6 \times (6/4)^2$ or equivalent
17(.1 cm^2)</td><td>B1
M1
A1</td><td>Accept implied from sight of an answer of 11.4</td></tr>
<tr><td>18. $x = \{ -7 \pm \sqrt{(7^2 - 4 \times 4 \times -5)} \} / (2 \times 4)$
$= \{ -7 \pm \sqrt{129} \} / 8$
x = 0.54 and x = -2.29 (Answers to 2dp)</td><td>M1
A1
A1</td><td>Allow one error in sign or substitution, not in the formula
CAO. Accept from sight of 0.5447… with -2.2947…
CAO</td></tr>
</table>

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Summer 2016 Linear Paper 2 Higher Tier Summer	Mark	Comments
19(a) $y \propto 1/x^2$ OR $y = k/x^2$ $50 = k/3^2$ or $k = 50 \times 3^2$ or $k = 450$ $y = 450/x^2$ or $y = 450 \div x^2$	M1 M1 A1	Allow incorrect notation, e.g. $y \propto k/x^2$ FT non linear only Do not accept $y \propto 450/x^2$ Maybe stated in part (b)
19(b) x: ½, 3 y: **1800**, 50	B1	FT their non linear expression
20(a) Strategy, finding area $0.5\times10 + 2\times10 + 4\times10 + 3\times10 + 1\times20$ or equivalent 115 (people)	M1 M1 A1	Any single area is sufficient Must show intention to add. Allow for 4 of the 5 terms correct (Note for markers: 5+20+40+30+20 or the final 20 as 10+10) CAO
20(b) $0.5\times10 + ¼ \times2\times10$ or equivalent 10 (people)	M1 A1	FT 'their 5' + ¼ of 'their 20' provided area is being considered, with M1 awarded in (a)
20(c) (80% of 115 people is) 92 (people) 95 (people in up to 40 seconds) (Exceeded by serving) 3 (extra people)	B1 B1 B1	FT 'their 115' provided area has been considered, with M1 awarded in (a) FT 'their 115' – 'their 20', with M1 awarded in (a) CAO Allow B3 for an unsupported answer of 3 *Alternative:* *95 (people in up to 40 seconds)* *B1* *(100 ×) 95 ÷ 115 (0.826… or 82.6%) AND* *(Difference) 2.6…% of 115* *B1* *(exceeded by serving) 3 (extra people)* *B1* *With equivalent FT, provided M1 awarded in (a), 'their 115' and 'their 115 – their 20',*
21. $\cos x = \frac{7.8^2 + 8.6^2 - 4.2^2}{2\times7.8\times8.6}$ (=0.8732856…..) x = 29.157…(°) rounded or truncated Value for calculated angle $x \div 2$ with an attempt at the sine rule $y = \frac{7.8 \times \sin 14.578…°}{\sin 49°}$ Answers in the range y = 2.58(cm) to 2.61 (cm)	M2 A1 S1 M2 A1	M1 for $4.2^2 = 7.8^2 + 8.6^2 - 2\times7.8\times8.6\times\cos x$ Accept 29(°), 29.1(°), 29.15(°), 29.2(°) FT 'their derived angle $x/2$', i.e. must come from some previous working FT 'their angle for x/2' M1 for $\frac{y}{\sin 14.578…°} = \frac{7.8}{\sin 49°}$ CAO

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4370/06

S15-4370-06

MATHEMATICS – LINEAR
PAPER 2
HIGHER TIER

A.M. THURSDAY, 4 June 2015

2 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.	**7**	
2.	**8**	
3.	**7**	
4.	**8**	
5.	**9**	
6.	**6**	
7.	**4**	
8.	**4**	
9.	**1**	
10.	**5**	
11.	**6**	
12.	**9**	
13.	**3**	
14.	**8**	
15.	**6**	
16.	**4**	
17.	**5**	
Total	**100**	

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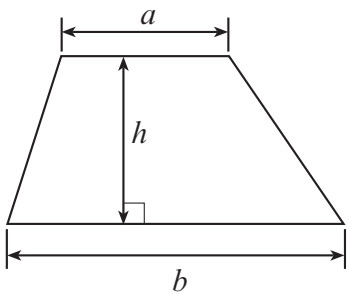
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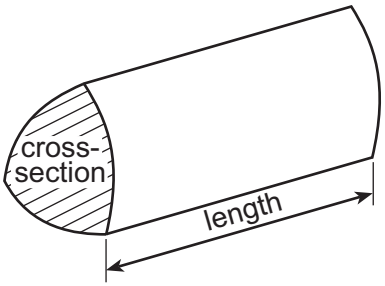
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Formula List

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

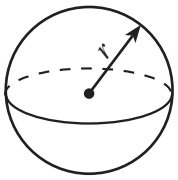


Volume of prism = area of cross-section × length



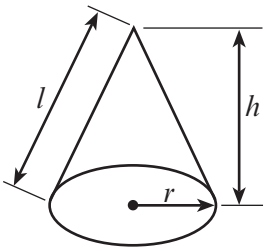
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

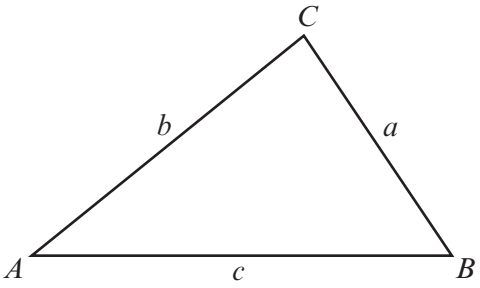


In any triangle ABC

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. Solve the following equations.

(a) $6x + 13 = 43 - 4x$. [3]

(b) $\frac{2x}{5} = 40$ [1]

(c) $2(30 - x) = 44$. [3]

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2. The table below shows some comparative data for 3 different European airlines.



	European Airlines		
	FreeFlight	Best2Fly	GoJet
Percentage of flights arriving on time, based on 30 000 flights	85%	88%	92%
Number of complaints, per 1000 passengers	0·62	0·68	0·78
Number of lost suitcases, per 1000 passengers	0·36	0·24	0·42

Use the information given in the table to answer the following questions.

(a) FreeFlight, Best2Fly and GoJet all claim to be the best of these 3 airlines. Complete the following statements. [2]

'FreeFlight are the best of these 3 airlines because .....

..... '

'Best2Fly are the best of these 3 airlines because .....

..... '

'GoJet are the best of these 3 airlines because .....

..... '

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(b) How many of the 30 000 flights with Best2Fly were late? [2]

(c) FreeFlight and GoJet both expect to carry 500 000 passengers next month.
How many more suitcases would you expect GoJet to lose than FreeFlight next month? [3]

(d) Write down an estimate for the probability that a flight with GoJet does not arrive on time.
Express your answer as a percentage. [1]

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3. Lewis owns a restaurant in Austria.
He has received a bill for the electricity he used in the last three months.



The bill he received was for 760 euros. This was based on an **estimated** meter reading.

Lewis had made a note of his own meter readings.
His note shows the following:

Previous meter reading	30 256
Meter reading at the end of this 3 month period	31 008

Electricity costs 0.78 euros per unit.
The standing charge for electricity is 24.40 euros **per month**.
In Austria, VAT is charged at 12% on electricity bills.

Calculate the difference between the bill Lewis was sent and what he thinks he should pay using the meter readings given. [7]

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4. *(a)* In Bilchbach, the rainfall for each of 10 days was measured.
The results are summarised in the table below.

Daily rainfall, r (mm)	Number of days
$4{\cdot}5 \leqslant r < 5{\cdot}5$	4
$5{\cdot}5 \leqslant r < 6{\cdot}5$	2
$6{\cdot}5 \leqslant r < 7{\cdot}5$	0
$7{\cdot}5 \leqslant r < 8{\cdot}5$	2
$8{\cdot}5 \leqslant r < 9{\cdot}5$	2

(i) Calculate an estimate for the mean daily rainfall for the 10 days. [4]

.....

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(ii) State the modal class. [1]

Modal class .....

(iii) Write down the class in which the median lies. [1]

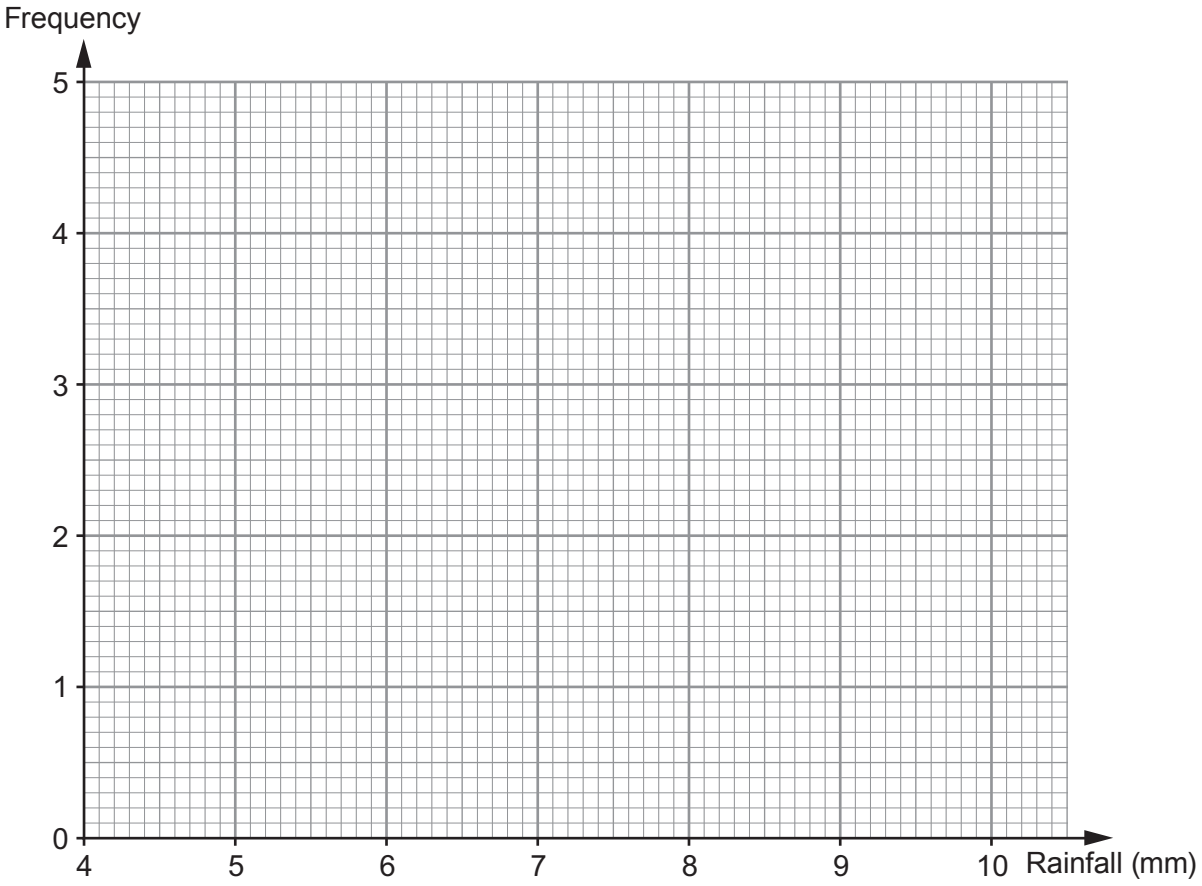
Median class .....

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(b) On the graph paper below, draw a frequency polygon to show this rainfall data. [2]



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

The diagram below shows a rectangle and a triangle joined by a common side *BD*.

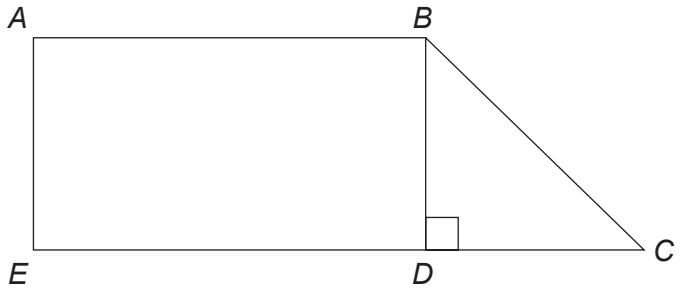


Diagram not drawn to scale

The area of rectangle *ABDE* is 3900 cm^2, *ED* = 75 cm and *DC* = 25 cm.

Calculate each of the following:

- the area of triangle *BDC*, and
- the length of *BC*.

You must show all your working. [9]

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Area of triangle *BDC* is .....

Length of *BC* is .....

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6. A machine is used to pack boxes of peaches.



There should be exactly 8 peaches in each box.

To check the machine, 10 boxes of peaches are selected on the hour for 5 consecutive hours. Each hour the number of boxes containing exactly 8 peaches is recorded.

	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.
Number of the 10 boxes with **exactly** 8 peaches	8	10	7	7	9

(a) The company prints a label for each box.

Contains at least 8 peaches

Explain why this label **may** not be suitable to use on the boxes of peaches. [1]

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.....

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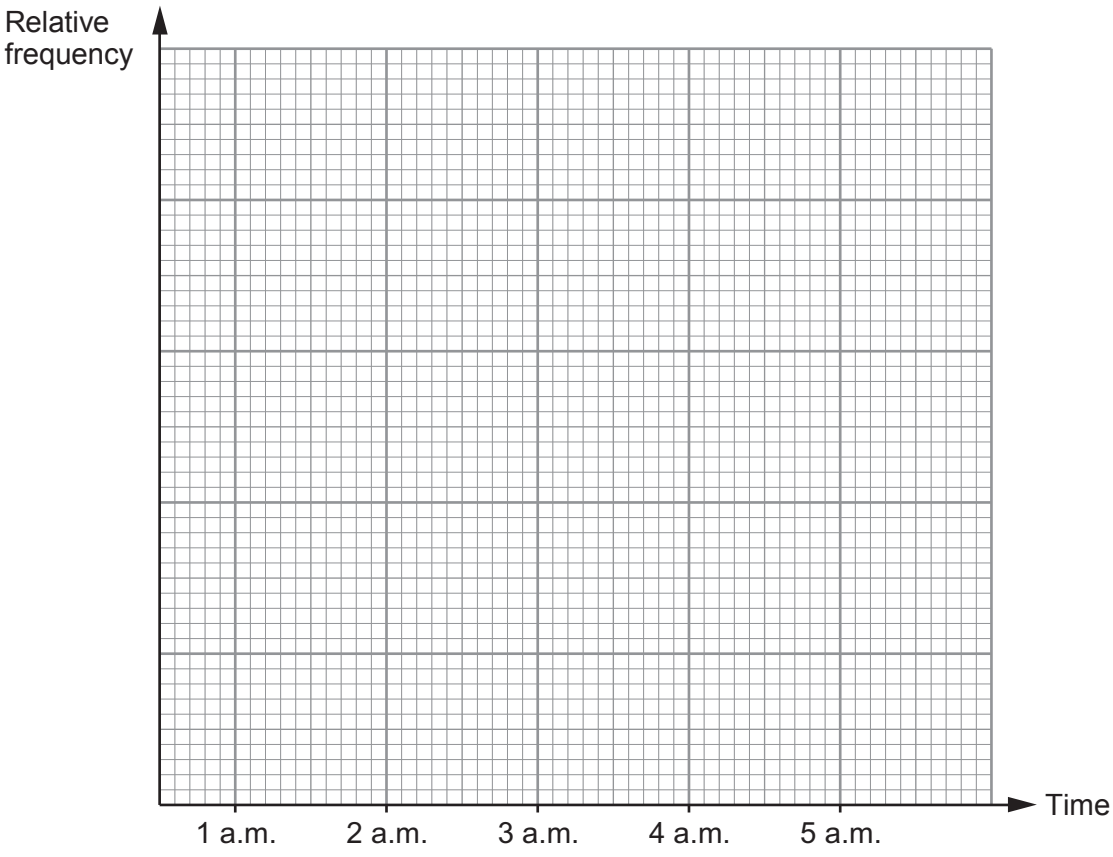
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(b) It is decided to record and plot the relative frequencies for the information shown in the previous table.

(i) Complete the table below.
Relative frequency must be recorded to 2 decimal places. [2]

	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.
Total number of boxes with exactly 8 peaches	8	18	25	32	41
Total number of boxes checked	10	20	30		
Relative frequency	0·80				

(ii) Use the graph paper below to plot the relative frequencies. [2]



(iii) A box of peaches is selected at random.
What is the best estimate of the probability that the box contains exactly 8 peaches? [1]

.....

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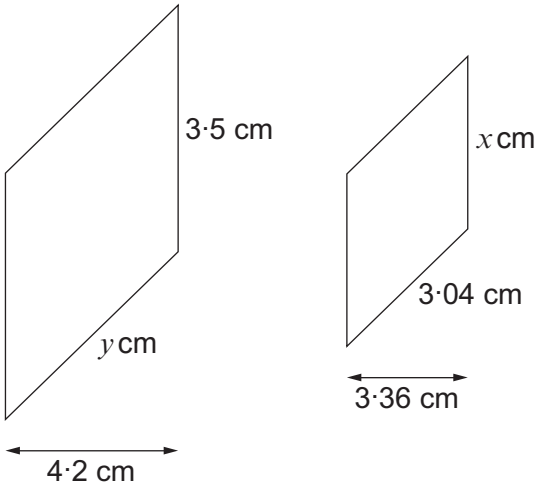
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Turn over.

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7. The diagram shows two similar shapes.



Diagrams not drawn to scale

Calculate x and y. [4]

x = ...

y = ...

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8. *(a)* Rearrange the following formula to make k the subject. [2]

$$3k^2 = m$$

(b) Rearrange the following formula to make g the subject. [2]

$$eg + fg = h$$

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9. Express 13 million in standard form. [1]

.....

.....

10. Jake's car has travelled a total of 31 500 miles, correct to the nearest 100 miles.

For each hour that the car travelled, he estimates that it travelled 46 miles, correct to the nearest mile.

Calculate the least number and greatest number of hours that Jake's car could have taken to travel this distance.
Give your answers correct to the nearest hour. [5]

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Least number of hours taken .....

Greatest number of hours taken .....

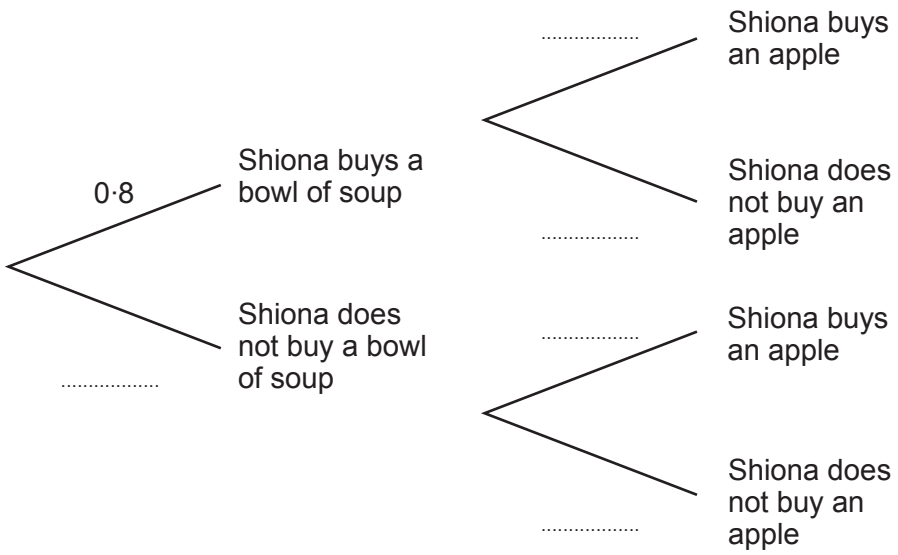
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11. At lunchtime, the probability that Shiona buys a bowl of soup is 0·8.
The probability of Shiona buying an apple is independent of her buying a bowl of soup.
The probability that Shiona buys a bowl of soup and an apple is 0·32.

(a) Complete the tree diagram. [4]



(b) Find the probability that Shiona does not buy soup and does not buy an apple. [2]

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12.

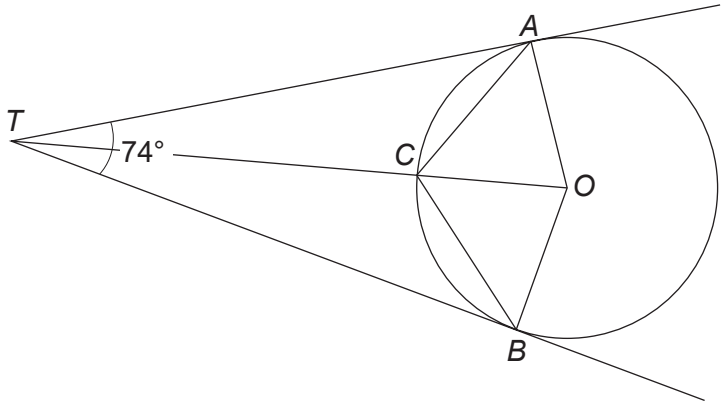


Diagram not drawn to scale

The diagram shows a circle with centre O.

AT and BT are tangents to the circle and $\hat{ATB} = 74°$.

(a) Calculate the size of each of the following angles.

(i) $\hat{AOT}$ [2]

(ii) $\hat{OBC}$ [2]

(iii) $\hat{ACB}$ [1]

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(b) The radius of the circle is 8 cm.
Calculate the perimeter of the quadrilateral *TAOB*. [4]

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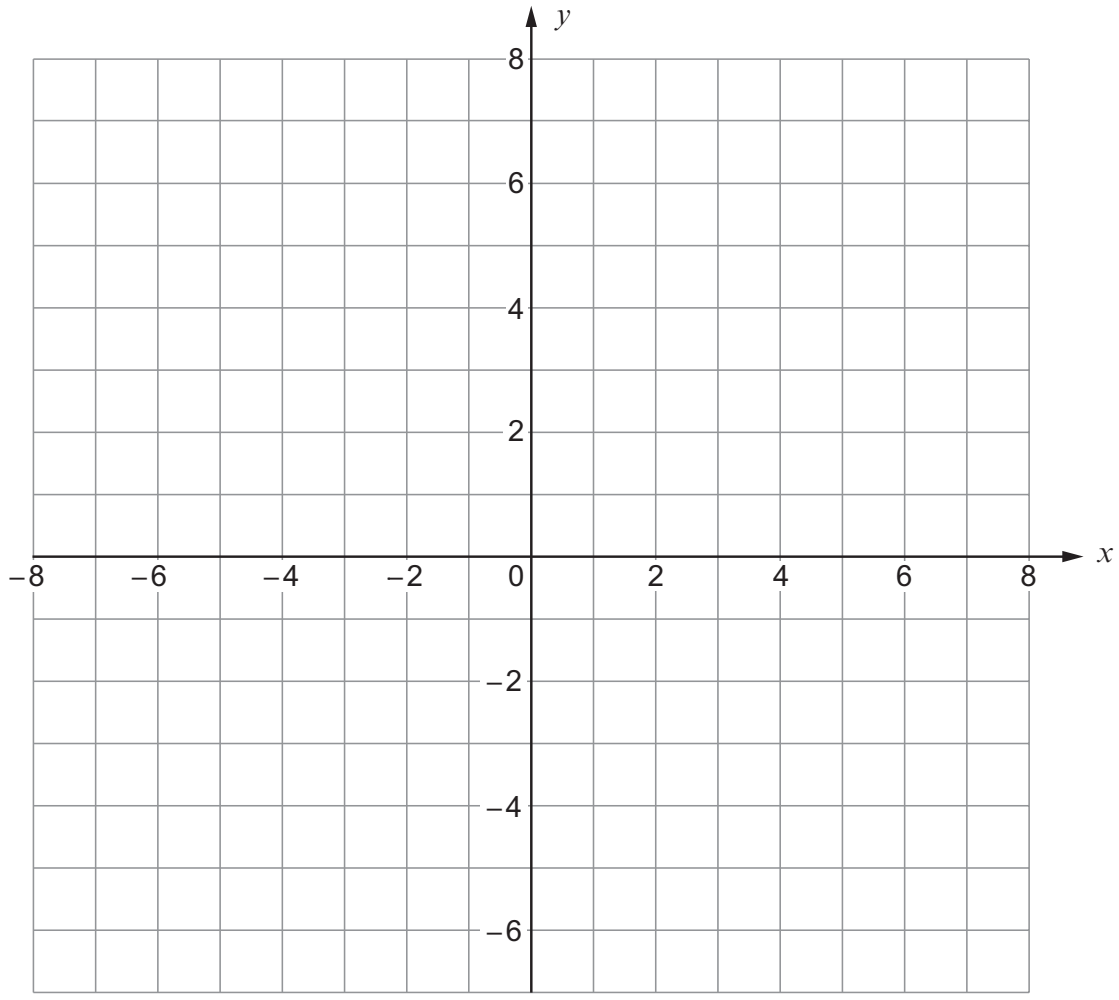
13. On the squared paper below, draw the region which satisfies all of the following inequalities.

$$x \leqslant 7$$

$$x + y \geqslant 6$$

$$y \leqslant \frac{x}{2}$$

Make sure that you clearly indicate the region that represents your answer. [3]



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14. The base of an open rectangular box is of length $(2x + 6)$ cm and width x cm.
The area of this base is $59\,\text{cm}^2$.
The height of the open box is $(x - 3)$ cm.

(a) Show that $2x^2 + 6x - 59 = 0$. [2]

(b) (i) Solve the equation $2x^2 + 6x - 59 = 0$, giving your answers correct to 2 decimal places.
You must show all your working. [3]

(ii) Hence calculate the volume of the box.
State clearly the units of your answer. [3]

Volume of the box is .....

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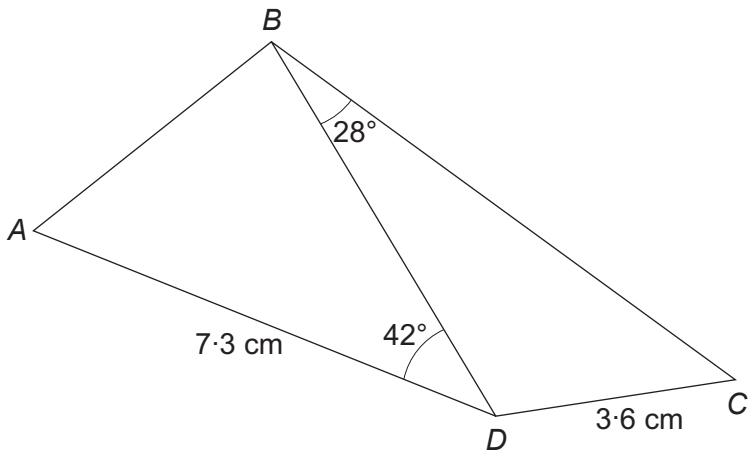


Diagram not drawn to scale

The area of triangle ABD is $16{\cdot}2\,\text{cm}^2$.
$B\hat{C}D$ is an acute angle.
Calculate the size of $B\hat{C}D$. [6]

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



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

$$\sin x = -0{\cdot}829$$

.....

.....

.....

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17. The diagram below shows a box of chocolates.
The shape of the box is a cylinder attached to a cone.

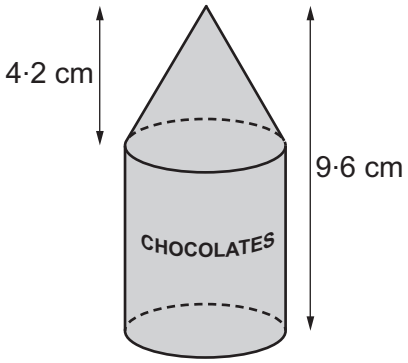


Diagram not drawn to scale

The volume of the complete box is 245 cm^3.
Calculate the radius of the base of the box.
Give your answer correct to one decimal place. [5]

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 - LINEAR

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 - LINEAR. 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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Paper 1 - Higher Tier	6
Paper 2 - Foundation Tier	12
Paper 2 - Higher Tier	16

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PAPER 2 - HIGHER TIER

2015 Summer Linear Paper 2 Higher Tier		Comments
1(a) $6x + 4x = 43 - 13$ $10x = 30$ or $x = 30/10$ $x = 3$	B1 B1 B1	FT until 2nd error Must be simplified *Accept an embedded answer for B3*
1(b) $(x =) 100$	B1	Accept embedded answer
1(c) $30 – x = 44 \div 2$ or $60 – 2x = 44$ $30 – x = 22$ or $-2x = 44 – 60$ or $60 -44 = 2x$ or $–x=-8$ $x = 8$	B1 B1 B1	FT until 2nd error FT equivalent level of difficulty *Accept an embedded answer for B3* *Note:* *Writing $2x = -16$ or $-2x = 16$ leading to $x = -8$ is generally from 1 error.* *Sight of $2x = 44 – 60$ is regarded as 1 error* *$60 – x = 44$ leading to $x = 16$ is awarded B0, B1, B0 (as level of difficulty is eased)*
2(a) Reason to include, without contradiction……. • FreeFlight: fewest complaints • Best2Fly: fewest lost suitcases • GoJet: best arrival on time record	B2	B1 for any 2 correct responses *Allow, if respectively, 'complaints', 'suitcases' or 'arrival time' is mentioned uniquely or if mentioned as **the** positive feature.*
2(b) $30000 – 0.88 \times 30000$ OR 0.12×30000 3600 (flights late)	M1 A1	Accept $(1 – 0.88) \times 30000$ *If the incorrect airline is selected, award SC1 for either* *Freeflight or 0.15×30000 = 4500 (flights late), or* *GoJet or 0.08×30000 = 2400 (flights late)* *Do not accept these as unlabelled unsupported answers; need sight of workings or the airline name as sufficient identification*
2(c) Use of 0.36 **and** 0.42 (per 1000 compared) $500 \times (0.42 – 0.36)$ OR 500×0.06 OR $500 \times 0.42 – 500 \times 0.36$ or equivalent 30 (suitcases)	B1 M1 A1	Use of (0.)36 and (0.)42 in any calculation(s), or sight of 0.06 Ignore consistent place value errors for '500 thousand passengers', e.g. 21(00) – 18(00) CAO. ISW *If no marks and no working allow SC1 for an answer of 3 or 300 or 3000 or 30000* *GoJet and FreeFlight are mentioned twice in the question, hence no MR or SC marks awarded for use of the incorrect airlines*
2(d) 8(%)	B1	Do not accept 8/100 or 0.08. ISW conversion to fractions or decimals. The answer must be a percentage

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2015 Summer Linear Paper 2 Higher Tier		Comments
3. Expect to pay: Standing charge 3×24.4(0 euros) (=73.2(0 euros) Cost of electricity (31008 – 30256) × 0.78 (euros) = 586.56 (euros) Total bill 1.12 × (73.2(0) + 586.56) (euros) (or 1.12×659.76) 738.93(12 euros) Difference 21(.0688 euros)	B1 M1 A1 M2 A1 B1	 (752 × 0.78) CAO FT 'their non-zero 73.2(0)' (including 24.4(0)) and 'their 586.56' provided it was evaluated from a calculation involving '×0.78' M1 for 0.12×(73.2(0)+586.56) (euros) CAO. Accept 739 or 738.9. Do not accept 738 FT 760 – 'their total bill' correctly evaluated, provided at least M1 previously awarded, e.g. FT from omitting the standing charge is allowed provided M1 awarded for the method to calculate the cost of electricity *Note: FT from 738 will give an answer of 22 (euros)*
4(a)(i) Mid-points 5,6,7,8,9 5×4 + 6×2 + 7×0 + 8×2 + 9×2 ÷ 10 6.6(mm)	B1 M1 m1 A1	 FT their mid points including bounds provided they fall within the classes. 20 + 12 + 0 + 16 + 18 (= 66) Intention their ∑fx / 10 For correct evaluation of their ∑fx / 10
4(a)(ii) Modal class $4.5 \leq r < 5.5$	B1	Accept '4.5 to 5.5' or other unambiguous indication of the group Do not accept 5
4(a)(iii) Median $5.5 \leq r < 6.5$	B1	Accept '5.5 to 6.5' or other unambiguous indication of the group Do not accept 6
4(b) Correct frequency polygon (for range of data given)	B2	If B2, penalise -1 if joined to any other point (apart from at (7, 0)) on horizontal axis other than (4, 0) and (10, 0) Must be accurate, indication to be on the horizontal grid line and on the vertical grid line B1 if joined with curve or not joined OR one plot incorrect within the polygon OR if translated provided the polygon is at the bounds or within the bounds for the group *Ignore frequency diagram as working*

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2015 Summer Linear Paper 2 Higher Tier		Comments
5. (Length common side BD is) 3900 ÷ 75 (BD =) 52 (cm) (Area of triangle BDC =) ½ × 25 × BD (=) 650 (cm^2) (BC^2 =) $25^2 + 52^2$ (BC =) $\sqrt{3329}$ or $BC^2 = 3329$ (BC =) 57.697…(cm) rounded or truncated 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 A1 M1 A1 M1 A1 A1 QWC 2	*Check the diagram for any answers* FT 'their BD', including BD as 25(cm) or spurious BD FT 'their BD' provided both previous M marks awarded FT 'their BD', including BD as 25(cm) or spurious BD FT 'their BD' provided ≠25(cm) and it is not a spurious BD CAO. Do not accept 60 (cm) unless 57(.697…) seen *Alternative for the first 4 marks:* *Base of triangle = ⅓ × base rectangle* *B1* *Area of the triangle = ⅓ × ½ ×3900* *M1* *= 650 (cm^2)* *A2* *Alternative for the final 3 marks:* ***Complete** method, all stages required to find BC* *M1* *Intermediate stages answer correct* *A1* *Final answer correct* *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 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.
6(a) Explanation, e.g. 'this information was not recorded', 'don't know how many peaches are in the other boxes', 'don't know if boxes have fewer than 8 peaches', 'doesn't show more or less than 8', 'could be fewer than 8 peaches', 'not all boxes may (or will) have 8 peaches'	E1	Do not accept, e.g. 'because some boxes only had 7 peaches', 'because they should contain exactly 8 peaches (not at least 8)' (given in the question), 'because 2/5 of the boxes are under 8'
6 (b)(i) (8) (18) (25) (32) (41) (10) (20) (30) 40 50 (0.80) 0.9(0) 0.83 0.8(0) 0.82	B2	Must be to appropriate 2dp, although allow 0.9 and 0.8 for 0.90 and 0.80 respectively B1 for any 4 or 5 correct entries
6(b)(ii) Uniform scale on the vertical axis, suitable for values of relative frequency Correct plots (allow joined or not joined)	M1 A1	Allow not starting at 0, but must be uniform from their first marked value. Do not accept inappropriate scales, the maximum value on the top of the vertical scale must not exceed 2.5, unless clearly working with percentage FT from (i) if possible provided all relative frequencies <1 , or shown as percentages and they are not all identical. Tolerance of plotting is within the appropriate small square *Ignore any 'line of best fit drawn' or additional bars*
6(b)(iii) 0.82 or equivalent probability	B1	FT from their final decimal in the table in (b)(i) and provided it is <1 Do not accept 0.82% unless a correct equivalent to 0.82 is also seen

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2015 Summer Linear Paper 2 Higher Tier		Comments
7. 3.5/4.2 = x/3.36 or equivalent correct statement x = 2.8 (cm) y/4.2 = 3.04/3.36 or equivalent correct statement y = 3.8 (cm)	M1 A1 M1 A1	OR appropriate use of scale factor (×)0.8 (or (÷)1.25) Do not accept errors from premature approximation OR appropriate use of scale factor (÷)0.8 (or (×)1.25) Do not accept errors from premature approximation *Accept unlabelled answers if given unambiguously*
8(a) $k^2 = m/3$ $k = (\pm)\sqrt{m/3}$	B1 B1	 Clearly must show square root of m/3 entirely FT from 1 error, e.g. $k^2 = m-3$ to give $k = (\pm)\sqrt{m-3}$ (B0, B1) or $3k = \sqrt{m}$ to give $k = (\pm)\sqrt{m}/3$ (B0, B1)
8(b) $g(e + f) = h$ OR $e + f = h/g$ $g = \frac{h}{e+f}$	B1 B1	Factorise FT from 1 error provided equivalent difficulty (not single term denominator), e.g. from incorrectly factorising as 2g(e+f) = h to give a response g = h/2(e+f) is awarded B0, B1
9. 1.3×10^7	B1	CAO
10. Sight of 31450, 31550, 45.5 and 46.5 Least 31450/46.5 (Least number of hours is) 676 ISW Greatest 31550/45.5 (Greatest number of hours is) 693 ISW	 B1 M1 A1 M1 A1	 Accept 46.49 or 31549.9 Do not accept 46.49 or 31549.9 Must be clearly their least FT 31400 ≤ numerator < 31500 FT 46 < denominator ≤ 47 CAO from correct calculation. Must be whole number of hours Must be clearly their greatest FT 31500 < numerator ≤ 31600 FT 45 ≤ denominator < 46 CAO from correct calculation Must be whole number of hours *If both A0 due to not to the nearest hour, then **also** allow SC1for 676.344… and 693.406… rounded or truncated*
11(a) 0.2 indicated for no soup Idea 0.8 ×… = 0.32 P(buys an apple) = 0.4 Second branches 0.4 0.6 0.4 0.6	B1 M1 A1 B1	In working or on tree In working or on tree FT from their P(buys an apple) if M1 awarded
11(b) 0.2 × 0.6 = 0.12	M1 A1	FT 'their 0.6' from their lowest 2nd branch in (a)
12(a)(i) 180 – 90 – 74/2 53(°)	M1 A1	Indication of a complete correct method *Ignore a slip in notation, e.g. 90+37 = 53, award M1, A1*
12(a)(ii) (180 – 53)÷ 2 63.5(°)	M1 A1	Indication of a complete correct method. FT 'their 53' Accept 64(°) from correct working
12(a)(iii) 127(°)	B1	FT 2×'their 63.5' or 180° - 'their 53°'

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2015 Summer Linear Paper 2 Higher Tier		Comments
12(b) AT (or BT) = 8/tan (74°/2) or AT (or BT) = 8 × tan 53° or AT (or BT) = 8 × tan (90°-74°/2) or AT (or BT) = 8 × sin53°/sin37° or AT (or BT) = 8 × sin(90°-74°/2)/sin37°	M2	M1for tan (74°/2) = 8/AT OR tan (74°/2) = 8/BT or $\frac{AT(or\ BT)}{sin53°} = \frac{8}{sin37°}$ or tan 53° = AT(or BT)/8 OR tan (90°-74°/2) = AT(or BT)/8 *Alternative:* *$OT/sin90° = 8/sin(74°/2)$ followed by AT^2 or $BT^2 = OT^2 - 8^2$* *M2* *(M1 for 1 **rearrangement** error in either sine rule or Pythagoras' Theorem)*
10.6(16358…. cm)	A1	Do not accept other answers from premature approximation, their response must be such that it would round to 10.6 (cm)
Perimeter of TAOB is 37.2(327….cm)	A1	FT 2×'their 10.6' + 16 evaluated correctly provided at least M1 awarded
13. Any two lines drawn correctly Correct region identified	B2 B1	B1 for any 1 line drawn correctly CAO
14.(a) Sight of x(2x + 6) or equivalent Convincing $2x^2 + 6x – 59 = 0$	B1 B1	Including within an equation x(2x + 6) = 59 Must be from of x(2x + 6) = 59 or $2x^2 + 6x = 59$
14(b)(i)Substitution into quadratic formula, allow 1 slip $(x =) \frac{-6 \pm\sqrt{(6^2 - 4\times2\times-59)}}{2\times2}$ $(x =) \frac{-6 \pm\sqrt{508}}{4}$ (x =) 4.13 with -7.13	M1 A1 A1	Must be correct formula Must be 2 d.p. *Only accept a trial & improvement if both solutions are found:* *Correctly evaluated trials that could lead to a positive and a negative solution* *M1* *Refinement of trials to 3 decimals places to confirm both solutions* *A1* *(x=) 4.13 with -7.13* *A1*
14(b)(ii) Volume 4.13(47…)×14.26(94)×1.13(47) or 59× 1.13(47…) Answers in the range 66.5 to 67 **cm^3**	M1 A1 U1	FT 'their derived 4.13(47…)' from a value that must be >3 given in a response in (b)(i) CAO. With no other answer (e.g. negative volume). Unsupported or from appropriate working Mark final answer **Independent mark**
15. ½ × 7.3 × BD × sin42° = 16.2 BD = 6.6(3301...cm) sinC/BD = sin28°/3.6 or BD/sinC = 3.6/sin28° sinC = BD × sin28°/3.6 Ĉ in the range 59.39(°) to 59.88...(°) or 59.9(°)	M1 A2 M1 M1 A1	A1 for BD = 16.2/(½ × 7.3 × sin42°) Must show a substitution for BD FT 'their derived BD', must be from working, not spurious Must show a substitution for BD OR sinC = 0.865…. **CAO**, accepting 59(°) or 60(°) from appropriate working.
16(a) Sin curve, through the origin Correct sketch, with ±1 shown on the vertical axis and clearly y = 0 shown at 0°, 180° & 360° implied correctly	M1 A1	 Accept 180° as mid-way between 0° and 360° if unlabelled Accept 360° as unlabelled provided the sketch does not exceed 360° ±1 must be both shown on the vertical axis

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2015 Summer Linear Paper 2 Higher Tier		Comments
16(b) 236° and 304° with no other angles	B2	B1 for a correct angle. Accept unrounded values and embedded answers *If no marks, allow SC1 for answers of 235° and 305° (from truncation of 55.996…° to 55°)*
17. (Volume of cone =) $\frac{1}{3}\times\pi\times r^2\times 4.2$ (Volume of cylinder =) $\pi\times r^2\times(9.6 - 4.2)$	B1 B1	($=7/5\ \pi r^2 = 4.398r^2$ to 3 dp) ($=27/5\ \pi r^2 = 16.965r^2$ to 3 dp)
$\frac{1}{3}\times\pi\times r^2\times 4.2 + \pi\times r^2\times(9.6 - 4.2) = 245$	M1	FT provided both terms on the left are terms in $\pi\times r^2$ and are dimensionally correct ($6.8\pi r^2 = 245$, $245 = 21.363r^2$ to 3 dp)
$r^2 = 245\ /\ (\frac{1}{3}\times\pi\times 4.2\ +\ \pi\times 5.4)$ $(= 245/(4.39.. + 16.9..))$	A1	FT for correct rearrangement for r^2 ($r^2 = 11.46\ldots$ to 11.537 or $245/6.8\pi$)
3.4 (cm)	A1	CAO, however allow answers in the range 3.38 to 3.396 (cm)

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Surname	Centre Number	Candidate Number
Other Names		0

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GCSE

4370/06

MATHEMATICS – LINEAR
PAPER 2
HIGHER TIER

A.M. TUESDAY, 17 June 2014

2 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 **2***(a)*.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**8**	
3.	**16**	
4.	**5**	
5.	**6**	
6.	**3**	
7.	**4**	
8.	**8**	
9.	**4**	
10.	**6**	
11.	**6**	
12.	**7**	
13.	**6**	
14.	**7**	
15.	**9**	
Total	**100**	

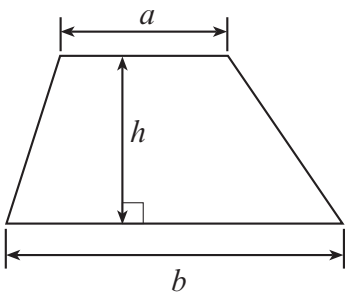
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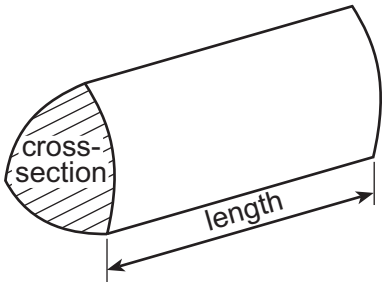
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Formula List

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

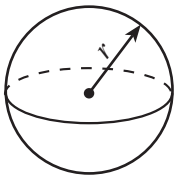


Volume of prism = area of cross-section × length



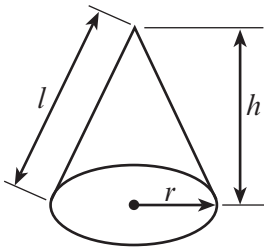
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

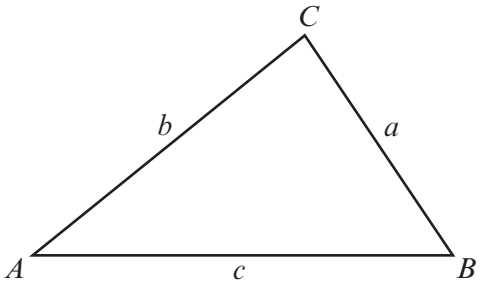


In any triangle ABC

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

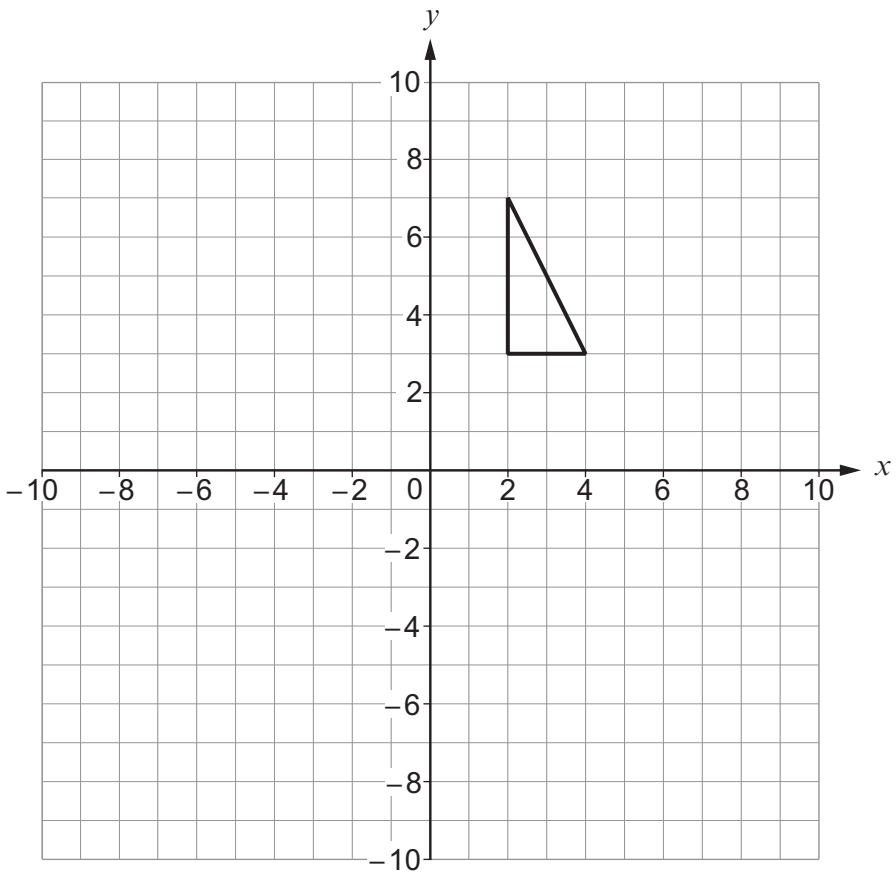
$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

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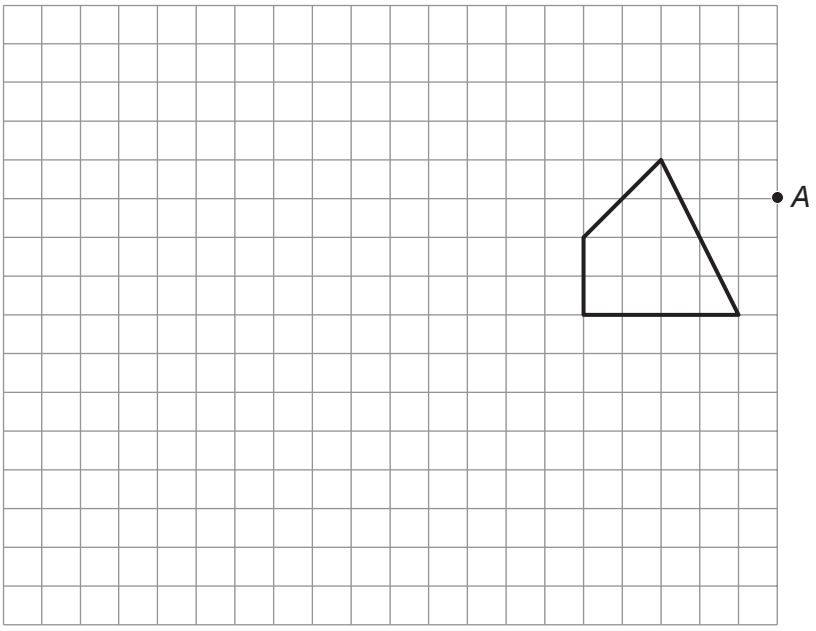
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1. *(a)* Draw a reflection of the triangle in the line $y = 1$. [2]



(b) Enlarge the shape shown on the grid by a scale factor of 2, using *A* as the centre of the enlargement. [3]



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2. The ruling body for international football has rules for the dimensions of rectangular football pitches.

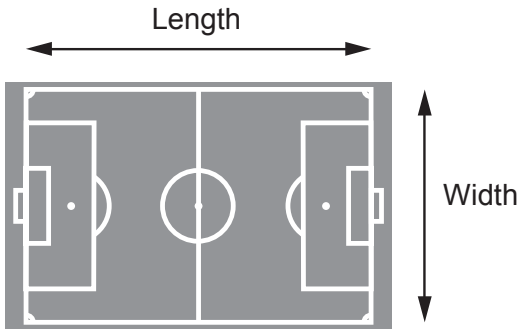


Diagram not drawn to scale

Football pitch dimension rules:

- the minimum width is 45 m
- the maximum width allowed is double the minimum width
- the maximum length is 120 m
- the minimum length allowed is three-quarters of the maximum length

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

Susan says

'The maximum area of a pitch is **at least 50%** greater than the minimum area of a pitch.'

Is Susan correct?
You must show all your working to justify your answer. [6]

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(b) Ceri makes a correct statement.
Complete Ceri's statement below using a decimal, correct to 2 decimal places. [2]

'Minimum area of a football pitch x ..... = maximum area of a football pitch.'

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3. *(a)* In 2013, there were 119 days on which there was rain or snowfall in Moscow.
For what fraction of the number of days in 2013 was there **no** rain and **no** snowfall in Moscow? [1]

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(b) The mean temperature in Moscow for a 12 month period is 4°C.
It is warmest in July, typically 26°C.
What would be the estimate for the mean temperature in Moscow if the temperature for July was not included? [4]

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(c) One year, during the 31 days in March, the temperature was recorded every day at midday.
The results are shown in the table below.

Midday temperature, t, in °C	Number of days
$-12 \leqslant t < -10$	1
$-10 \leqslant t < -8$	3
$-8 \leqslant t < -6$	5
$-6 \leqslant t < -4$	8
$-4 \leqslant t < -2$	4
$-2 \leqslant t < 0$	10

Calculate an estimate for the mean midday March temperature in Moscow.
You must show all your working. [4]

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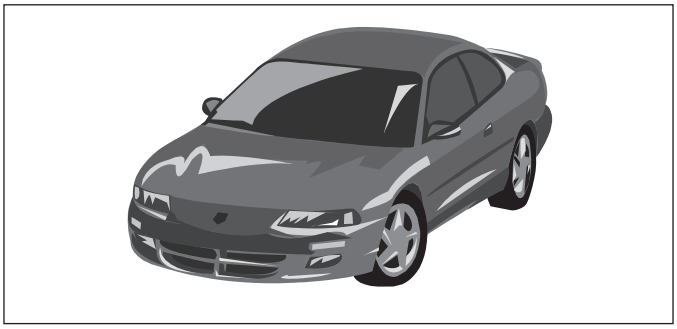
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(d) Boris bought a car in Moscow for 251 850 Russian roubles.



(i) Each year, the value of Boris's car depreciates by 10% of its value at the start of the year.
At the end of two years, by how much has the value of Boris's car depreciated? [4]

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(ii) The exchange rate for Russian roubles when Boris bought his car was £1 = 50.37 Russian roubles.

At the same time, Angharad bought a car in Wales.
Angharad paid £5250 for her car.

How much more than Boris did Angharad spend on buying her car?
Give your answer in pounds. [3]

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4. The table shows some of the values of $y = x^3 + 6$ for values of x from –2 to 3.

(a) Complete the table by finding the value of y for x = –1 and x = 2. [2]

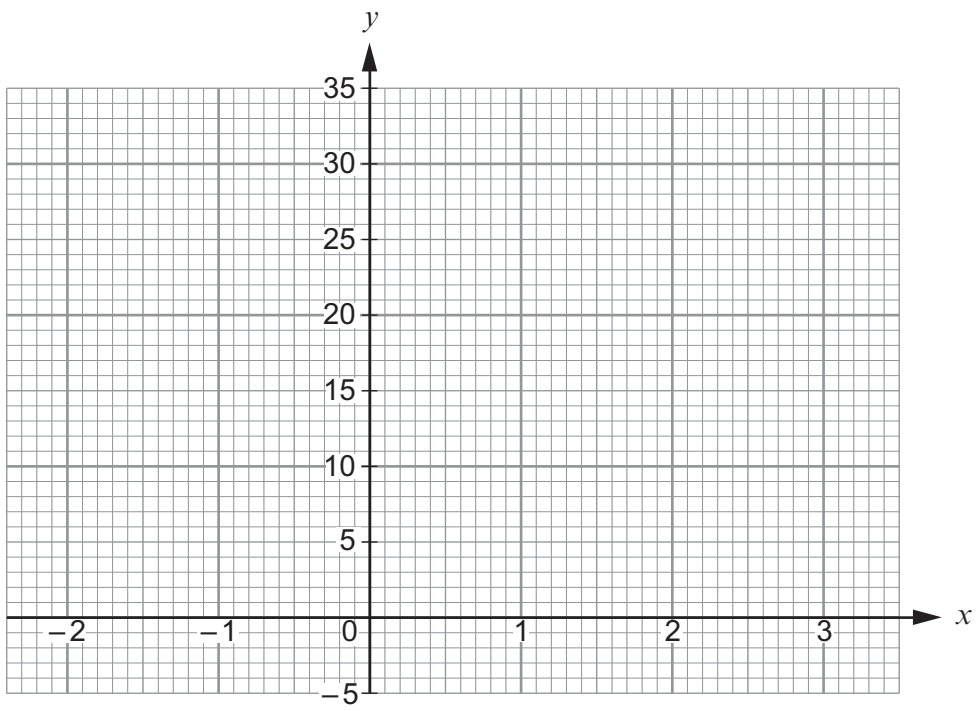
x	–2	–1	0	1	2	3
$y = x^3 + 6$	–2		6	7		33

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(b) On the graph paper below, draw the graph of $y = x^3 + 6$ for values of x from –2 to 3. [2]



(c) Faye wants to solve the equation $x^3 + 6 = 10$ by first drawing a line on the graph above.
Show how Faye would do this on the graph above.
You do not need to find the solution of the equation. [1]

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5. Claudia was given the following information.

UK Income Tax

April 2013 to April 2014

taxable income = gross income – personal allowance

- personal allowance is £9205
- basic rate of tax: 20% on the first £32 255 of taxable income
- higher rate tax: 40% is payable on all taxable income over £32 255

During the tax year 2013 to 2014, Claudia's gross income was £52 250.

Calculate the total amount of tax that Claudia should pay.
You must show all your working. [6]

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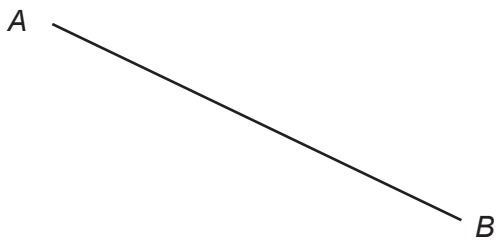
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6. Shade the region that satisfies both of the following conditions.

(i) The points are less than 4 cm from *B*.

(ii) The points are nearer to *B* than to *A*. [3]

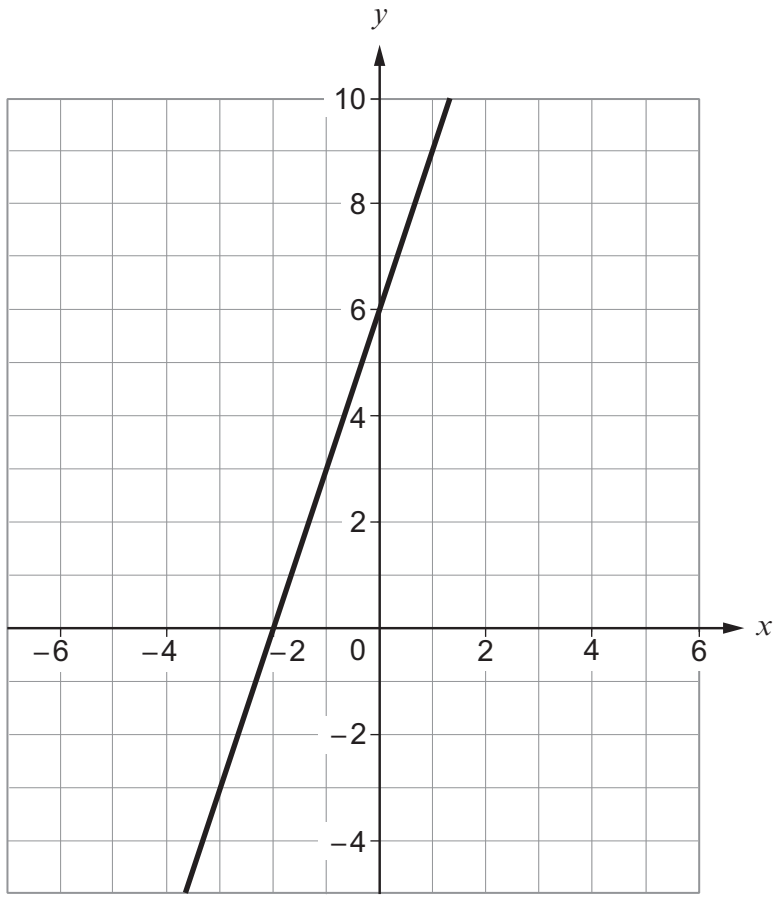


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7. *(a)* Find the equation of the straight line shown in the following diagram.
Write your answer in the form $y = mx + c$. [2]



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Equation of the straight line is $y =$ ..... $x +$ .....

(b) On the grid above, draw the straight line which has a gradient of –2 and which passes through the point (0, –1). [2]

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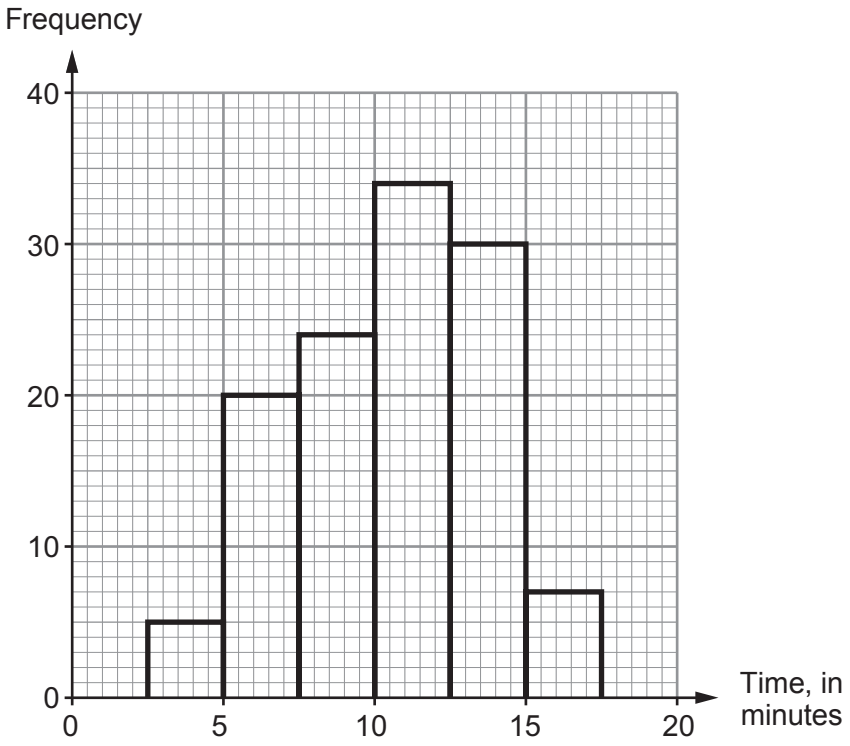
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Turn over.

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8. A number of people took part in a challenge to swim across a lake.
The grouped frequency diagram shows the times taken to cross the lake.



(a) How many people took between 5 minutes and 12 minutes 30 seconds to swim across the lake? [1]

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(b) Complete the cumulative frequency table for the swimming times. [2]

Time, t in minutes	$t \leqslant 2{\cdot}5$	$t \leqslant 5$	$t \leqslant 7{\cdot}5$	$t \leqslant 10$	$t \leqslant 12{\cdot}5$	$t \leqslant 15$	$t \leqslant 17{\cdot}5$
Cumulative frequency							

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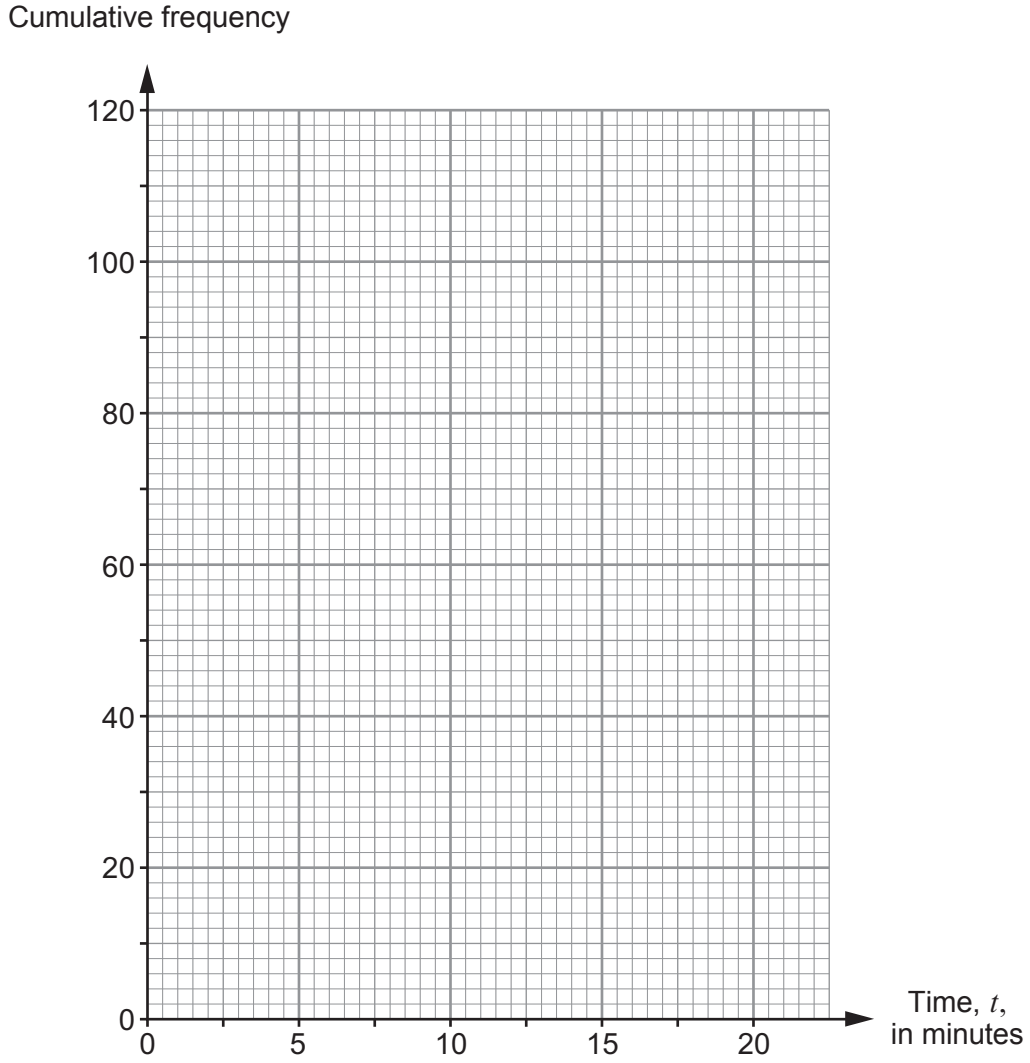
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(c) Use the graph paper below to draw a cumulative frequency diagram for the swimming times. [2]



(d) Use your cumulative frequency diagram to find

(i) an estimate for the median swimming time, [1]

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(ii) an estimate for the inter-quartile range of the swimming times. [2]

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9. A ship leaves port *A* and sails for 6·2 miles on a bearing of 090° to a point *B*.
It then turns and sails on a bearing of 224° until it reaches point *C*, which is due south of port *A*.
Calculate the distance between the point *C* and port *A*. [4]

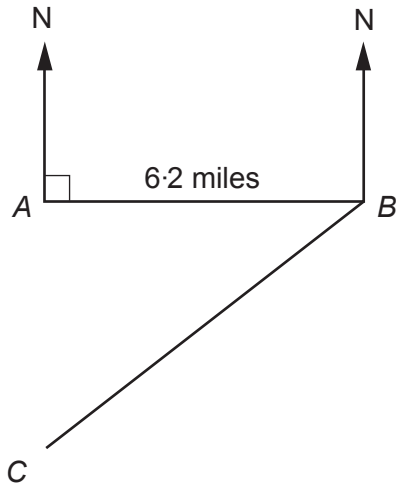


Diagram not drawn to scale

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10. *(a)* Factorise and hence solve $x^2 - 4x - 12 = 0$. [3]

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(b) Write down the nth term for each of the following sequences.

(i) 4, 9, 14, 19, 24, ... [2]

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(ii) 2, 5, 10, 17, 26, 37, 50, ... [1]

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11. The probability that Ifor buys a sandwich for lunch is 0·6.
The probability that Ifor buys a sandwich and a drink for lunch is 0·18.
Buying a sandwich for lunch and buying a drink for lunch are independent events.

(a) (i) Find the probability that Ifor buys a drink for lunch. [2]

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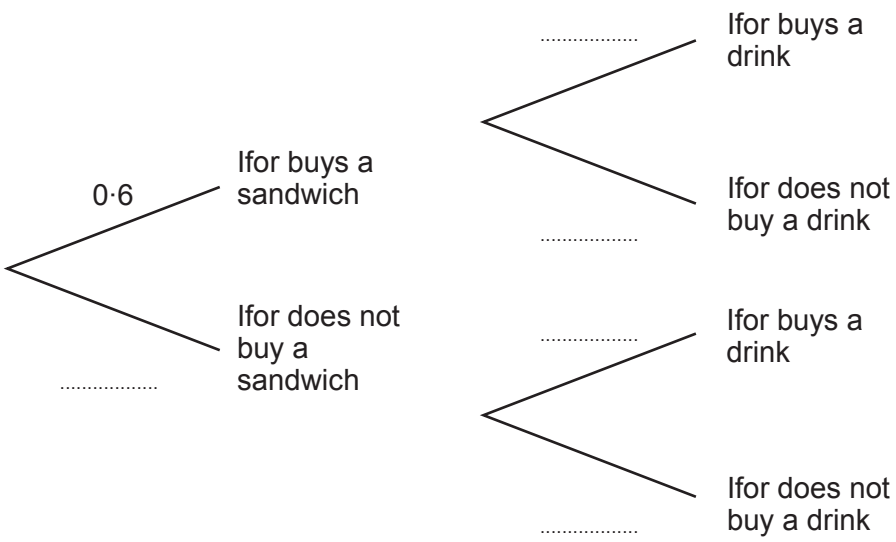
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Probability that Ifor buys a drink = ...

(ii) Complete the tree diagram. [2]



(b) Find the probability that Ifor does not buy a sandwich and does not buy a drink at lunchtime. [2]

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12. The diagram shows a parallelogram and a rectangle joined along a common side.

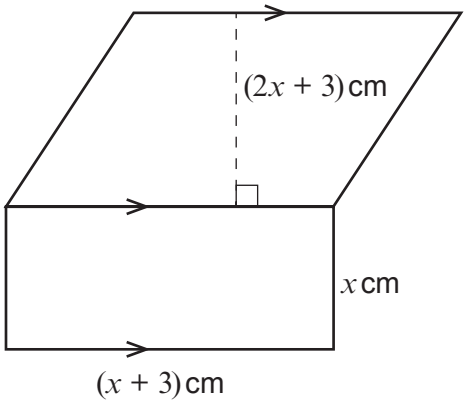


Diagram not drawn to scale

The width of the rectangle is x cm.
The length of the rectangle is $(x + 3)$ cm.
The height of the parallelogram is $(2x + 3)$ cm.
The total area of the parallelogram and the rectangle together is 70 cm^2.

(a) Show that $3x^2 + 12x - 61 = 0$. [3]

(b) Use the quadratic formula to calculate the length of the rectangle.
Give your answer correct to 2 decimal places. [4]

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13.

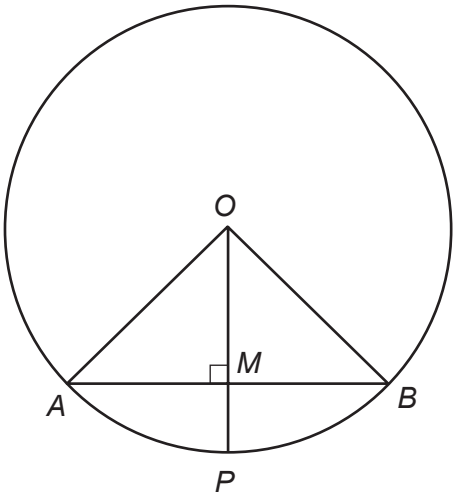


Diagram not drawn to scale

AOB is a sector of a circle, with *OP* perpendicular to *AB* and *AM* = *MB*.
You are given that *AB* = 20·8 cm and *MP* = 1·5 cm.
Calculate the radius of the circle. [6]

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14. The diagram shows a plan of drains connecting houses at points *A*, *B*, *C*, *P* and *Q*.

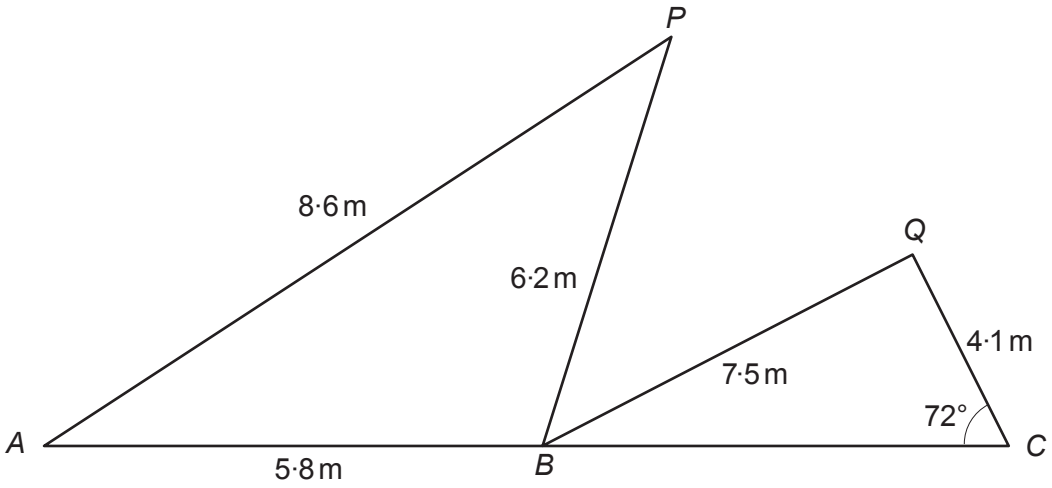


Diagram not drawn to scale

Given that *A*, *B* and *C* lie on a straight line, calculate the size of $P\hat{B}Q$.
Give your answer correct to the nearest degree. [7]

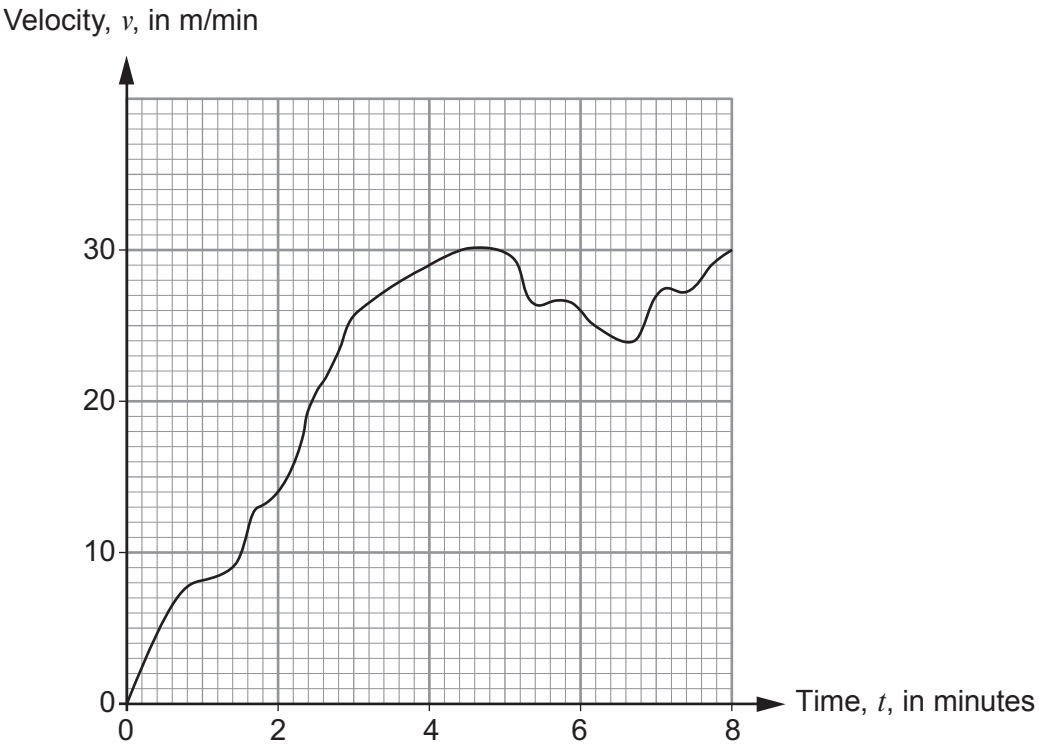
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15. Polly carried out an experiment.
She used equipment to record the velocity of an object, v, in m/min for the first 8 minutes of the experiment.

The velocity-time graph is shown below.



(a) Write down the gradient of the curve when $t = 4{\cdot}6$. [1]

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(b) Find an estimate for the acceleration of the object at $t = 3{\cdot}5$. [3]

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(c) (i) Use the trapezium rule, with the ordinates $t = 0$, $t = 2$, $t = 4$, $t = 6$ and $t = 8$, to estimate the area of the region bounded by the curve, the positive time axis and the line $t = 8$. [4]

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(ii) Calculate an estimate for the distance the object travelled in the first 8 minutes of Polly's experiment, giving your answer in kilometres. [1]

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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 - LINEAR

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 - LINEAR. 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.

Paper 1 - Foundation Tier	1
Paper 1 - Higher Tier	6
Paper 2 - Foundation Tier	12
Paper 2 - Higher Tier	17

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Summer 2014 Paper 2 Higher Tier	Marks	Comments
1(a) Correct reflection	B2	B1 for the sight of the line y = 1, or a reflection in any horizontal line B0 if more than one triangle drawn, unless all are reflections in a horizontal line
1(b) Correct enlargement Correct position	B2 B1	B1 for any two adjacent lines correct Intention of correct placement, i.e. with appropriate rays seen, or correct positioning of at least two vertices *Penalise consistent incorrect scale factor -1*
2(a) (maximum width is 2 × 45 =) 90 (m) **AND** (minimum length is ¾ × 120 =) 90 (m) (maximum area is 90 × 120 =) 10800 (m^2) **AND** (minimum area is 45 × 90 =) 4050 (m^2) 4050 × 1.5 = 6075 (m^2 <10800 m^2) **OR** 100×10800/4050 = 266.6(6…% >150%) **OR** 100 ×(10800 – 4050)/4050 = 166.6(6..% >50%) **OR** similar appropriate check against Susan's statement, e.g. 2×4050 = 8100 (<10800m^2) Conclusion that Susan **is correct** based on calculations, e.g. 'it is at least 50% greater, in fact it is (much) more' following from an appropriate calculation, or '6075 (m^2) <10800 (m^2)', or '100×(10800 – 4050)/4050 = 166.6(6..)% >50%, or '100×10800/4050 = 266.6(6…%) >150(%)', or 'Twice 4050 is less than 10800' Look for • spelling • clarity of text explanations, • the use of notation (watch for the use of '=', m, m^2 being appropriate) 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	B1 B1 B1 E1 QWC 2	Sight of 90(m) TWICE if unlabelled (max width & min length) Both areas correct FT 'their 2×45' × 120 correctly evaluated **AND** 45 × 'their ¾ ×120' correctly evaluated *If neither of the previous B1s awarded, then award SC1 for sight of 90(m) and one correct (FT) area* The award of this mark requires a correct evaluation of the candidate's check. Must show **correct** evaluation FT 'their 4050'× 1.5 correctly evaluated, or 100× 'their max area' / 'their min area' correctly evaluated, or similar appropriate check. *Do not accept 50% of 10800 or 5400, B0, unless applied appropriately. Allow FT from this type of comparison. However, sight of 4050<5400 is an appropriate comparison, hence B1 (and may also gain E1)* Allow 'is correct' implied, do not accept 'not correct' Accept that there may be errors in calculations, but that it is a conclusion based on attempting to work with area *Watch for incorrect conclusion following correct working.* FT appropriate conclusion based on their working provided the candidate has attempted to work with **area**. No working shown, then E0 *Alternative:* *2×4/3* *B2* *= 8/3* *B1* *Appropriate conclusion* *E1* *Allow responses that clearly engage with the concept that doubling the width will result is an area that is at least 50% greater.* 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 or grammar.
2(b) (×)2.67	B2	Must be to 2decimal places B1 for sight of 10800/4050 or 2.6(66…) or 2.7 or 2⅔ or $^8/_3$ For B2, FT '100 ×their max area / their min area' (%) expressed as a decimal to 2 decimal places, or for B1, FT if truncated, unrounded or given as a fraction

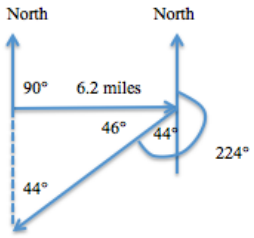
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Summer 2014 Paper 2 Higher Tier	Marks	Comments
3(a) 246/365 ISW	B1	Allow 247/366, 246.25/365.25
3(b) (Total for 12 months 12 × 4 =) 48(°C) 48 - 26 (=22) ÷ 11 = 2(°C)	B1 M1 m1 A1	 FT 'their 12×4' *Award B4 for an unsupported answer of 2(°C)* *Sight of 48 – 26/12 is B1 only,* *Sight of (48-26)/12 is B1, M1 only*
3(c) Mid points -1, -3, -5, -7, -9, -11 -11×1 + -9×3 + -7×5 + -5×8 + -3×4 + -1×10 (Σ*fx* = -135) their Σ*fx*/31 -4.3548…(°C) rounded or truncated to 1 or more d.p.	B1 M1 m1 A1	Sight of any 3 correct values, with no incorrect values FT their mid points from within appropriate groups, or at bounds of the groups FT their Σ*fx*/31 correctly evaluated. Must be negative. Accept -4, -4.4 or -4.3 only from correct working Award all 4 marks for unsupported -4.35 Omitted negative sign, penalise -1 only, then follow mark scheme as above
3(d)(i) Any correct 10% of a value seen in working 251850 – 0.10 × 251850 (= 251850 – **25185**) 226665 – 0.10 × 226665 (= 226665 – **22666.5**) 47851.5(0 Russian roubles)	B1 M1 A2	OR **B1and M1 for 251850 × 0.90^2** **B1 and M0 for 251850 × 0.90** Two different 10% OR sight of 0.10 × 251850 AND 0.10 × 226665 (25185 AND 22666.5) Accept 47851 or 47852 (roubles) A1 for 203998.5(0), 203998 or 203999 (roubles) *Appreciate: B1 and SC1 for 304738.5(0) and 52888.5(0)* *Simple interest, accept a correct 20% for B1 only (50370)*
3(d)(ii) Boris's car cost 251850/50.37 (£)5000 Angharad paid (£)250 (more)	 M1 A1 B1	*Treat use of 203998.5, 203998 or 203999 as MR-1* FT 5250 – 'their 5000' correctly evaluated provided M1 previously awarded OR (Angharad's car 5250 × 50.37 = 264442.5 roubles) AND Difference 264442.5 – 251850 =) **12592.5** (roubles) B1 (Difference, Angharad paid) 12592.5 ÷ 50.37 M1 (£)250 (more) A1 *For the M1 A1, FT 'their 12592.5' provided appropriate calculations are shown in the first 2 stages*
4(a) 5 and 14	B2	B1 for each
4(b) Plots correct, allowing one error or the 2 omissions (x=-1 and x=2) All 6 points correct & joined with a curve	B1 B1	FT from (a) FT from (a). Need to have all 6 plots no omissions
4(c) Sight of y = 10 including the intersection, or marking the intersection and y = 10 with a point, or a vertical line to the point of intersection with y = 10	B1	FT their graph. Unambiguous answer **on the graph**
5. Taxable income (52250 – 9205=) (£)43045 40% tax to be paid on (£)10790 0.2 × 32255 (=6451) 0.4 × 10790 (=4316) (£) 6451 AND (£)4316 Claudia's tax should be (£)10767	B1 B1 M1 M1 A1 A1	 FT 'taxable income' – 32255, i.e. 'their 52250 -9205' – 32255 correctly evaluated FT 0.4 × ('their 43045' – 32255) provided 'their 43045' > 32255, also FT (52250 – 32255 =) giving 0.4 × 19995 (=7998) FT sum of 'their 6451' + 'their 4316' provided at least 1 of these values is correct and M2 awarded *(Note: 6451 + 7998 = 14449)*
6. Correct region shaded (major segment)	B3	Mark intention. B1 for line, B1 for any arc radius 4cm centre B, B1 for shading (FT from a circle centre B and a straight line crossing AB)

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Summer 2014 Paper 2 Higher Tier	Marks	Comments
7(a) $y = 3x + 6$	B2	B1 for $y = {}^{6}/_{2}\ x + 6$ or equivalent, or for m = 3 (must be clear that this is the gradient), or for c = 6 (must be clear that this is the intercept)
7(b) Correct straight line drawn (gradient -2, passing through (0,-1))	B2	B1 for any straight line drawn with gradient -2, or a straight line passing through (0, -1) with either gradient 2 or with a negative gradient
8(a) 78	B1	
8(b) 0, 5, 25, 49, 83, 113, 120	B2	B1 for any three correct values, OR FT cumulative from 1 error finding 3 further cumulative values accurately
8(c) 3 unique vertical plots correct at upper bounds All plots correct and joined, including to zero at t=2.5	 M1 A1	Only FT their <u>cumulative table</u> to (c) and (d) Accuracy of plotting: time on the grid line, cumulative frequency within the appropriate square with 1st & last plots on the grid lines *Ignore bars only if intention clear that line or curve is being used in (d)*
8(d) (i) Median from cumulative graph (10.8 minutes)	B1	FT from their cumulative graph in (c)
8(d)(ii) Attempt, (using the reading on the horizontal) UQ - LQ (5 minutes)	M1 A1	*If (b) is not cumulative then do not FT to (c) &(d)*
9. Appropriate 46° or appropriate 44° seen or implied, e.g.  Distance = 6.2 × tan46° OR Distance = 6.2 ÷ tan44° = 6.4(2… miles)	B1 M2 A1	At least 1 relevant angle 44° or 46° seen or implied Sight of 224° is insufficient Do not FT for an angle of 45° as this is a simplified problem FT for M1 only, their 44° or their46° provided it is <90° M1 for tan46° = distance/6.2 or tan44° = 6.2/distance CAO *Unsupported answers gets no marks*
10(a) (x – 6)(x + 2) x = 6 AND x = -2	B2 B1	B1 for (x + 6)(x – 2) OR (x – 6)(x – 2) **STRICTLY** FT their pair of brackets
10(b)(i) 5n -1	B2	Accept 5N – 1. *Allow 'n(th) = 5n -1'* B1 for 5n *Penalise incorrect letter -1 only*
10(b)(ii) $n^2 + 1$	B1	CAO. Accept n×n + 1 *Do not penalise change of letter*
11(a)(i) Using 0.6 ×… = 0.18 or sight of 0.18÷0.6 or 0.18/0.6 P(drink) = 0.3	M1 A1	
11(a)(ii) Tree completed correctly (0.4, 0.3, 0.7, 0.3, 0.7 on appropriate branches)	B2	FT their '0.3', this could be 0.18 and 0.82 on second pairs of branches B1 for 0.4 with at least one other pair of branches total of 1
11(b) 0.4 × 0.7 = 0.28	M1 A1	FT attempt to multiply appropriate probabilities, provided no probability >1 FT for correct evaluation, provided not >1
12(a) (x + 3)(2x + 3) + x(x + 3) = 70 $2x^2 + 6x + 3x + 9 + x^2 + 3x = 70$ Convincing lead to $3x^2 + 12x – 61 = 0$	M1 A1 A1	 Accept $3x^2 + 12x = 61$

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Summer 2014 Paper 2 Higher Tier	Marks	Comments
12(b) $x = \{ -12 \pm\sqrt{(12^2 - 4 \times 3 \times -61)}\} / (2 \times 3)$ $= \{-12 \pm\sqrt{876}\ \} /6$ $x = 2.93(288\ldots)$ (and $x = -6.9328\ldots$) Parallel side is 5.93 (cm)	M1 A1 A1 B1	Allow one slip in the substitution, but with correct formula Ignore if negative answer is also given. Allow rounded or truncated for A1, but 2 d.p. accuracy is required then for B1 Must be to 2d.p. From 2 d.p value of x. FT their positive x + 3 evaluated to 2d.p. provided at least M1 awarded. B0 if negative response also given
13. Strategy: Use of right angled triangle (OAM or OMB) with either AM or MB = 10.4(cm) Sight of OM = radius – 1.5 or equivalent OR $\text{Radius}^2 = OM^2 + 10.4^2$ $R^2 = 10.4^2 + (R - 1.5)^2$ OR $(OM+1.5)^2 = 10.4^2 + OM^2$ $R^2 = 108.16 + R^2 - 1.5R - 1.5R + 2.25$ OR $OM^2 + 3OM + 2.25 = 108.16 + OM^2$ $3R = 110.41$ OR $3OM = 105.91$ or $OM = 35.3033\ldots$ $R = 36.8(033\ldots$ cm) or 37(cm)	S1 B1 M1 M1 A1 A1	 Allow 1 slip FT from their 1 slip CAO *Alernative:* Strategy: Use of triangle MAP or PMB with 1.5cm and 10.4cm S1 Tan MPA(MPB) = 10.4/1.5 leading to 81.792…° B1 (FT provided tanP=10.4/1.5 seen) 180 - 2×81.792…° (=16.41….°) M1 (Allow FT from 1 slip) sin 16.41….° = 10.4/radius M1 Radius = 10.4/sin16.41…° A1 Radius 36.8(033… cm) or 37(cm) A1 CAO Also allow application of other circle theorem
14. $\cos PBA = \frac{6.2^2 + 5.8^2 - 8.6^2}{2 \times 6.2 \times 5.8}$ 91.4978…(°) $\sin QBC = \frac{\sin 72° \times 4.1}{7.5}$ 31.326…(°) Angle PBQ = 57(°)	M2 A1 M2 A1 B1	M1 for $8.6^2 = 6.2^2 + 5.8^2 - 2 \times 6.2 \times 5.8 \times \cos PBA$ Rounded or truncated M1 for $\frac{\sin QBC}{4.1} = \frac{\sin 72°}{7.5}$ or $\frac{4.1}{\sin QBC} = \frac{7.5}{\sin 72°}$ Rounded or truncated Do not FT from premature rounding or truncation. Do not accept 58(°) or 57.2(°), must be correct and whole FT provided at least M1 for each of cosine and sine rule awarded
15(a) 0	B1	
15(b) **Tangent** drawn at t = 3.5 Method, difference y / difference x Evaluated estimated answer from their reasonable **tangent**	B1 M1 A1	 The values used must be correct, do not allow 27/3.5 May not be from a tangent, but must be from use of differences, e.g. curve used to form a 'right-angled triangle' (Approximately 3.3 (m/min^2)
15(c)(i) Finding v values: (0,) 14, 29, 26, 30 Split into 4 areas and attempt to sum Correct substitution into trapezium rule 168 (metres)	B1 M1 M1 A1	Sight of (0,) 14, 29, 26, 30 Sight of the sum of 4 products or an attempt substitution of their 5 values in the trapezium rule Or equivalent. (14 + 43 + 55 + 56) or (0+28+ 58+52+30) FT their values for v provided at least 3 values are correct, OR 2 areas correct in sum of 4 possible
15(c)(ii) 0.168(km)	B1	FT their (i)/1000 evaluated correctly

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4370/06

MATHEMATICS – LINEAR
PAPER 2
HIGHER TIER

A.M. MONDAY, 11 November 2013

2 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.

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***(a)*.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**4**	
3.	**6**	
4.	**8**	
5.	**7**	
6.	**5**	
7.	**4**	
8.	**9**	
9.	**5**	
10.	**3**	
11.	**6**	
12.	**4**	
13.	**7**	
14.	**4**	
15.	**6**	
16.	**5**	
17.	**7**	
18.	**6**	
Total	**100**	

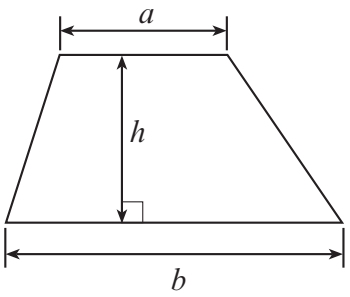
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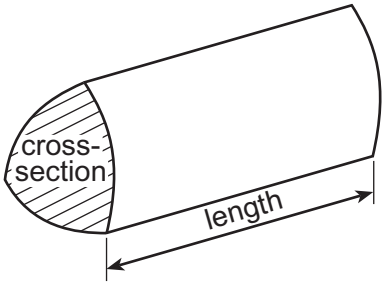
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Formula List

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

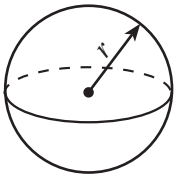


Volume of prism = area of cross-section × length



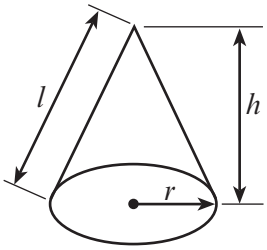
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

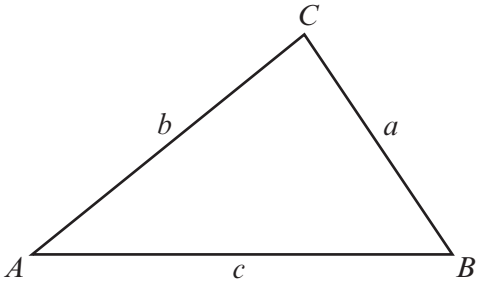


In any triangle ABC

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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Examiner only

1. Agatha and Bryn each bought some pens.
Each pen Agatha bought cost £2.20.
Each pen Bryn bought cost £1.40.
Altogether, the cost of the pens was £13.
How many pens did they buy altogether? [4]

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2. *(a)* Calculate the size of an interior angle in a regular 12-sided polygon. [3]

(b) Do regular 12-sided polygons tessellate?
You must give a reason for your answer. [1]

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3. *(a)* Simplify each of the following.

(i) $-7g - 4h - 6g - (-8h)$ [2]

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(ii) $3p^6 \times 5p^5$ [1]

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(iii) $\dfrac{46y^6}{23y^2}$ [1]

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(b) Pencils cost x pence each.
Pens cost twice as much as pencils.
Write and simplify an expression, in terms of x, for the total cost of 3 pencils and 4 pens. [2]

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4. *(a)* In Newterry, the mean daily rainfall for the first week in April was 3·8 cm.
Comparing this first week with the following week, it rained:

- 1 cm more on Sunday, Monday and Tuesday of the second week than on these days during the first week,
- 1 cm less on Wednesday, Thursday and Friday of the second week than on these days during the first week,
- the same amount on the Saturday of the second week as on the Saturday of the first week.

What was the mean daily rainfall in the second week?
Give a reason for your answer. [2]

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(b) In Summerfield, the rainfall for each of 30 days was measured. The results are summarised in the table below.

Daily rainfall, r, in cm	Number of days
$0{\cdot}5 \leqslant r < 1{\cdot}5$	5
$1{\cdot}5 \leqslant r < 2{\cdot}5$	11
$2{\cdot}5 \leqslant r < 3{\cdot}5$	13
$3{\cdot}5 \leqslant r < 4{\cdot}5$	1

(i) Calculate an estimate for the mean daily rainfall for the 30 days. [4]

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(ii) State the modal class. [1]

Modal class .....

(iii) Write down the class in which the median lies. [1]

Median class .....

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5. *(a)* An internet company, offering money exchange, displays a conversion exchange table as shown below.

		Exchange from				
		US dollars 1$	GB pounds £1	Canadian dollars 1$	euros 1€	Australian dollars 1$
Exchange to	US dollars	1	1.59003	0.967202	1.4304	0.916279
	GB pounds	0.628915	1	0.608287	0.8996	0.576261
	Canadian dollars	1.03391	1.64395	1	1.4789	0.94735
	euros	0.699105	1.1116	0.676175	1	0.640575
	Australian dollars	1.09137	1.73532	1.05557	1.56109	1

The method of using this table of exchanges is as follows:

To exchange GB pounds to euros, read down the table, £1 is 1.1116 euros.

Using the exchange rates from the table, calculate the following.

(i) Exchange 200 US dollars to Australian dollars. [2]

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(ii) How many Canadian dollars were exchanged to give 250 euros? [2]

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(b) Fill in the **two** gaps, indicated with dotted lines, in the following conversion exchange table. [3]

		Exchange from		
		Hong Kong dollar 1$	Japanese yen 1 yen	euro 1€
Exchange to	Hong Kong dollar	1		.....
	Japanese yen		1	133·5
	euro	0·090147	.....	1

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Turn over.

Examiner only

6. *(a)* Solve $\frac{x}{3} + 42 = 53$. [2]

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(b) Solve $\frac{40 - x}{11} = 4$. [3]

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7. A solution to the equation $3x^3 - x = 4{\cdot}5$ lies between 1·2 and 1·3.
Find this solution correct to 2 decimal places. [4]

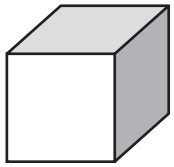
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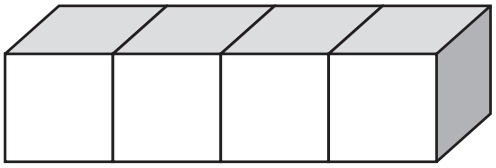
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8. The total surface area of one cube is 54 cm^2.



Four of these cubes are joined together to make a cuboid as shown in the diagram below.



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

Calculate the total surface area of the cuboid shown in the diagram. [6]
You must show all your working.

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(b) Calculate the volume of the cuboid shown in the diagram. [3]

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9. *(a)* Lucy bought a designer jacket for £120.
She made a profit of 26 % by selling the jacket in an auction.
How much did Lucy's jacket sell for in the auction? [3]

(b) Given that 65 % of a measurement is 43·55 metres, calculate the whole measurement. [2]

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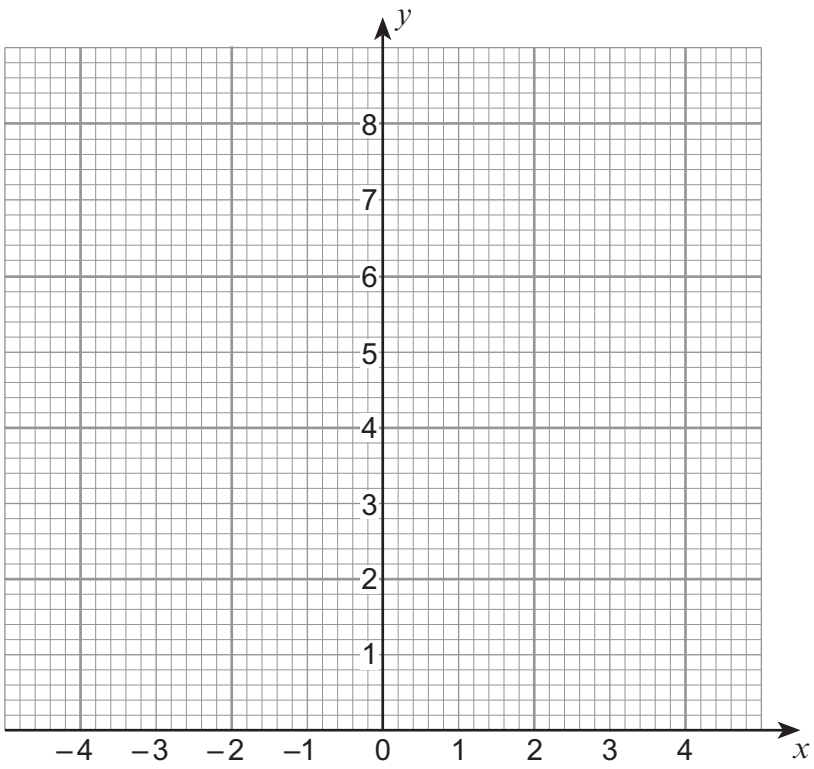
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10. On the graph paper provided, draw the region which satisfies **all** of the following inequalities.

$$x + y \leqslant 4$$
$$y \leqslant 2x + 4$$
$$y \geqslant 1$$

Make sure that you clearly indicate the region that represents your answer. [3]



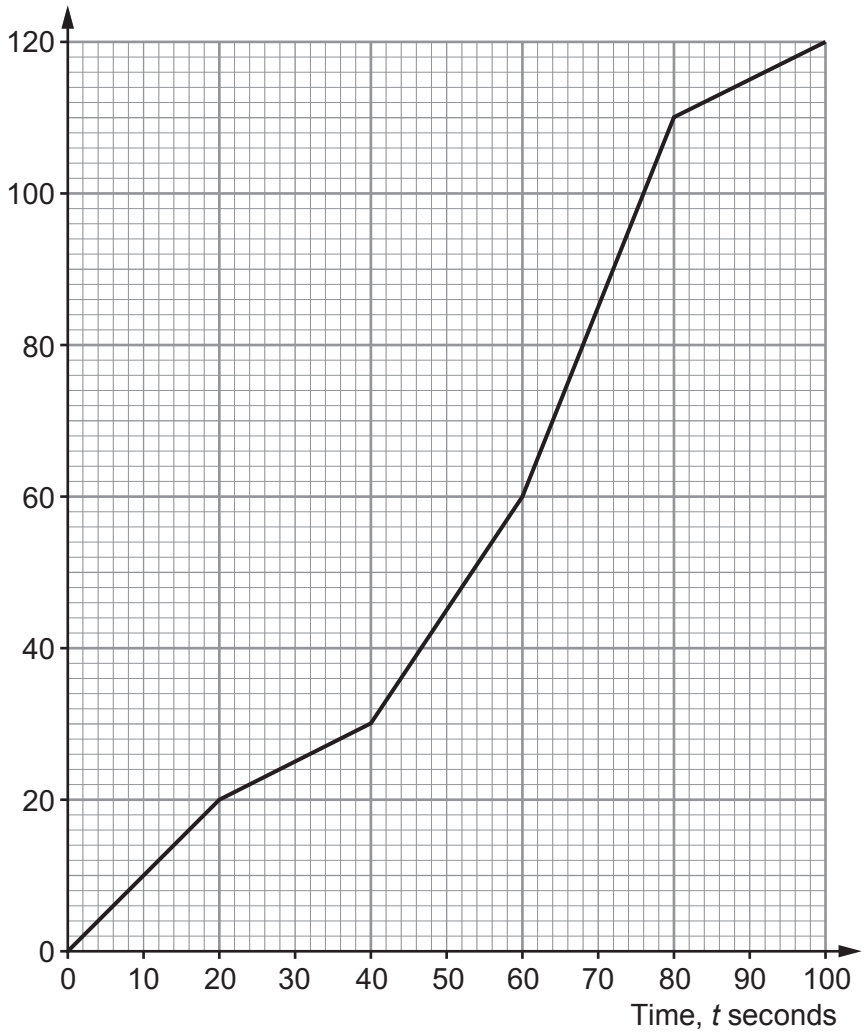
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Examiner only

11. The times taken by customer service operators to answer 120 telephone calls are illustrated in the cumulative frequency diagram shown below.



(a) Calculate an estimate for the interquartile range. [2]

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(b) Calculate an estimate for the percentage of telephone calls that were answered within 50 seconds. [2]

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(c) The customer service team was given a target to answer 90% of the telephone calls within 75 seconds.
Did the team meet its target?
You must show your working and give a reason for your answer. [2]

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12. A yacht sails on a bearing of 138° for 3·2 km.
The yacht then turns to sail on a bearing of 270°.
Calculate the distance the yacht sails in this direction until it is due South of its starting position.
[4]

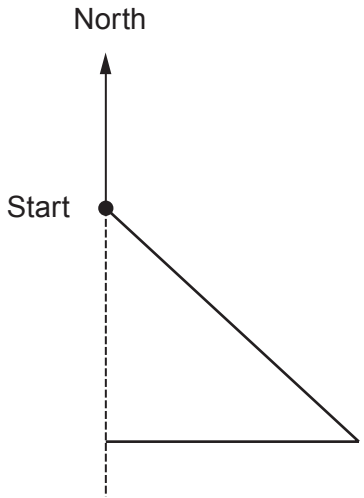


Diagram not drawn to scale

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13. *(a)* Solve the simultaneous equations below using an algebraic method. Show all your working. [4]

$$5x + 2y = -5$$
$$4x + 3y = 3$$

(b) Solve the following quadratic equation. Give your answers correct to two decimal places. [3]

$$5x^2 + 3x - 7 = 0$$

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Turn over.

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14. A company produces suitcases with dimensions 55 cm by 40 cm by 20 cm.



The company has been asked to produce a new, smaller suitcase.

- The new suitcase must be **similar** to the original suitcase, with dimensions in the same proportions.
- The volume of the new smaller suitcase should be **half** the volume of the original suitcase.

Find the dimensions of the new smaller suitcase.
Give your dimensions correct to an appropriate degree of accuracy. [4]

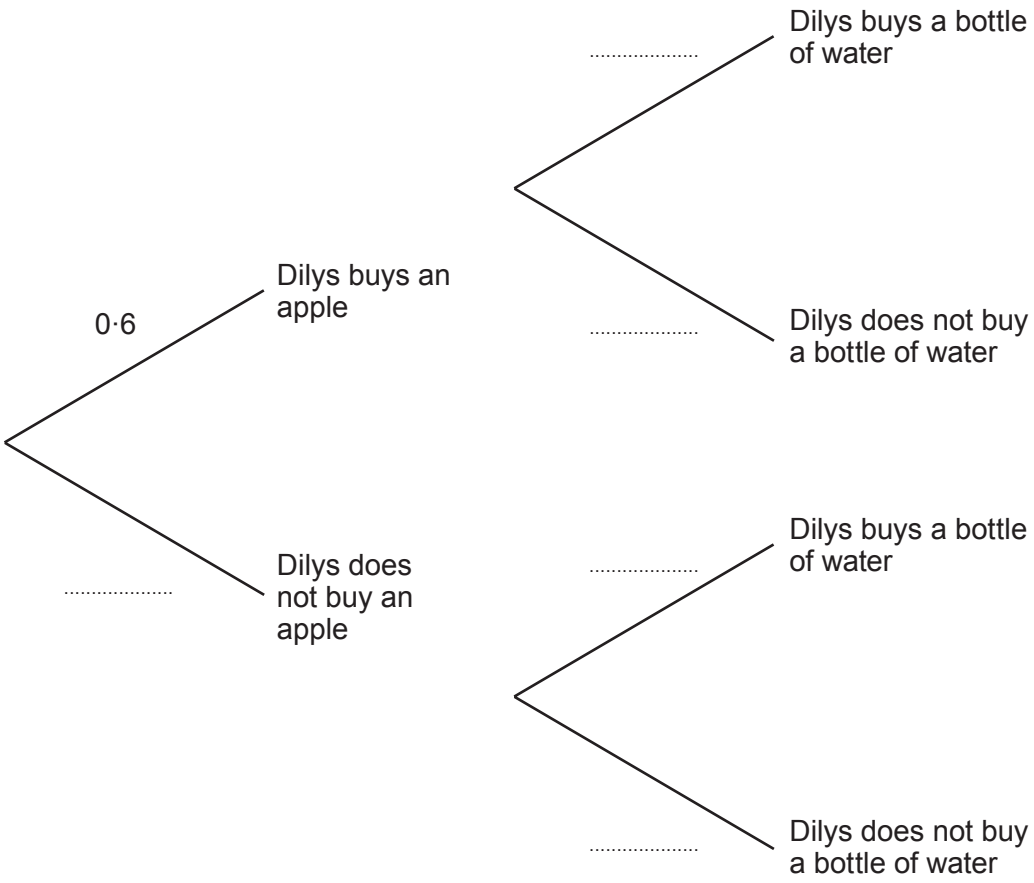
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15. The probability of Dilys buying a bottle of water is independent of her buying an apple. The probability that Dilys buys an apple **and** a bottle of water is 0·18.

(a) Complete the tree diagram. [4]



(b) Find the probability that Dilys does not buy an apple and does not buy a bottle of water. [2]

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16. *(a)* The diagram below shows a circle with centre *O*.

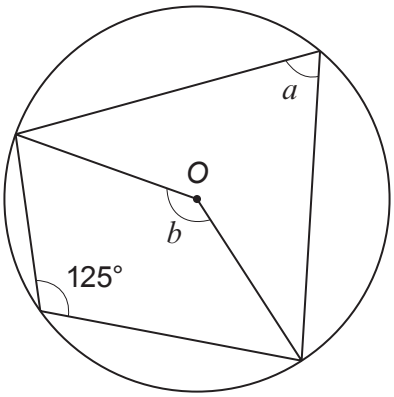


Diagram not drawn to scale

Calculate the sizes of angles a and b. [3]

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$a =$ ..... ° $b =$ ..... °

(b) The diagram shows a tangent to a circle.
The vertices of the triangle shown all lie on the circumference of the circle.

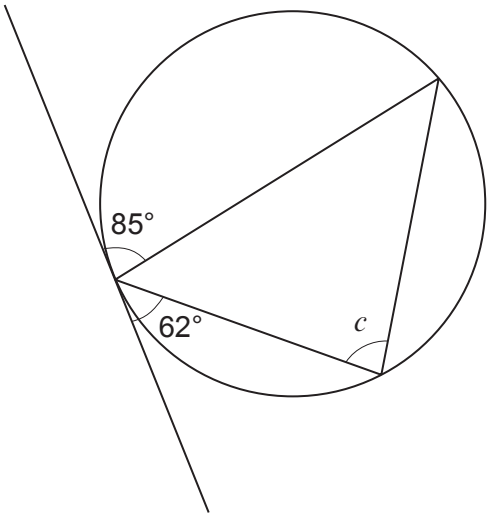


Diagram not drawn to scale

Giving a reason for your answer, calculate the size of angle c. [2]

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$c =$ ..... °

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17. The diagram shows triangle *ABC*.

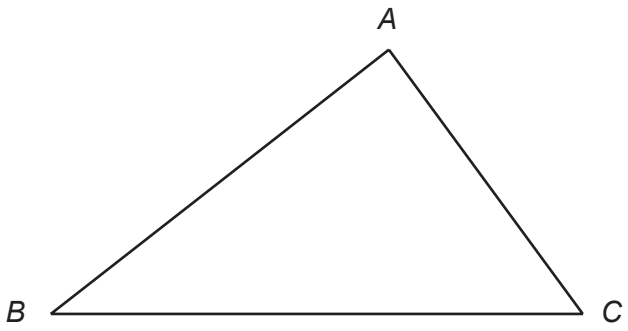


Diagram not drawn to scale

You are given the following information:

- *D* is a point on the side *BC*
- $A\hat{B}C = 35°$ and $A\hat{C}B = 60°$
- *AC* = 10·6 cm and *BD* = 14·2 cm

Calculate the length of *AD*. [7]

Examiner only

18. The diagram below shows a circle with centre *O*.

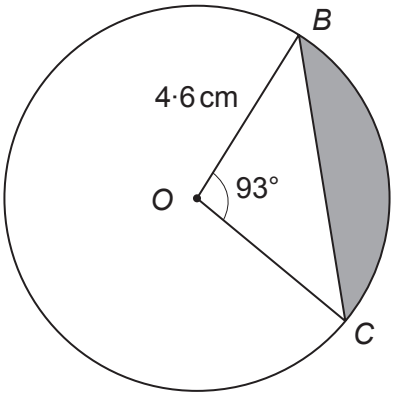


Diagram not drawn to scale

Calculate the area of the shaded segment. [6]

END OF PAPER

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GCSE MARKING SCHEME

MATHEMATICS - LINEAR

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 - Linear. 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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PAPER 2 HIGHER TIER

PAPER 2 Higher Tier	Marks	FINAL MARK SCHEME Comments
1.(Agatha) 220, 440, 660, (880, 1100, 1320, ...) (p) (Bryn) 140, 280, 420, (560, 700, 840, 980 ,…) (p) **4** × 2(.)20 = 8(.)80 AND **3** × 1(.)40 = 4(.)20 (£ or p) 7 (pens)	M1 M1 A1 A1 4	In £ or p or mixed. M1 for any 3 correct multiples In £ or p or mixed. M1 for any 3 correct multiples Identifying the correct number of each CAO. Must state total number of pens altogether *Alternative, Trial & improvement:* *2 trials, correctly evaluated showing* ***improvement*** *M1* *2 trials, correctly evaluated between £10 & £16 inclusive M1* ***4**×2(.)20 and **3**×1(.)40 = (£)13 A1* *7(pens) CAO A1* Award all 4 marks for an unsupported answer of 7 (pens)
2(a) (12 – 2) ×180 ÷ 12 150(°) (b) No AND a reason, e.g. '150 not a factor or 360', '150+150 = 300 not enough', '3 lots of 150 is 450 too much'	M1 m1 A1 E1 4	Alternative: Sum of exterior angles 360(°) **Exterior** 360/12 (not as a final answer) Interior (180 – exterior) 150(°) ***If final answer 360/12 or 30, then allow M1, m0, A0*** *OR* *Sum interior((2 ×12–4) rt angles)* ***20 ×90***(°) *(= 1800(°)) M1* *Each interior angle (1800)* ***÷12*** *m1* ***150(°)*** *A1* No FT from working with exterior angle in (a), FT from M1, m1 in (a) only
3(a)(i) -13g + 4h (ii) $15p^{11}$ (iii) $2y^4$ (b) 3×x + 4 ×2x or equivalent 11x	B2 B1 B1 B1 B1 6	Must be written as an expression. B1 for either term correct Mark final answer ISW ISW (ii) &(iii) penalise change of variable once only -1 Mark final answer. FT for equivalent level of difficulty, provided either pencils or pens is correct
4(a) 3.8 (cm) or states 'the same' Reason, e.g. 'they even out', 'the mean of these is zero', 'totals are the same each week', 'taking away 3 and adding 3 so it stays the same', 'same amount of rainfall in both weeks' (b)(i) Mid-points 1, 2, 3, 4 1×5 + 2×11 + 3×13 + 4×1 Intention their ∑fx / 30 2.3(33…cm) (ii) Modal class 2.5 ≤ r < 3.5 (iii) Median 1.5 ≤ r < 2.5	B1 E1 B1 M1 m1 A1 B1 B1 8	Mark final answer. Award independently from E mark Accept a correct method as a reason, e.g. (3.8×7 + 3 – 3)÷7 or equivalent Allow '3.8+3 = 6.8, and 6.8-3 = 3.8', or '4.8×3+2.8×3 + 3.8 = 26.6 with 26.6÷7=3.8 i.e. showing by calculation that +3 and -3 means no change. Allow indication of + 1 -1 bringing 3.8 or 7×3.8 back to original FT their mid points, including bounds, provided they fall within the classes. 5 + 22 + 39 + 4 (= 70) (70/30) Following correct working, however accept unsupported 2.3(3..cm) for all 4 marks. Accept 7/3 or 2⅓ as a final answer Accept '2.5 to 3.5' Accept '1.5 to 2.5' *If neither B1 awarded in (ii) or (iii), then award SC1 for answers of 3 and 2 respectively.*

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PAPER 2 Higher Tier	Marks	FINAL MARK SCHEME Comments
5(a)(i) 200 × 1.09137 OR 200 ÷ 0.916279 218(.274) (ii) 250× 1.4789 OR 250 ÷ 0.676175 369(.72...) (b) 1 ÷ 0.090147 or 1 ÷ 133.5 11.09…… 0.00749……	M1 A1 M1 A1 M1 A1 A1 7	Accept 200×1.09(..) Accept rounded or truncated Accept rounded or truncated, also accept 370 Sight of either calculation Either answer correctly placed in the table also implies M1 Accept 0.0075. Only allow 0.01 if correct working seen If answers reversed in the table award M1, A0, A1 If 2 correct answers seen in working award M1, A1, A0 If 1 correct answer seen in working award M1, A0, A0 If only 1 answer given misplaced in table award M1, A0, A0
6(a) x/3 = 53 - 42 OR x/3 = 11 OR x + 126 = 159 x = 33 (b) 40 – x = 11×4 -x = 44 – 40 OR –x= 4 OR 40 – 44 = x x = -4	M1 A1 B1 B1 B1 5	 Award both marks for an embedded answer FT until 2nd error in (b) Award all marks for an embedded answer. Do not accept –x = 4 for this final B1 *Award B1, B0, B1 for 40-x=44, leading to x=44-40 and x=4*
7. One correct evaluation, 1.2 ≤ *x* ≤ 1.3 2 correct evaluations, 1.235 ≤*x* ≤1.25, one either side of 4.5 2 correct evaluations, 1.235 ≤ *x* ≤1.245, one either side of 4.5 OR correct evaluation of 1.245 if previous B1 awarded 1.24 *No calculations shown: accept "too high",">", etc.*	B1 B1 M1 A1 4	x $3x^3 - x$ 1.2 3.984 1.21 4.104683 1.22 4.227544 1.23 4.352601 1.24 4.479872 1.241 4.49272156 1.242 4.50559346 1.243 4.51848772 1.244 4.53140435 1.245 4.54434338 1.246 4.55730481 1.247 4.57028867 1.248 4.58329498 1.249 4.59632375 1.25 4.609375 1.26 4.741128 1.27 4.875149 1.28 5.011456 1.29 5.150067 1.3 5.291 1.235 gives 4.41595

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PAPER 2 Higher Tier	Marks	FINAL MARK SCHEME Comments
8(a) $6 \times \ldots = 54$ or $54 \div 6 = \ldots$ (Area each face on small cube =) $9(cm^2)$ 18 (small faces on cuboid) $(18 \times 9 =)$ $162(cm^2)$ Look for • spelling • clarity of text explanations, • the use of notation (watch for the use of '=', cm^2) 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 (b) (Length side of small cube =) $\sqrt{9}$ (= 3) Volume = $(4 \times) 3 \times 3 \times 3$ $108\ (cm^3)$	M1 A1 B1 B1 QWC 2 M1 m1 A1 9	ISW. Watch for an embedded answer. FT 'their 54÷6' × 'their 18' evaluated correctly from a consistent misconception of the number of faces. *Alternative:* *Single cube has 6 faces* *Cuboid has 18 faces* *Total surface area* 3×54 $= 162\ (cm^2)$ *OR* *6 hidden faces* *Equivalent to 3 cubes at 6 faces each* *Total surface area* 3×54 $= 162\ (cm^2)$ *OR* *Area 4 cubes* $4 \times 54 = 216$ *6 hidden faces* *Area of cuboid* $216 - 54$ $= 162\ (cm^2)$ 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 or grammar. FT 'their 9' provided M1 awarded in (a) Method to calculate volume of 1 or 4 cubes. FT 'their 3' provided M1 awarded
9(a) 1.26×120 OR $0.26 \times 120 + 120$ (£)151.2(0) (b) $43.55/0.65$ OR $(43.55/65) \times 100$ 67 (m)	M2 A1 M1 A1 5	M1 for 0.26×120 (=31.2(0)) Mark final answer ISW (e.g. attempt to change units)
10.Any 2 of the lines x+y=4, y=2x + 4 and y= 1 correct Correct region shaded	B2 B1 3	B1 for any 1 correct line CAO

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PAPER 2 Higher Tier	Marks	FINAL MARK SCHEME Comments
11(a) Intention to subtract reading from horizontal scale for cumulative values 90 & 30 32 or 33 (b) 45 / 120 (×100) 37.5(%) rounded or truncated (c) 75 seconds means ≈ 100 × 97/120 (80.833..%), OR 90% calls means (0.9 × 120 =) 108 calls (≈80 seconds) AND interpretation 'No' (target not met stated or implied)	M1 A1 M1 A1 M1 A1 6	(72 – 40 or 73 – 40) Accept values between 44 to 46 inclusive leading to 36.66.. to 38.33..(%) rounded or truncated (OR 100×96/120 = 80%). 75 seconds gives 96 to 98 inclusive so accept 80 % to 81.666…%
12. Appropriate sight or use of 42º or 48º sin42 = distance/3.2 OR cos48 = distance/3.2 Distance = 3.2 × sin42 OR Distance = 3.2 × cos48 2.1(4… km)	B1 M1 A1 A1 4	 Ignore further working to add 3.2 (to give an answer 5.3(4..km)) *(Note: sin42 =sin138 = 0.669… hence watch for a correct answer from incorrect working, M0, A0, A0, possible B1 for sight of appropriate 42° or 48°)*
13(a) Method to eliminate variable, e.g. equal coefficients First variable Substitute to find second variable Second variable (b) $x = \{ -3 \pm\sqrt{(3^2 - 4 \times 5 \times -7)}\} / (2 \times 5)$ $= \{ -3 \pm\sqrt{149} \} / 10$ $x = 0.92$ and $x = -1.52$ (Answer to 2dp)	M1 A1 M1 A1 M1 A1 A1 7	Allow 1 error in one term, not one with equal coefficients x = -3 or y = 5 FT their first variable Allow one error in sign or substitution, not in the formula CAO CAO
14. Length scale factor $\times_3\sqrt{0.5}$ or $\div_3\sqrt{2}$ New dimensions 55 $\times_3\sqrt{0.5}$, 40 $\times_3\sqrt{0.5}$, 20 $\times_3\sqrt{0.5}$ or 55 $\div_3\sqrt{2}$, 40 $\div_3\sqrt{2}$, 20 $\div_3\sqrt{2}$ 43.7 or 44, 31.7 or 32, 15.9 or 16	B1 M1 A2 4	 FT their scale factor including need for root, must be equivalent level of difficulty for M1 only A1 if correct but to >1dp or incorrectly rounded (truncated): 43.6535…, 31.748…, 15.874… *Alternative method* B1 20 : 40 : 55 is 1 : 2 : 2.75 M1 So x : 2x : 2.75x giving $x \times 2x \times 2.75x = 5.5x^3$ M1 $x^3 = 22000 \div 5.5$ (=4000) or $x = \sqrt[3]{4000} = 15.9$ A1 15.9, 31.7, 43.7
15(a) 0.4 indicated for no apple Idea 0.6 ×… = 0.18 P(buys a bottle of water) = 0.3 Second branches 0.3 0.7 0.3 0.7 (b) 0.4 × 0.7 = 0.28	B1 M1 A1 B1 M1 A1 6	In working or on tree Accept evidence such as '18÷6', i.e. with incorrect place value In working or on tree FT 'their 0.4' and 'their 0.7' provided values >0 and <1 *(Note: 0.4×0.82 = 0.328, 0.4×0.18= 0.72)*
16(a) 180 – 125 a = 55° b = 110° (b) c = 85° Alternate segment theorem	M1 A1 B1 B1 E1 5	Or statement that opposite angle cyclic quad 180° FT 2 × 'their a' correctly evaluated Depends on B1 awarded. Accept a description

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PAPER 2 Higher Tier	Marks	FINAL MARK SCHEME Comments
17. Strategy, information transferred to the diagram with D marked on BC, AND deciding need to find AB using sine rule then need to find AD using cosine rule AB/sin60° = 10.6/sin35° AB = sin60° × 10.6/sin35° *(Rearranged form implies M1)* AB = 16(.0046… cm) *(FT their AB within cosine rule, not use of 10.6)* $AD^2 = 14.2^2 + AB^2 – 2 \times 14.2 \times AB \times \cos35°$ $AD^2 = 85.4(576…)$ AD = 9.2(443…cm) rounded or truncated from correct working	 S1 M1 A1 A1 M1 A1 A1 7	*Alternative example:* *Strategy, information transferred to the diagram with D marked on BC, AND deciding need to find BC using sine rule, then DC=BC-BD, then need to find AD using cosine rule* *BC/sin85° = 10.6/sin35°* *BC = sin85° × 10.6/sin35° (Rearranged form implies M1)* *BC = 18.4(102…cm) AND DC(BDC – 14.2)= 4.2(102…cm)* *(FT their DC within cosine rule, not use of 14.2)* $AD^2 = 10.6^2 + DC^2 – 2 \times 10.6 \times DC \times \cos60°$ $AD^2 = 85.4(576…)$ *AD = 9.2(443…cm) rounded or truncated from correct working*
18. $\Pi \times 4.6^2 \times 93/360$ Answers between 17.16 and 17.18 or 17.2 (cm^2) Appropriate use of ½ abSinC **OR** cos46.5 = h/4.6 with sin46.5 = b/4.6 ½ × 4.6 × 4.6 × sin 93 **OR** h = 3.16643.. and b = 3.3367.. (Triangle area) 10.5655…(cm^2) Approximately 6.6 (cm^2)	**M1** A1 **M1** M1 A1 B1 6	 Method to find base & height of right angled triangle Needs to be height and ½ base or base evaluated Do not accept 10.5 (cm^2) Depends on at least M1 from attempt to find each area, then FT their difference in areas

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4370/06

MATHEMATICS – LINEAR
PAPER 2
HIGHER TIER

A.M. MONDAY, 17 June 2013

2 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 **3***(b)*(ii).

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

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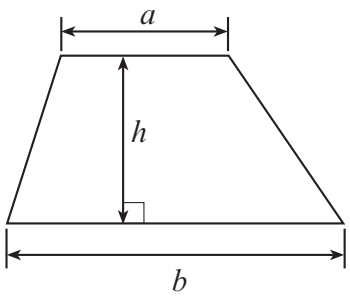
J U N 1 3 4 3 7 0 0 6 0 1

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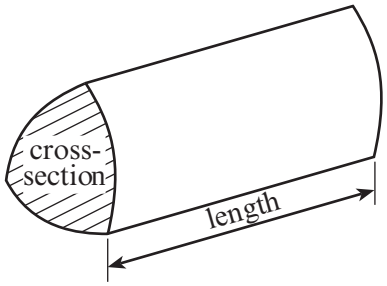
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Formula List

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

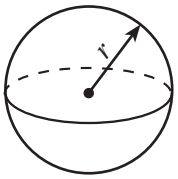


Volume of prism = area of cross-section × length



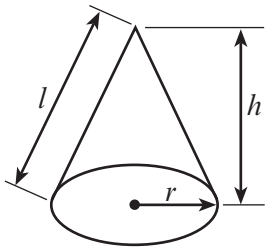
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

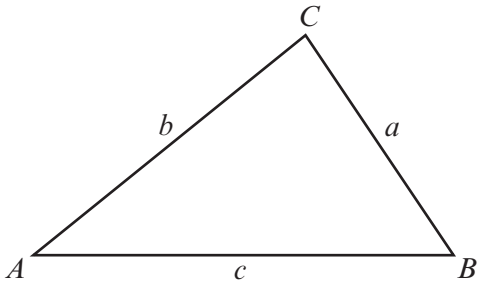


In any triangle ABC

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 table below shows the shoe sizes of 20 people.

Shoe size	Number of people
38	3
39	9
40	5
41	3

Calculate the mean shoe size.

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[3]

2. A fair coin and a fair six-sided dice are thrown together.
Calculate the probability of obtaining a head and a two.

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[2]

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3. Miriam is planning a holiday in Pakistan.

(a) Miriam went to an exchange bureau to get some Pakistan rupees for her holiday.



She exchanged £540 for 85 000 Pakistan rupees.
Complete the statement below, giving your answer correct to two decimal places.

.....

.....

.....

'Exchange rate: £1 buys ..... Pakistan rupees'

[3]

(b) Miriam knows that when it is 1p.m. in London it is 6p.m. local time in Karachi, Pakistan.
Miriam is booked onto a flight leaving London on Tuesday at 13:50.
The flight time is 7 hours 51 minutes.

(i) On which day and at what local time should Miriam land in Karachi?

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.....

Day ..... Landing time .....

[4]

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

Miriam's flight actually arrived 7 hours 45 minutes after departure.
The aeroplane flying speed between London and Karachi was 434 knots.
Given that 1 knot is 1·85 km/h, calculate the flying distance between London and Karachi.
Give your answer in kilometres.

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[7]

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4. Across the world, temperatures are measured using different units.
All the unit scales are uniform.

Approximate conversions are often used to give a reading in more than one unit in scientific reports.

Use the information given below to complete the tables.

(a)

degrees Celsius	degrees Fahrenheit
20	68
30	86
40	104
50	.....
60	140
70	158

.....

.....

[1]

(b)

kelvin	degrees Celsius
0	.....
100	.....
200	–73·15
300	26·85
400	126·85
500	226·85

.....

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[2]

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(c)

kelvin	degrees Celsius	degrees Fahrenheit
340	.....	.....

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[5]

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5. *(a)* Solve $8x - 11 = 3x + 29$.

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[3]

(b) Factorise $7x + 49$.

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[1]

(c) Factorise $x^2 - 10x$.

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[1]

(d) Expand $2x(x + 6)$.

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[2]

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6. The diagram shows a rectangle $ABCD$.

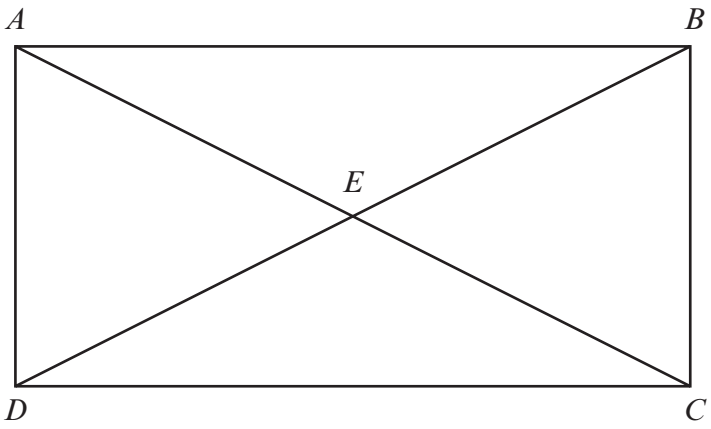


Diagram not drawn to scale

Select 3 **different** pairs of congruent triangles shown in the diagram above and then complete the sentences below for your 3 selections.

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

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

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

[3]

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7.

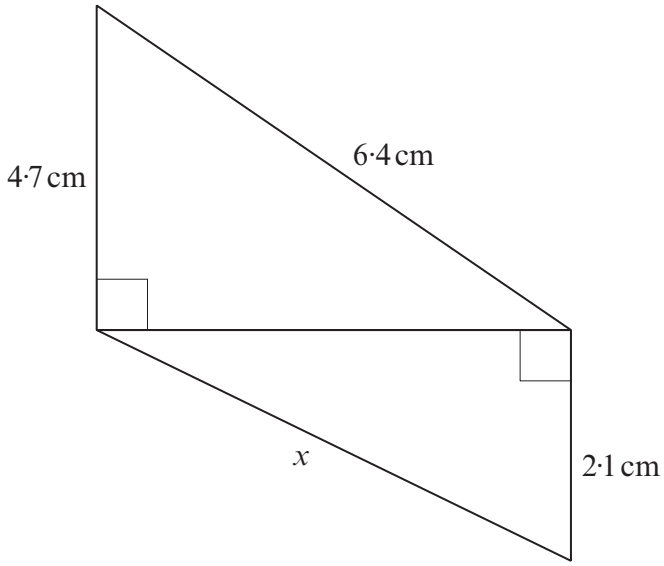


Diagram not drawn to scale

Calculate the length of the side marked x.

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[4]

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8. A factory production line packs buttons into bags.
There are exactly 80 buttons packed into each bag.
There is a mixture of different coloured buttons in each bag.
A total of 600 bags of buttons were packed in a day.

The first 100 bags were checked and it was found that a total of 1200 red buttons had been used.
In the 600 bags of buttons, it was found that the relative frequency of red buttons packed was 40%.

Calculate the relative frequency of red buttons packed in the final 500 bags.

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[7]

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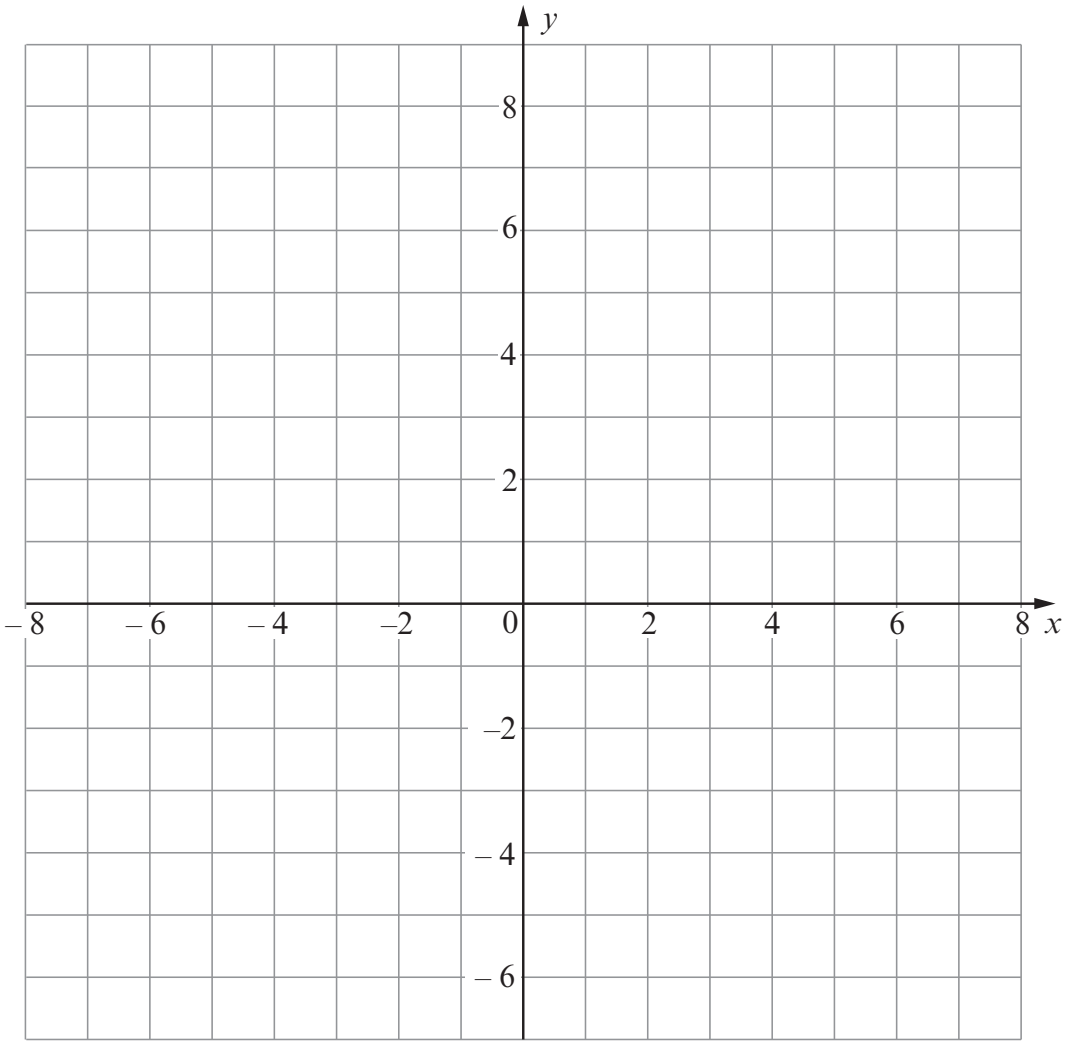
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9. On the squared paper provided, draw the region which satisfies all of the following inequalities.

$$y \leqslant 8$$
$$x + y \geqslant 2$$
$$y \geqslant 2x - 4$$

Make sure that you clearly indicate the region that represents your answer.



[3]

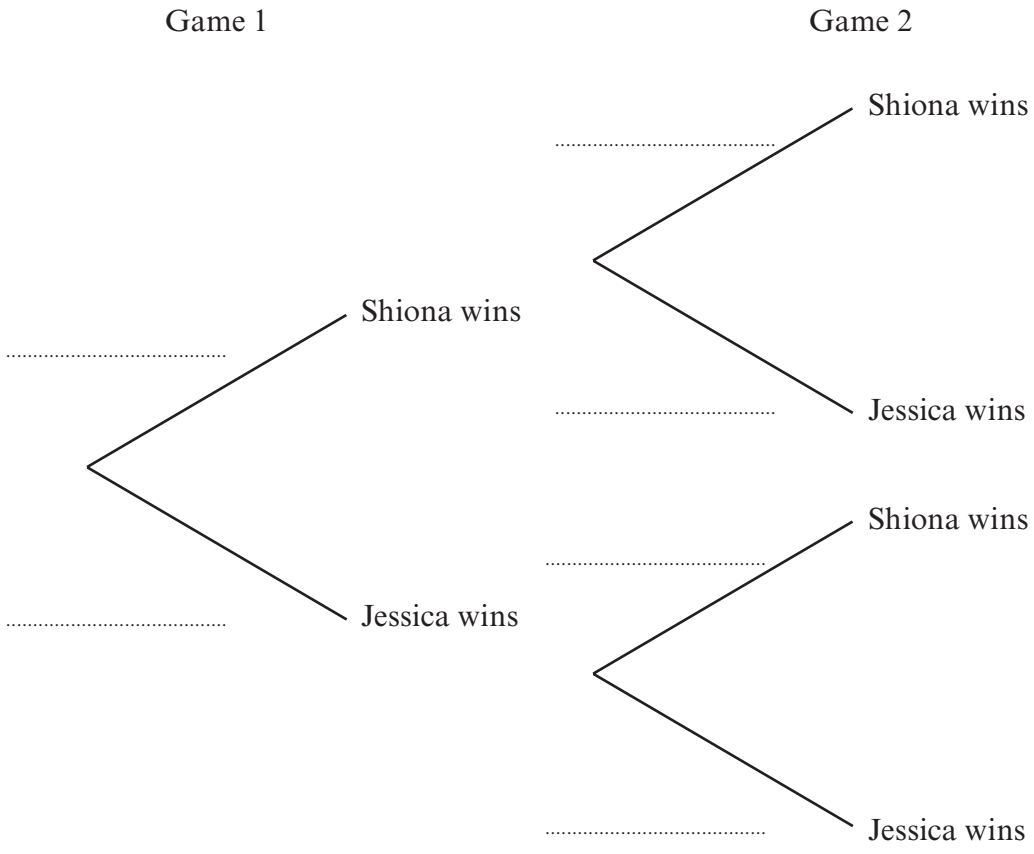
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10. Whenever Shiona and Jessica play a game of 'Jewels' the probability that Shiona wins is 0·3.

(a) Complete the following tree diagram to show the probabilities of what can happen when Shiona and Jessica play two games of 'Jewels'.



[2]

(b) Calculate the probability that Shiona wins exactly one game.

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[3]

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11. City planners need to know the difference in height between a building on one side of a road and a building on the other side of the road.
The buildings are vertical and directly opposite each other.

The horizontal road is 20 m wide.
From the centre of the road between the buildings, the angle of elevation of

- the top of the building on one side is 72°,
- the top of the building on the other side is 38°.

Calculate the difference in the heights of the buildings.

Space for diagram.

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[5]

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12. Show that $(4x - 1)(6x + 5) - (8x - 1)(3x + 5)$ is identical to $-23x$.

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[4]

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13. Dewi's company is planning a new logo.
The diagram shows two similar versions of the planned logo.

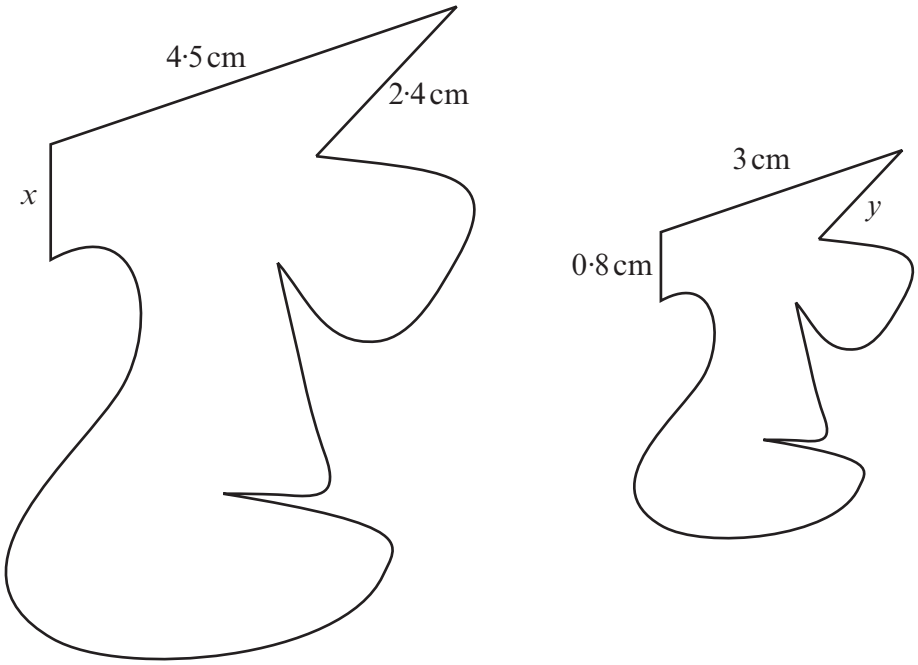


Diagram not drawn to scale

(a) Calculate the lengths of the sides marked x and y.

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x = ... cm

y = ... cm

[4]

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(b) The smaller of the two versions of the logo costs £3.40 to paint with metallic gold paint. Calculate the cost of painting the larger version of the logo with the same metallic gold paint.

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[3]

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14.



In the UK, some soft drinks are sold in cans.
75% of all these cans are made of aluminium.
In 2008, 5 billion aluminium cans were sold.

Given that 1 billion is 1000 million, calculate how many of the cans that were sold in 2008 were **not** made of aluminium.
Give your answer in standard form correct to two significant figures.

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[5]

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15. *(a)* By factorising, solve the following quadratic equation.

$$8x^2 + 18x - 5 = 0$$

[3]

(b) Use the quadratic formula to solve the following quadratic equation, giving your answers correct to 2 decimal places.

$$3x^2 - 5x - 7 = 0$$

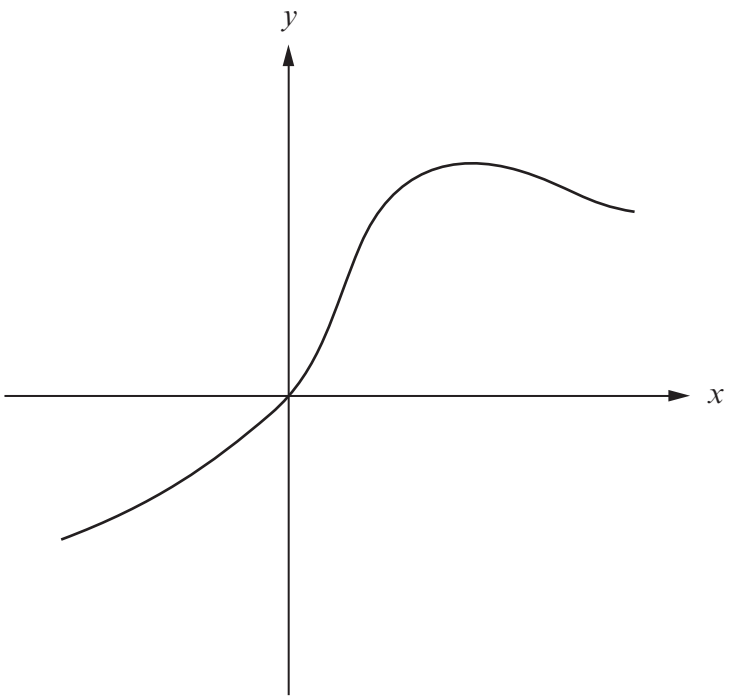
[3]

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16. The diagram shows a sketch of $y = f(x)$.
On the same diagram, sketch the curve $y = -f(x)$.



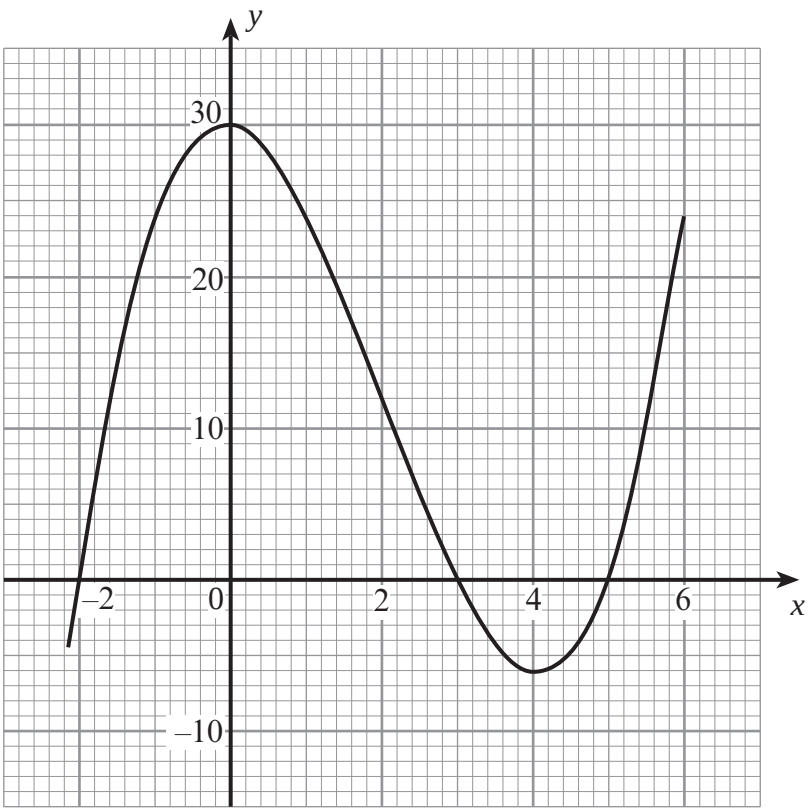
[1]

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17. The graph of the equation $y = x^3 - 6x^2 - x + 30$ is shown on the graph paper below.



Use the graph above to answer the following questions.

(a) Solve $x^3 - 6x^2 - x + 30 = 0$.

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[2]

(b) By drawing a suitable straight line, solve the equation $x^3 - 6x^2 - x + 30 = -5x + 10$.

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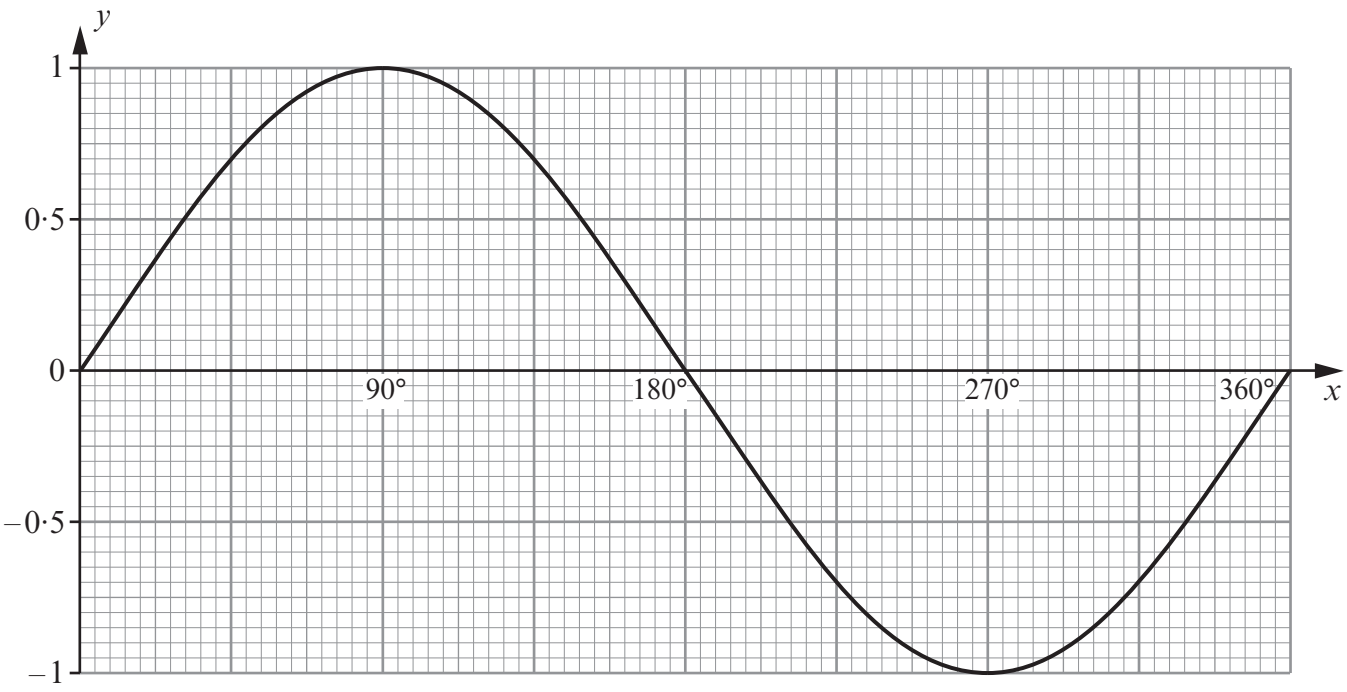
[4]

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



Find all solutions of the following equation in the range 0° to 360°.

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

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[2]

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19. A triangular flowerbed in a park is being prepared for planting bulbs.
The gardener is going to lay compost over all the flowerbed to a depth of 12 cm.

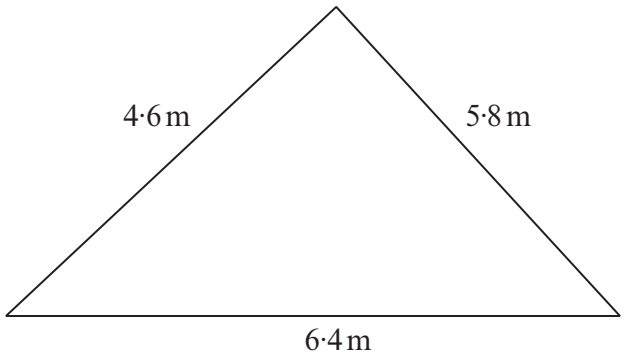


Diagram not drawn to scale

Calculate the volume of compost required.

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[8]

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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 - LINEAR

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 - LINEAR. 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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Paper 1 - Higher Tier	5
Paper 2 - Foundation Tier	9
Paper 2 - Higher Tier	12

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Higher Tier Linear GCSE Mathematics Summer 2013 - Paper 2	Marks	FINAL MARK SCHEME Comments
1. 38×3 + 39×9 + 40×5 + 41×3 (= 788) Their ∑fx / 20 39.4 (ISW)	M1 m1 A1	 CAO Must be from a correct method. Need to check method to watch for incorrect ÷4
2. ½ × 1/6 1/12 or 0.083(3…) or equivalent	M1 A1	OR 3/6 × 1/6. Accept 1/6 written as 0.166.. or 0.17, NOT 0.16 OR 3/36
3(a) 85000/540 157.41	M1 A2	 Mark final answer A1 for sight 157(.407407…) not to 2dp as required
3(b)(i) Wednesday Method, e.g. 13:50 + 5 hours + 7hrs 51 minutes (0)2(:)41 or 2(:)41 am	B1 M1 M1 A1	 Do not penalise poor notation for M marks Award M2 for '+12hr 51mins' Notation for 24 or 12 hour time must be correct Do not accept 241pm The A mark depends on M2, award all marks for a correct answer
3(b)(ii) (Speed) 434 × 1.85 (Distance) × 7.75 6222(.475 km) or 6223.25(km) Look for • spelling • clarity of text explanations, • the use of notation (watch for the use of '=' , and units being appropriate) 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	M1 M2 A2 QWC 2	M1 for '× 7hr 45min' or '×465 mins' A1 for an answer of 3363.5, OR 6215.5(km) or other similar answers that would be correct apart from premature approximation 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.
4(a) 122	B1	
4(b) (0 kelvin) -273.15 and (100 kelvin) -173.15	B2	B1 for either, or 2 negative answers with their 0 kelvin answer being 100 less than their 100 kelvin answer

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Higher Tier Linear GCSE Mathematics Summer 2013 - Paper 2	Marks	FINAL MARK SCHEME Comments
4(c) 340 kelvin to Celsius: working with 100 difference in both kelvin and Celsius 66.85 (degrees Celsius) Answer for Fahrenheit <u>between 140 and 158</u> exclusive 6.85 tenths of 18 OR (6.85/10)×18 152(.33 Fahrenheit)	M1 A1 B1 M1 A1	e.g. sight of 40 + 26.85, 126.85 – 60, 340-273.15 Look for response in the table. Accept 66.8, 66.9, 67 Look for evidence in the table. FT from rounding 66.85 (Celsius), e.g. 7 tenths of 18 Accept 153 from correct working *Allow final B1, M1, A1 for a correct evaluation of 'their 66.85' × 1.8 + 32* Penalise reversed answers - 1
5(a) $8x – 3x = 29 + 11$ $5x = 40$ OR $x = 40/5$ $x = 8$	B1 B1 B1	**FT until 2nd error** Must be simplified
5(b) $7(x +7)$	B1	CAO
5(c) $x(x – 10)$	B1	CAO
5(d) $2x^2 + 12x$	B2	Must be as one complete expression. Mark final answer B1 for each term
6. Any three different pairs of congruent triangles identified	B3	B1 for each pair. If letters are used then ignore the order of letters Watch for repeats!
7. $a^2 = 6.4^2 – 4.7^2$ $a^2 = 18.87$ x is $\sqrt{22.9}$ to $\sqrt{23.28}$ x is 4.78… to 4.8(249…)	M1 A1 M1 A1	 Accept sight of a = 4.3(439…) FT 'their a^2' or 'their a' provided M1 awarded or *M1 for x from $\sqrt{66.82}$ to $\sqrt{67.46}$* (*when 'a^2= 63.05' or 'a=7.94..'*) Accept 5 from correct working *FT from a^2= 63.05 is x = 8.174… to 8.2134..*
8. 80 × 600 ×0.4(0) = 19200 19200 – 1200 OR 18000 red buttons ÷ 500 AND ÷80 OR ÷40 000 0.45 or 45%	M2 A1 B1 m2 A1	M1 for product of any two seen. Or equivalent calculation FT 'their 18000' provided M2 awarded m1 for ÷ 500 or ÷80 Accept 36 buttons per bag as evidence for m1 CAO
9. Any two lines drawn correctly Correct region identified	B2 B1	B1 for any 1 line drawn correctly CAO
10(a) All correct entries	B2	B1 for 2 pairs of branches correct
10(b) 0.7×0.3 + 0.3×0.7 = 0.42	M1 M1 A1	FT from their tree, probabilities must be <1

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Higher Tier Linear GCSE Mathematics Summer 2013 - Paper 2	Marks	FINAL MARK SCHEME Comments
11. Strategy: relevant sketch showing understanding of centre of the road and vertical buildings **and** angle(s) of elevation shown in the correct positions (x =) tan72 × 10 OR (y =) tan38 × 10 (x =) 30.7768…. AND (y =) 7.812856… Answers in the range 22.9(m) to 23(m)	S1 M2 A1 A1	Ignore placement of 20m in the sketch This S1 may be implied by relevant working M1 for tan72=x/10 or tan38=y/10, OR M1 for x = tan72 × 20 or y = tan38 × 20 FT use of 20, answers 61.55… AND 15.6257… FT use of 20, answer of 46(m) or 45.9(3m) Accept sine rule as an equivalent method. *Incorrect placement of the angles leads to:* *Either* *S0 sketch appropriate but angles at top vertices* *M1 for x =10/tan72 OR y = 10/tan38* *A1 for x = 3.249… AND y = 12.799…* *A1 for 9.55… (m) rounded or truncated* *Or* *20 used, not 10, then SC2 for an answer of 19.1…(m), or SC1 for 6.498… or 25.598…* Do not accepted unsupported answers, as scale drawing are not accepted, max S1 for meeting the criteria for the sketch
12. $24x^2 - 6x + 20x - 5$ AND $24x^2 - 3x + 40x - 5$ OR $-24x^2 + 3x - 40x + 5$ Clearly reducing to -6x + 20x +3x -40x to -23x	B3 B1	B2 for either expansion of pair of brackets correct B1 for one slip in both expansions CAO. Convincing from correct working
13(a) x/0.8= 4.5/3 OR x = (4.5/3)× 0.8 OR x = 1.5×0.8 x = 1.2 (cm) y = (3/4.5) ×2.4 OR y = 2.4/1.5 OR y = 2.4× 0.8/x y = 1.6 (cm)	M1 A1 M1 A1	Or equivalent Or equivalent FT their *x*
13(b) Area scale factor 1.5^2 or 2.25 or 9/4 $1.5^2 \times 3.4(0)$ OR 2.25 × 3.4(0) (£)7.65	B1 M1 A1	Or equivalent FT for M1 only incorrect evaluation of 1.5^2 CAO
14. Interpreting that 75% equates to 5 billion 5 billion / 3 or equivalent (e.g. ÷75×25) 1 666 666 666.66... or 1.66.. billion 1.7×10^9	B1 M1 A1 B2	Accept rounded answers. Do not accept truncated answers FT 'their 1 666 666 666.66...' provided it is >1 million B1 for an answer with attempt at standard form but not correctly expressed, e.g. 16.667×10^8, 1.67×10^9 *If no marks SC1 for 5 billion expressed as* 5×10^9
15(a) (2x + 5)(4x – 1) x = -5/2 AND x = 1/4	B2 B1	B1 for (2x … 5)(4x … 1) FT from their pair of brackets, equivalent difficulty *No marks for the use of the quadratic formula, or trial & improvement*
15(b) $\{5+\sqrt{(-5^2 - 4x3x-7)}\}/2x3$ $= \{5 \pm \sqrt{109}\}/6$ 2.57 and -0.91	M1 A1 A1	For substitution, allow one slip CAO *Accept method of completing square*
16. Correct sketch, reflection in the x-axis	B1	

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Higher Tier Linear GCSE Mathematics Summer 2013 - Paper 2	Marks	FINAL MARK SCHEME Comments
17(a) (x=) -2, 3 and 5	B2	Mark final answer B1 for any one correct answer Accept embedded answers
17(b) Realising that the line needed is y = -5x + 10 Method to find points to plot for y=-5x+10 Accurate graph of y = -5x + 10 drawn x-value of intersection from their graph (-1.4)(±0.1)	M1 m1 A1 A1	 E.g. table with coordinates for 2 correct points CAO. Remember this depends on M1 *If y=5x + 10 selected leading to answers of -2 and 1.5(±0.1), SC1 for each of -2 and 1.5(±0.1)* *If y=5x -10 selected leading to answers of 2.7(±0.1) and 5.8(±0.1), SC1 for both answers given*
18. Answers that round to 203.6(°) or 336.4(°) Then: the other angle with no other values	B1 B1	Accept 204 or 336 FT 540 – first answer. FT must be in required range. Accept embedded answers
19. $6.4^2 = 4.6^2+5.8^2- 2\times4.6\times5.8\times\cos X$, or $4.6^2= 6.4^2+5.8^2- 2\times6.4\times5.8\times\cos Y$, or $5.8^2= 6.4^2+4.6^2- 2\times6.4\times4.6\times\cos Z$, or Correct rearrangement 74.967(…°) or 43.95(..°) or 61(.07….°) Use of area = ½ ab sinC with appropriate substitution ½ ×4.6×5.8×sin75, or ½ ×6.4×5.8×sin44, or ½ ×4.6×6.4×sin61 12.9 (m^2) Volume compost = 0.12 × 12.9 or 12×129 000 1.5(46.. m^3) or 1 546 017(.335cm^3)	M1 m1 A1 M1 A1 M2 A1	 This implies the first M1 With appropriate rounding, 75, 44, 61 FT their 75, 44, 61 if clear this is the included angle as appropriate for M1 only. Not for use of spurious angles (needs to be from calculation) Accept 12.883… or appropriately rounded, accept 13 FT their 12.9 provided M1 for cosine rule and M1 for ½ abSinC awarded. M1 for 12 × their 12.9, or sight the product with the digits 12 and their 129, may be implied by an answer with correct digits but incorrect place value Or correct FT response from M2 Accept reasonable rounding or truncation If an incorrect unit is given then A0

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4370/06

MATHEMATICS – LINEAR
PAPER 2
HIGHER TIER

A.M. MONDAY, 12 November 2012

2 hours

ADDITIONAL MATERIALS

A calculator will be required for this paper.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

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

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **4**.

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

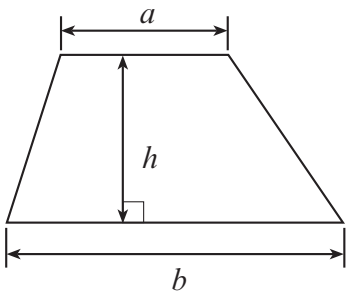
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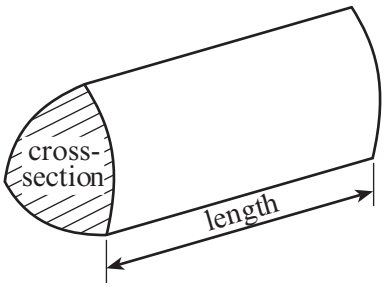
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Formula List

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

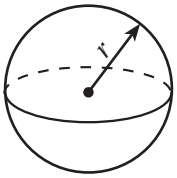


Volume of prism = area of cross-section × length



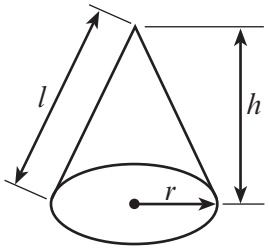
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

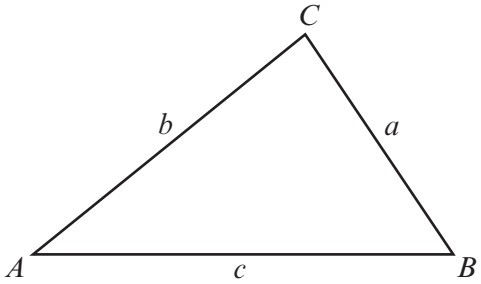


In any triangle ABC

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.

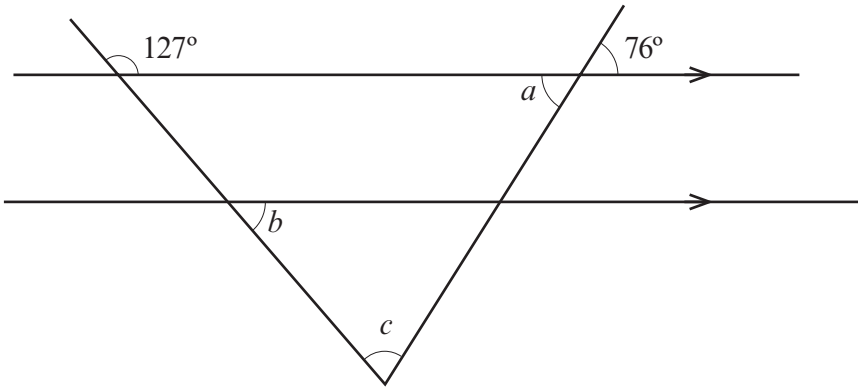


Diagram not drawn to scale

Find the sizes of the angles a, b and c.

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.....

a = ... ° b = ... ° c = ... °

[3]

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Turn over.

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2. The table below gives information from the Highway Code on stopping distances for cars.

Speed in mph	**Stopping distance in metres = Thinking distance + Braking distance** (Thinking distance is given first, followed by Braking distance)
20 mph	6 m | 6 m
30 mph	9 m | 14 m
40 mph	12 m | 24 m
50 mph	15 m | 38 m

Diagram not drawn to scale

(a) A warning sign for a crossroads is to be placed on a road, which has a speed limit of 30 mph.
Use the data given above to find the minimum distance that the warning sign should be placed from the crossroads.

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[1]

(b) An average car is approximately 4 metres in length. How many car lengths is the stopping distance for a car travelling at 40 mph?

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[2]

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(c) Complete the table below.

Speed	
mph	km/h
30	.....
50	80
.....	112

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[3]

(d) The stopping distances given in the Highway Code are given assuming good driving conditions and alert drivers.
When a driver is tired, the thinking distance increases by 30% and the braking distance increases by 20%.
Calculate the stopping distance, in metres, for a tired driver travelling at 50 mph in good driving conditions.

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[4]

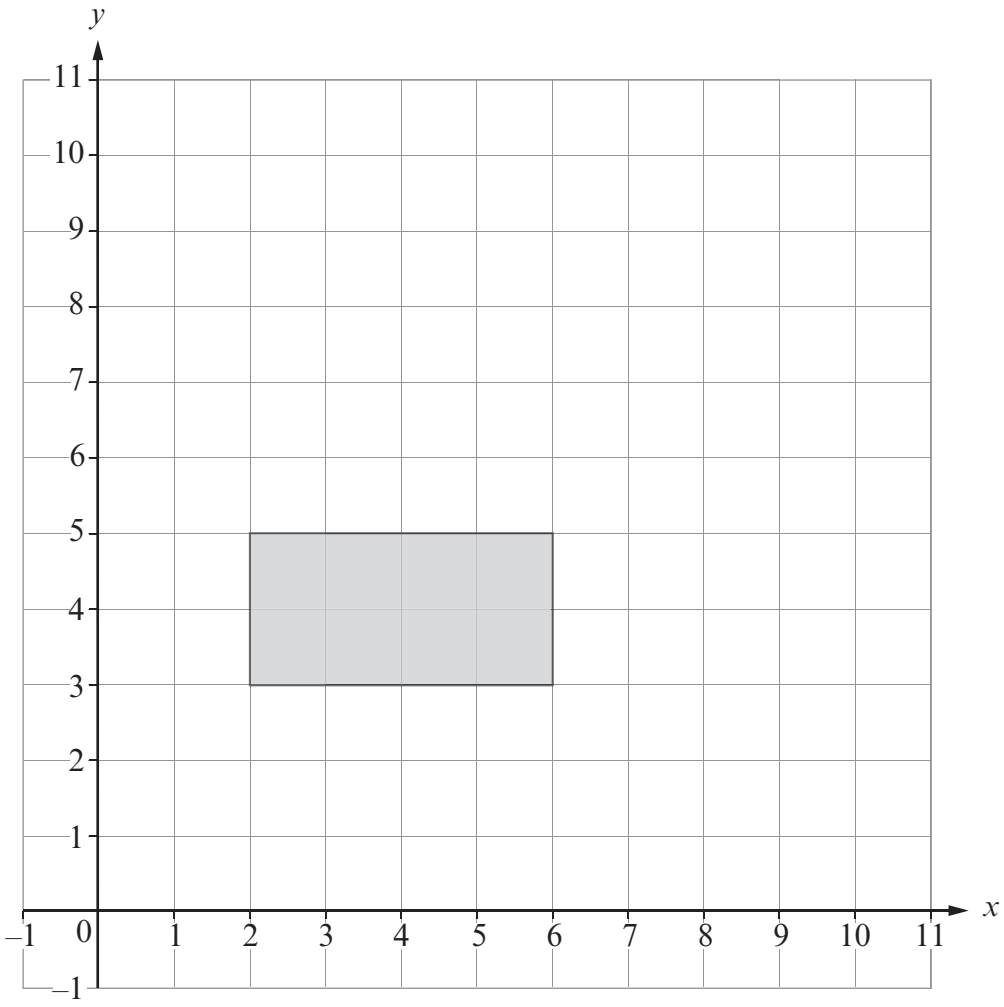
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3. *(a)* Enlarge the rectangle shown by a scale factor of 2 using (2, 2) as the centre of the enlargement.

[2]



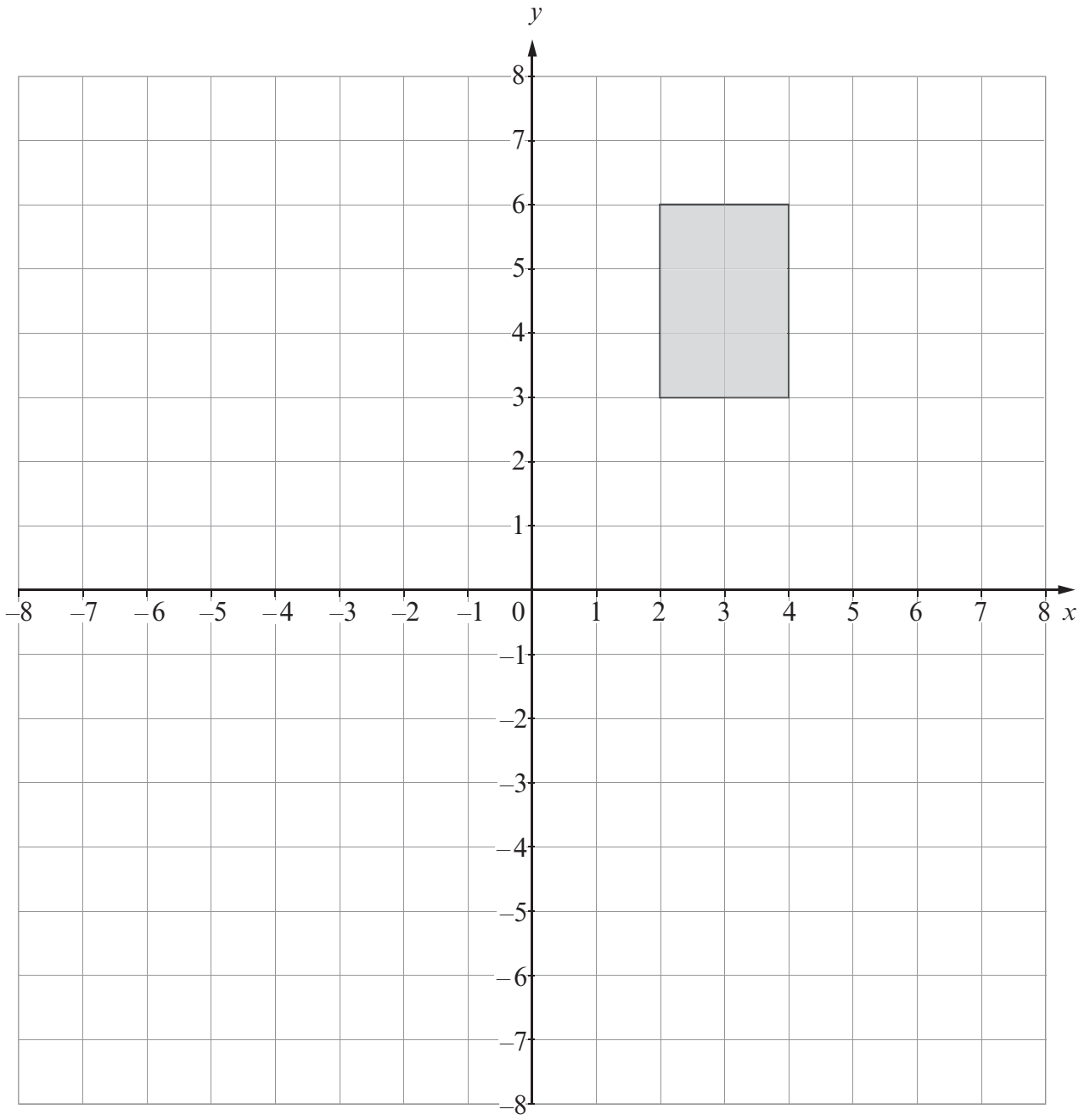
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(b) Rotate the rectangle shown below through 180° about the point (2, 1).

[2]



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

Kate lives in the UK. She goes on holiday to Paris with two friends, Janie who lives in America and Ami who lives in Japan.
They meet in London for a few days and then fly to Paris together.
Janie exchanges 450 American dollars to pounds and Ami exchanges 30 000 Japanese yen to pounds.
In London, Janie and Ami each spend £100 and exchange their remaining money to euros.
Kate also exchanges £250 to euros.

£1 = 129.82 Japanese yen
£1 = 1.57 American dollars
£1 = 1.18 euros

Use the exchange rates shown above to calculate how many euros in total the three girls take to Paris.
You must explain each step of your calculations and show all your working.

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[8]

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5. *(a)* In Kingstone, the mean daily snowfall for a week was 5·6 cm.
What would the mean daily snowfall have been if it had snowed 2 cm more on each day?

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[1]

(b) In Greyfield, the snowfall for each of 10 days was measured.
The results are summarised in the table below.

Daily snowfall, s, in cm	Number of days
$4{\cdot}5 \leqslant s < 5{\cdot}5$	4
$5{\cdot}5 \leqslant s < 6{\cdot}5$	2
$6{\cdot}5 \leqslant s < 7{\cdot}5$	1
$7{\cdot}5 \leqslant s < 8{\cdot}5$	1
$8{\cdot}5 \leqslant s < 9{\cdot}5$	2

(i) Calculate an estimate for the mean daily snowfall for the 10 days.

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[4]

(ii) State the modal class.

Modal class .....

[1]

(iii) Write down the class in which the median lies.

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[1]

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6. *(a)* Calculate the volume of a cylinder with a diameter of 4·6 cm and a height of 8·4 cm.

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[3]

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(b)

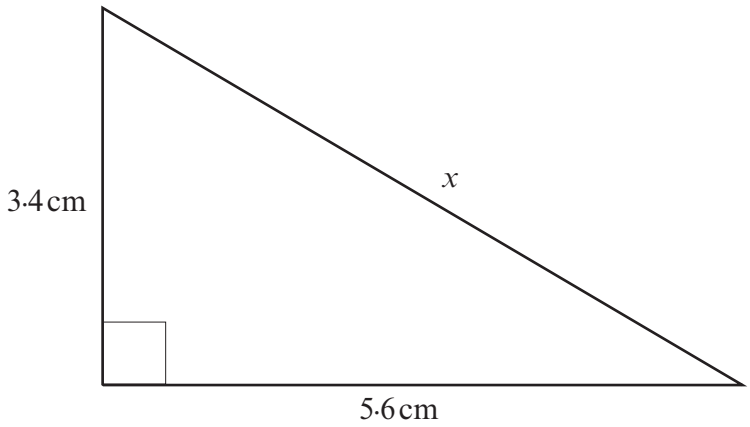


Diagram not drawn to scale

(i) Calculate the length of the side marked x in the diagram above.
Give your answer correct to 2 significant figures.

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[4]

(ii) Calculate the area of the triangle.

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[2]

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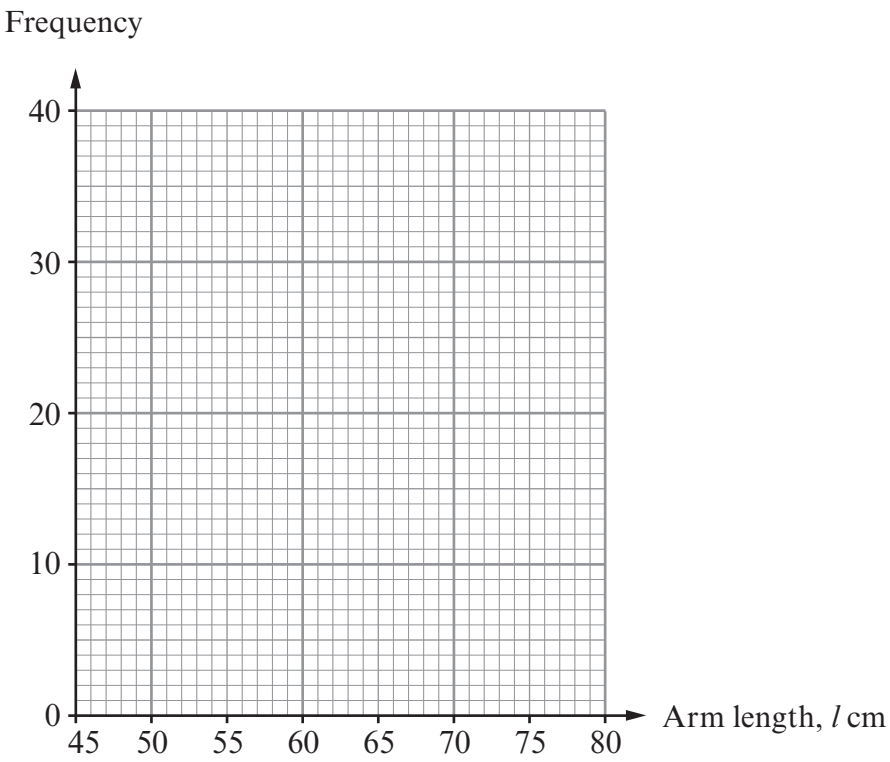
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7. The arm lengths of 100 women were measured in centimetres.
The table below shows a grouped frequency distribution of the results.

Arm length, l cm	$50 < l \leqslant 55$	$55 < l \leqslant 60$	$60 < l \leqslant 65$	$65 < l \leqslant 70$	$70 < l \leqslant 75$
Frequency	4	18	38	30	10

(a) On the graph paper below, draw a frequency polygon to show this data.

[2]



(b) Complete the following cumulative frequency table.

Arm length, l cm	$l \leqslant 50$	$l \leqslant 55$	$l \leqslant 60$	$l \leqslant 65$	$l \leqslant 70$	$l \leqslant 75$
Cumulative frequency	0	4				

[1]

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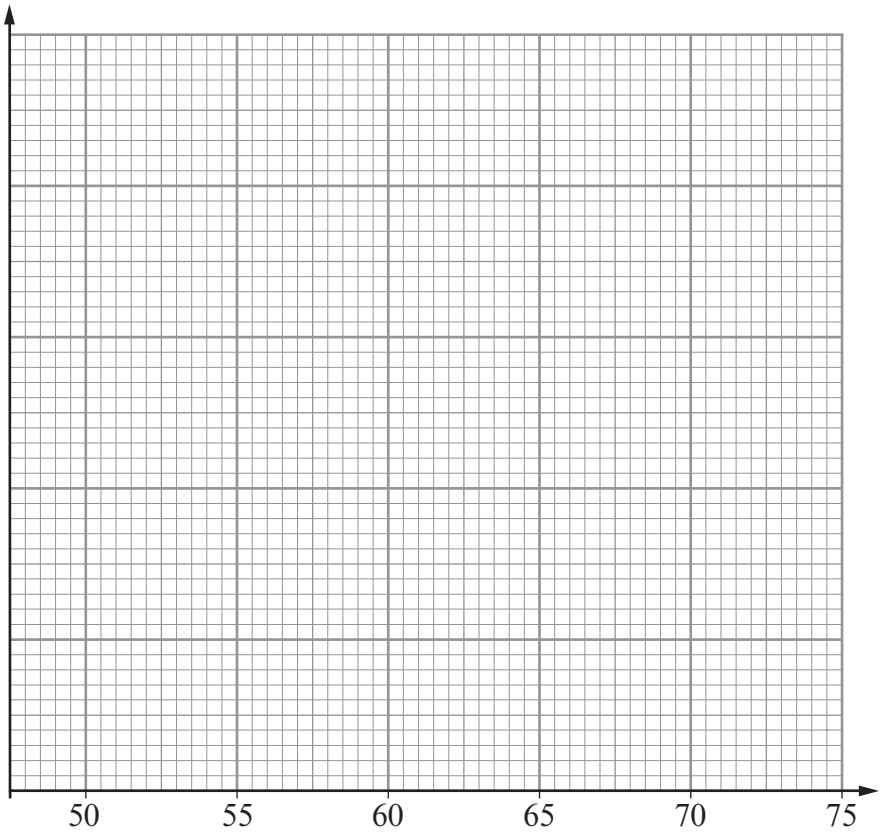
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(c) Use the graph paper below to draw a cumulative frequency diagram for the arm lengths of the 100 women.

[4]

Cumulative frequency



(d) Use your cumulative frequency diagram to find estimates for

(i) the median,

.....

[1]

(ii) the interquartile range.

.....

.....

[2]

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8. A warehouse stores electrical goods in boxes.
The boxes are all cuboids.

(a) One of the boxes has a depth of 46 cm, a width of 55 cm and a length of 62 cm, where all the measurements are correct to the nearest centimetre.

(i) Write down the greatest and least possible values for each of these measurements in the table below.

Dimension	Least value	Greatest value
Depth 46 cm	..... cm	..... cm
Width 55 cm	..... cm	..... cm
Length 62 cm	..... cm	..... cm

[2]

(ii) Hence, calculate the **greatest** possible volume of the box.

.....

.....

[2]

(b) Another box has dimensions x cm by y cm by z cm.
Each of these measurements is correct to the nearest cm.
Find an expression for the **least** possible volume of this box in terms of x, y and z.
You do not need to simplify your expression.

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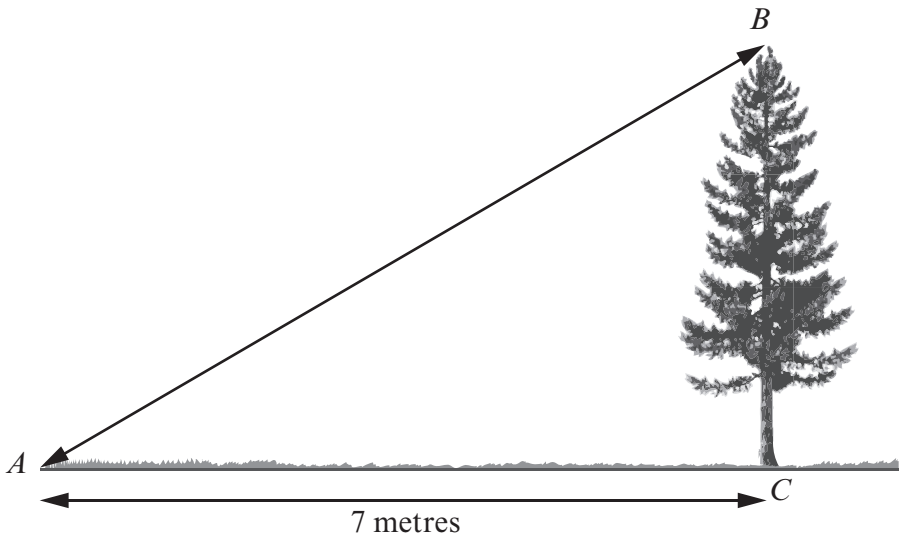
[2]

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9.



The height of a vertical tree is 3·2 metres.
The horizontal distance of a point *A* from the base of the tree is 7 metres.
Calculate the angle of elevation of the top of the tree from the point *A*.

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[3]

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Turn over.

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10. *(a)* Solve the following simultaneous equations using an algebraic method.

$$3x + 2y = 27$$
$$2x - 5y = 37$$

[4]

(b) Solve $\frac{3+x}{2} + \frac{2x-1}{11} = 13$.

[4]

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(c) Rearrange the following formula to make r the subject.

$$7r - b = ar - c$$

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[3]

11. A unit of measure used with textiles is the denier.
Silk is said to measure 1 denier when 9000 m of a single strand of the silk weights 1 g.

1 denier is the same as 1 g per 9000 m

(a) Complete the statement.

1 denier is the same as ..... g per 450 m

.....

[1]

(b) Complete the following statement, giving your answer in standard form correct to two significant figures.

1 denier is the same as ..... g per metre

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.....

.....

[2]

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12. *(a)* The diagram shows a circle with centre O.
The points A, B, C and D all lie on the circumference of the circle.

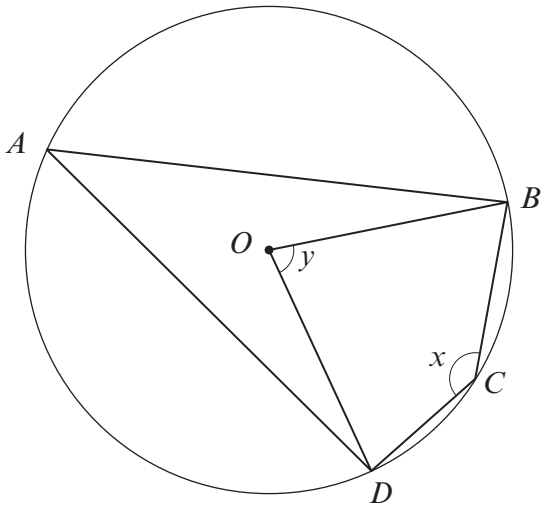


Diagram not drawn to scale

Find an expression for y in terms of x.

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[2]

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(b) A circle has a diameter FH.
The point G is a point on the circumference of the circle.
Given that the length of the straight line $GH = 6{\cdot}8\,\text{cm}$ and $G\hat{F}H = 32°$, calculate the length of FH.

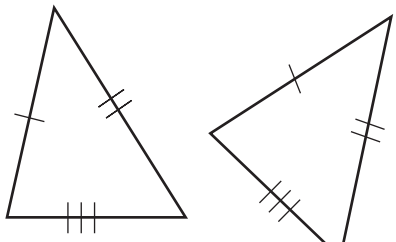
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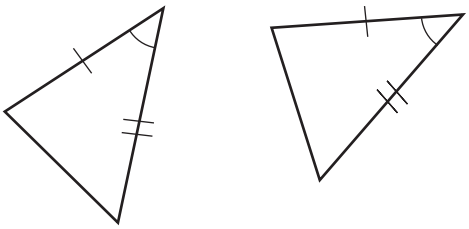
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13. State why each of the pairs of triangles below are congruent.



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[2]

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14. The point B is at the centre of the circle.
The points P and Q are on the circumference of the circle.

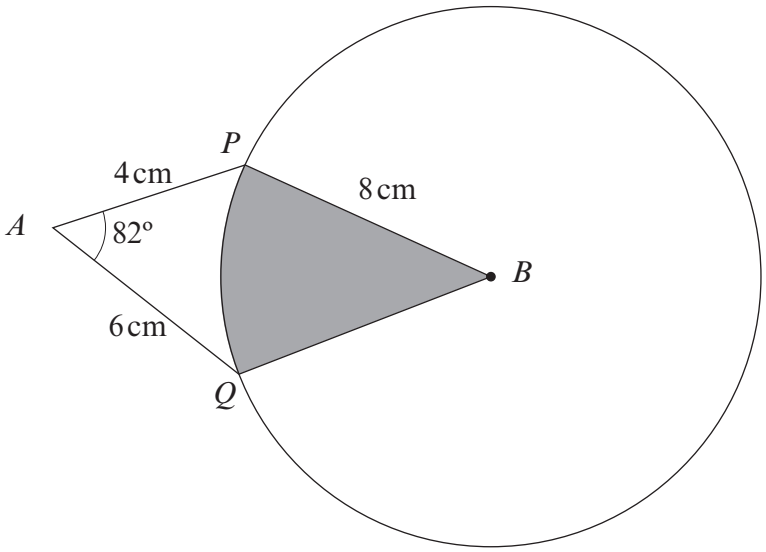


Diagram not drawn to scale

Calculate the area of the shaded sector.

[9]

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15. It is suggested that the three letters **a**, **e** and **r** are the most frequently used letters in the English language.
Six sentences were chosen at random from a newspaper article.
The total number of the letters **a**, **e** and **r** in each sentence was recorded.

Sentence number	1	2	3	4	5	6
Total number of letters a, e and r	8	6	8	3	4	5
Total number of letters in the sentence	36	22	42	8	10	14

(a) Using all of this information, calculate the best estimate of the probability that a letter chosen at random from this article is one of the letters **a**, **e** or **r**.

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[2]

(b) All of the letters from the 6 sentences are placed in a bag.
Two letters are selected at random from the bag and not replaced.
Calculate the probability that at least one of the letters is a letter **a**, **e** or **r**.
Give your answer correct to two decimal places.
You must show your working.

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[5]

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16. Using the axes below, **sketch** the graph of $y = \cos x + 1$ for values of x from 0° to 360°.

[2]



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GCSE MARKING SCHEME

MATHEMATICS - LINEAR

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 - LINEAR. 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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PAPER 2 - HIGHER TIER

PAPER 2 Higher Tier	Marks	FINAL MARK SCHEME Comments
1. a = 76(°) b = 53(°) c = 51(°)	B1 B1 B1 3	 FT 180 – (a + b)
2.(a) 23 (m) (b) (12+24)÷4 9 (car lengths) (c) Speed: mph / km/h: *30* / **48**; **70** / *112* (d) 15 + 0.30 × 15 OR 38 + 0.20 × 38 or equivalents 19.5 and 45.6 65(.1 m)	B1 M1 A1 M1 A2 M1 A2 A1 10	 Evidence of a method, e.g. ÷5 and ×8, or ×5 and ÷8 as appropriate, or sight of a correct scale, e.g. 80 × 30 /50 A1 for either answer correct. Also implies M1 A1 for either correct answer. Accept 20 and 46 FT from M1, A1 FT from rounding to 'their 20'+ 'their 46 '= 66(m) Unsupported 65 or 66 gain full credit If no marks, SC1 for an answer of 12.1 or 12 (giving the increase not the total)
3.(a) Scale factor 2 enlargement (Intention of the) Correct position (b) Correct rotation about (2, 1)	B1 B1 B2 4	 Perhaps watch for the position of the bottom left vertex B1 for rotation of 180° about (1, 2)
4. Janie 450/1.57 **or** Ami 30000/129.82 Janie (£)286.6242… or (£)286.62 Ami (£)231.0892.. or (£)231.08 or (£)231.09 or (£)231 (£)186.62 and 131.09 Sight of an amount (not starting dollars or yen) × 1.18 669.9(0 euros) or 669 (euros) or 670 (euros) Look for • spelling • clarity of text explanations, • the use of notation (watch for the use of '=', £, $, Yen being appropriate) 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 A1 A1 B1 M1 A1 QWC 2 <

PAPER 2 Higher Tier	Marks	FINAL MARK SCHEME Comments
5.(a) 7.6 (cm) (b)(i) Mid-points 5,6,7,8,9 $5\times4 + 6\times2 + 7\times1 + 8\times1 + 9\times2$ Intention their $\sum fx / 10$ 6.5 (cm) (ii) Modal class $4.5 \leq s < 5.5$ Median $5.5 \leq s < 6.5$	B1 B1 M1 m1 A1 B1 B1 7	 FT their mid points including bounds provided they fall within the classes. 20 + 12 + 7 + 8 + 18 (= 65) (65/10) For correct evaluation of $\sum fx / 10$ Accept '4.5 to 5.5' Accept '5.5 to 6.5'
6.(a) Radius 2.3 $\Pi\times 2.3^2 \times 8.4$ 139.5(998… cm^3) to 139.7(cm^3) (b)(i) (x^2 =) $3.4^2 + 5.6^2$ $x^2 = 42.92$ or $x = \sqrt{42.92}$ 6.6 (cm) (ii) $\frac{1}{2} \times 5.6 \times 3.4$ 9.5(2 cm^2)	B1 M1 A1 M1 A1 A2 M1 A1 9	 Do not accept from premature approximate SC1 for an answers 558(.3992… cm^3) to 558.7(cm^3) Depends on previous M1 and process of √. Mark final answer. A1 for 6.5(51… cm) Mark final answer
7.(a) Correct frequency polygon (b) 22 60 90 100 (c) Uniform scale vertically Plotting all points at the upper bounds All 6 accurate upper bound plots joined with a curve or lines (d)(i) Median for their graph (ii) Idea UQ – LQ, with an attempt at readings and intention to subtract Interquartile range accurate for their graph	B2 B1 B1 B2 B1 B1 M1 A1 10	Must be accurate between bounds of 1 small square horizontally and on the line vertically B1 if translated OR joined with curve or not joined OR one plot incorrect within the polygon *Ignore frequency diagram as working* Appropriate for their values in (b) FT their <u>cumulative</u> table only if cumulative Ignore if (50, 0) omitted Must be accurate on vertical lines and horizontal lines B1 if one error in plots, OR for all vertical plots correct but not at upper bounds FT from their <u>cumulative</u> graph in (d)(i) and (ii) (Answer in the range 63.5 to 64 (cm)) (67 to 68 - 60 to 60.5) (Answers in the range 6.5 to 7.5)
8.(a)(i) 45.5 46.5 54.5 55.5 61.5 62.5 (ii) 161296(.875 cm^3) or 161297 (cm^3) ISW (b) Least: (x-0.5)(y-0.5)(z-0.5)	B2 B2 B2 6	B1 for any 3 correct entries Accept .49• RECURRING as being equivalent to .5 FT their greatest provided all > given values and <47, <56 and <63 respectively B1 for selection of 46.5 (×) 55.5 (×) 62.5 (sight of digits 161296 or 161297). Allow SC1 for an answer of 164.5, or for selecting and recording addition for their greatest values B1 for minor slip, or omission of brackets, there needs to be intention to multiply, or if further incorrect working B0 for sight of the 3 terms only without intention to multiply
9. tan A = 3.2/7 24.567…(°) rounded or truncated	M1 A2 3	 A1 for 0.457… or $\tan^{-1}3.2/7$ *SC1 for calculating **B**, an answer of 65.43…(°), this is not for an answer labelled as A*

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PAPER 2 Higher Tier	Marks	FINAL MARK SCHEME Comments
10.(a) Method, equating coefficients or alternative First variable correct Method to find second variable Second variable correct (b) $11(3 + x) + 2(2x – 1) = 13 \times 2 \times 11$ $15x + 31 = 286$ $x = 17$ (c) $7r – ar = b – c$ $r(7 – a) = b – c$ $r = (b – c)/(7 – a)$ or equivalent	M1 A1 M1 A1 M2 A1 A1 B1 B1 B1 11	Allow 1 slip, but not in equated coeffs. $x = 11$ $y = -3$ FT their first variable No M mark if left as quotient M1 for 2 of these 3 terms correct FT from M1 for A1 only CAO (Must be simplified) Like terms *FT until second error* Factorise Isolate
11.(a) 0.05 (b) 1.1×10^{-4}	B1 B2 3	Accept equivalents, 1/20 B1 for 1×10^{-4} or 1.11×10^{-4} or $1.111\ldots \times 10^{-4}$ SC1 FT from their (a)/450 correctly expressed in standard form
12.(a) (y =) 360 – 2x or (y =) 2(180 – x) ISW (b) FGH = 90° seen or implied by used in calculation FH = 6.8/ sin 32 (×sin FGH) FH = 12.8(32.. cm) or 13 (cm)	B2 B1 M2 A1 6	B1 for <u>appropriate</u> 2x, or 180 – x may be seen on the diagram or labelled, OR B1 for x = (360 –y)/2, or a correct expression but not 'y=..' M1 for sin 32 = 6.8/ FH or FH/sinFGH = 6.8/ sin 32 Answer of 12 gets A0
13. 'Three sides' or SSS 'Two sides and INCLUDED angle' or SAS	 B1 B1 2	<u>Accept descriptions</u> Do not accept e.g. 'dashes in the same places' Must be clear that it is the **included** angle
14. Strategy to find (½) PQ and <PBQ $PQ^2 = 4^2+6^2 – 2.4.6.\text{Cos}82$ $PQ^2 = 45.31969\ldots$ PQ = 6.73199.... $PQ^2 = 8^2+8^2 – 2.8.8.\text{CosPBQ}$ $\text{Cos PBQ} = \underline{8^2+8^2 – PQ^2}$ 2.8.8 <PBQ = 49.763…(°) Area shaded = (<PBQ/360) ×Π×8^2 = 27.79.. (cm^2) or 28 (cm^2) or 27.8(cm^2)	S1 M1 A1 A1 M1 A1 A1 M1 A1 9	 Maybe embedded OR *Alternative:* *sin ½ PBQ = ½ PQ / 8* *M1* *< ½ PBQ = 24.88…* *A1* *<PBQ = 49.763…(°)* *A1* Accept answers in the range 49.5 to 49.8 inclusive, or 50 Correct answer, not FT FT their <PBQ provided not 82 and all M marks awarded Accept answers in the range 27.6 to 28 inclusive
15.(a) **Decision to find** overall totals of a, e, r and number of letters 34/132 or 0.2575... or equivalent (b)Use or sight of (a, e, r =) 34 **AND** (number of letters =) 132, OR, sight of any correct probability product, equivalent to ../132×../131 (or …/66×…/65) as appropriate P(at least one of a,e,r) = 1 – P(none) OR equivalent **full** strategy 1 – 98/132 × 97/131 or equivalent full method 0.45	M1 A1 B1 S1 M1 A2 7	(34 and 132) Mark final answer Accept sight of 34 and 132, or 17 and 66. FT from (a) For the idea without need to use values (As 66 = 132÷2) FT their <u>totals</u>, a method that would lead to correct answer A1 for answer not correct to 2dp, as a result of incorrect or premature rounding *N.B. Markers check working for no replacement*
16. Cosine curve from 0° to 360° Correct cosine curve with the correct translation, with 2 marked on the y-axis	M1 A1 2	Any vertical translation, but must be correct horizontally Accept if numbers of degrees missed but unambiguous

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4370/06

MATHEMATICS – LINEAR
PAPER 2
HIGHER TIER

A.M. WEDNESDAY, 13 June 2012

2 hours

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

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 **2***(a)*.

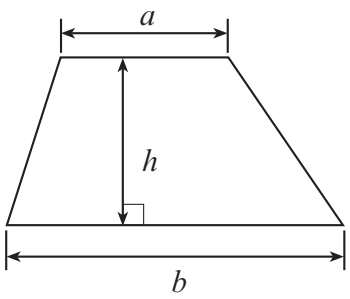
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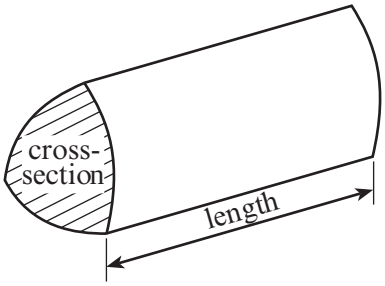
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Formula List

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

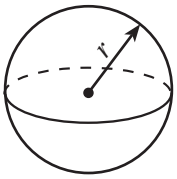


Volume of prism = area of cross-section × length



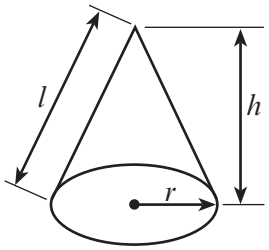
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

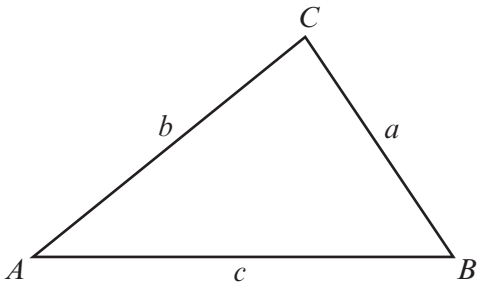


In any triangle ABC

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)* A bag contains 10 beads, of which 2 are red, 3 are blue and 5 are yellow.
One bead is selected at random from the bag.
Find the probability that the bead is

(i) white,

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.....

[1]

(ii) either red or yellow.

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[1]

(b) A fair dice is thrown.
What is the probability that the top face shows a square number?

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[2]

(c) There are marbles of 6 different colours in a bag.
The table shows the probabilities of selecting the different coloured marbles from the bag.

Colour	Red	Orange	Yellow	Green	Blue	Purple
Probability	0·23	0·12	0·13		0·22	0·21

(i) Complete the entry for Green in the table.

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[2]

(ii) Which colour of marble is the mode?

.....

.....

[1]

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

Valley Water Company measures the water used by a household in cubic metres.
There is a quarterly standing charge of £7.45.
The first 25 cubic metres of water used are charged at a rate of 93 pence per cubic metre.
All further water used is charged at the rate of 132 pence per cubic metre.

Calculate the quarterly water bill for a household using 46 cubic metres of water.

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[6]

(b) A different water company, Trevi Water, has a different scale of charges.

Trevi Water:

- Quarterly standing charge £4
- First 10 cubic metres per quarter at £1.50 per cubic metre
- All further water charged at £2 per cubic metre

Write down, in its simplest form, an expression for the quarterly bill in pounds for a Trevi Water customer who uses x cubic metres of water, where $x > 10$.

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[4]

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(c) Mr and Mrs Alston recycle the water from their bath and washing machine to use in their garden.
Their meter reading, in cubic metres, on 1st April was 1678 and on 30th June it was 1702.
They recycled 8 cubic metres of the water used between 1st April and 30th June.
Find the percentage of the water that they recycled in the quarter.

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[3]

3. *(a)* Solve $5(2x - 7) = 75$.

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[3]

(b) Simplify $7x - 3(4x - 1)$.

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[2]

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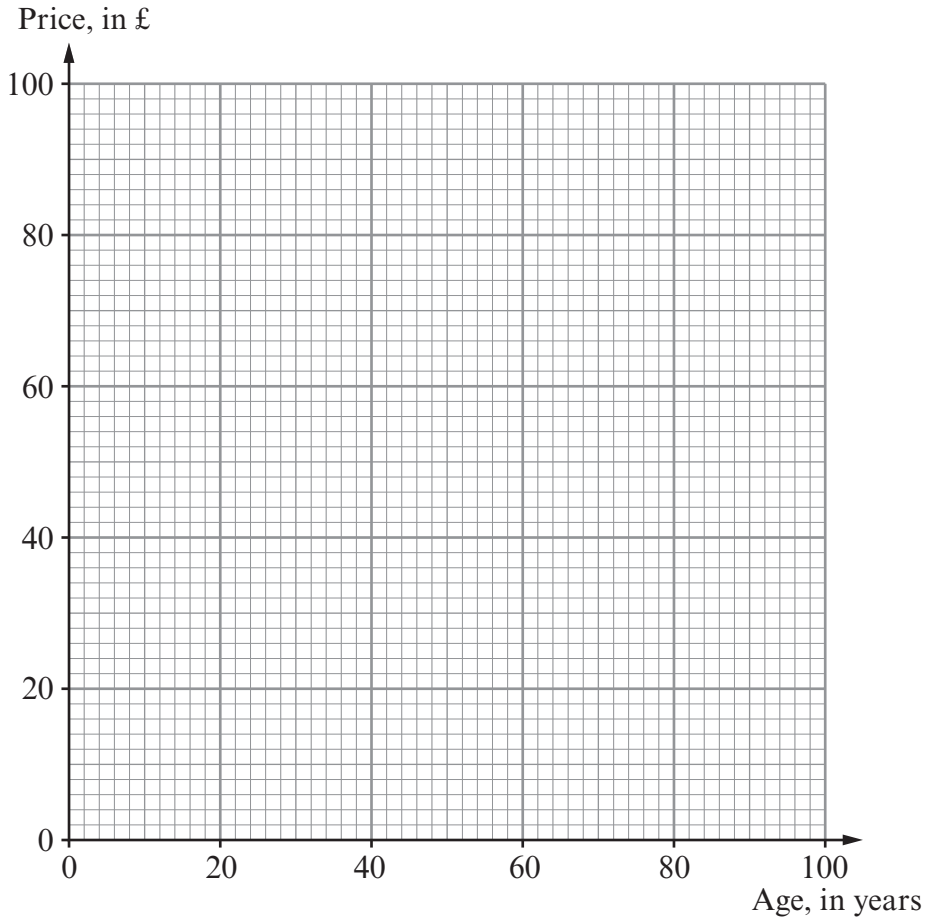
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4. *(a)* The age and price of each of 10 chairs in an antique shop are recorded in the table.

Age, in years	26	40	70	50	46	80	66	64	70	32
Price, in £	100	60	80	70	50	40	20	50	50	30

(i) Draw a scatter diagram to display these ages and prices.

[2]



(ii) Write down the age and price of the oldest chair.

Age ..... years

Price £ .....

[2]

(iii) Does the scatter diagram indicate that there is a correlation between the age and price of the chairs? You must give a reason for your answer.

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[1]

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(b) The same antique shop has a number of tables for sale.

Price, £x	Number of tables
$50 \leqslant x < 100$	6
$100 \leqslant x < 150$	10
$150 \leqslant x < 200$	4

Calculate an estimate for the mean price of a table.

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[4]

(c) A leather sofa costs £2400.
Each year, the value of furniture depreciates by 18% of its value at the start of the year.
At the end of two years, by how much has the value of the leather sofa depreciated?

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[4]

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5. *(a)* Kerbstones are made in the shape of a cuboid.



The dimensions of the kerbstones are 50 cm by 20 cm by 10 cm.
All measurements are given correct to the nearest centimetre.
Calculate the greatest possible length of 200 of these kerbstones laid along a straight road.
Give your answer in metres.
Explain any assumption you have made in working out your answer.

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[5]

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(b) Concrete blocks in the shape of cuboids are made using cement, sharp sand, gravel and water. A builder's yard offers customers use of their Concrete Quantity Calculator.

Customers enter the length, width and depth of the block of concrete they want to make. The calculator then works out the quantities of cement, sharp sand, gravel and water needed.

One customer enters her measurements, length 0·5 m, width 0·2 m and depth 0·3 m for the concrete she wants to make. This is what the Concrete Quantity Calculator shows:

Concrete Quantity Calculator			
Block dimensions	Length 0·5 metres	Width 0·2 metres	Depth 0·3 metres
	Cement	**10** kg	
	Sharp sand	**18** kg	
	Gravel	**36** kg	
	Water	**5** litres	

Complete the Concrete Quantity Calculator for another customer who wants to make a block of the same type of concrete, measuring 0·6 m by 0·4 m by 0·2 m.

Concrete Quantity Calculator			
Block dimensions	Length 0·6 metres	Width 0·4 metres	Depth 0·2 metres
	Cement	**16** kg	
	Sharp sand	..... kg	
	Gravel	..... kg	
	Water	..... litres	

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..... [4]

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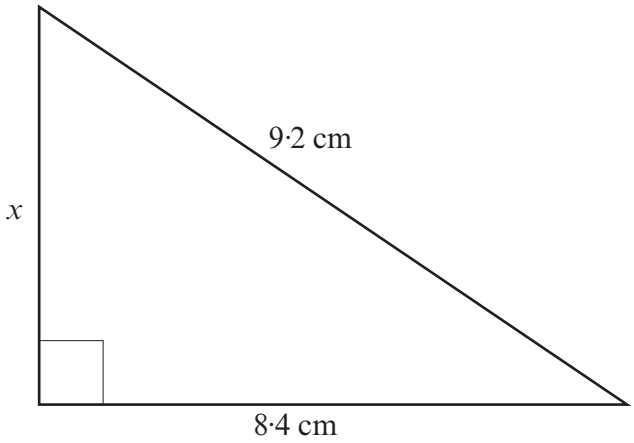


Diagram not drawn to scale

Calculate the length of the side marked x.

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[3]

7. *(a)* Write the number twenty million in standard form.

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.....

[1]

(b) Calculate, giving your answers in standard form correct to 2 significant figures.

(i) $(4{\cdot}6 \times 10^{-7}) \times (7{\cdot}2 \times 10^{14})$

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[2]

(ii) $\dfrac{4{\cdot}56 \times 10^{3}}{9{\cdot}24 \times 10^{14}}$

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[2]

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8.

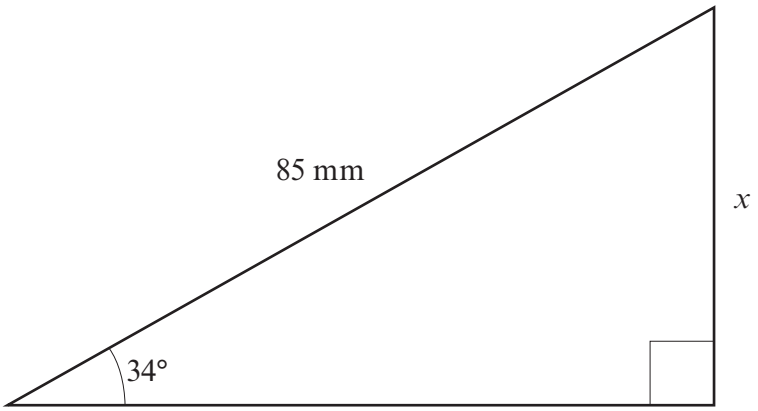


Diagram not drawn to scale

Calculate the length x to an appropriate degree of accuracy.

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[4]

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9. On the graph paper provided, draw the region which satisfies **all** of the following inequalities.

$$x + y \leqslant 6$$
$$y \leqslant 3x + 1$$
$$y \geqslant 2$$

Make sure that you clearly indicate the region that represents your answer.

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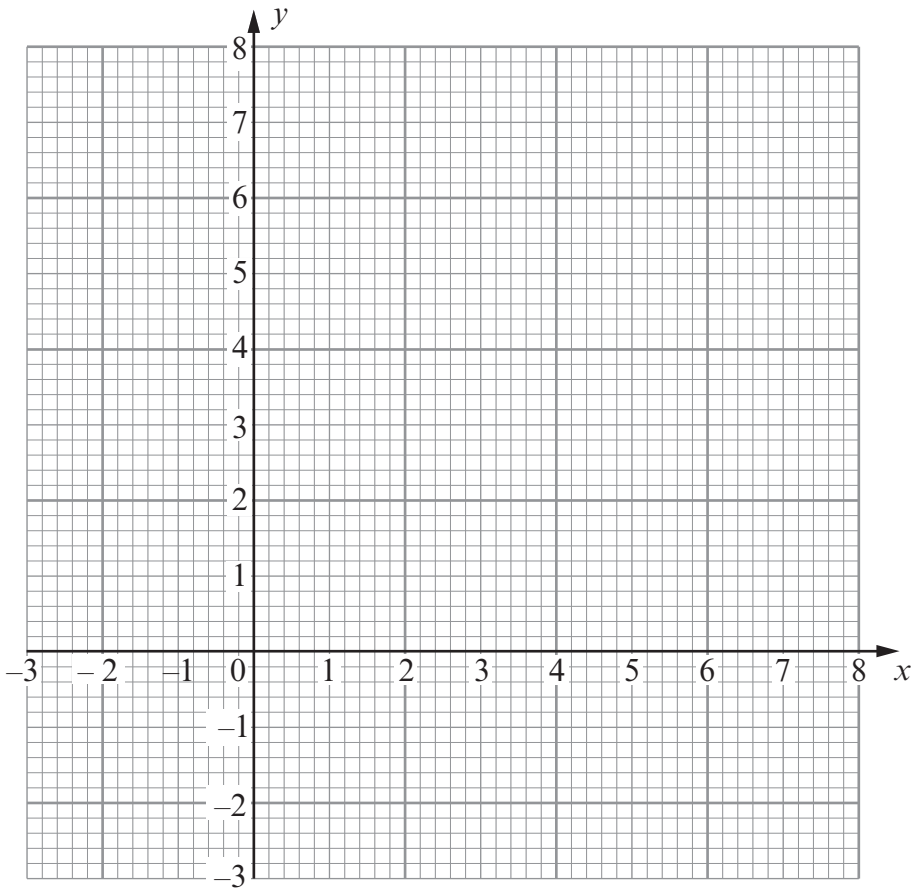
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[3]



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10. *(a)* Make g the subject of the formula.

$$3(g - 2f) = ag + 5h$$

[4]

(b) Factorise $4x^2 - 169$.

[2]

(c) Solve $3 - 2n > 4n - 9$.

[2]

(d) Solve $3x^2 + 4x - 18 = 0$, giving your answers correct to two decimal places.

[3]

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11.

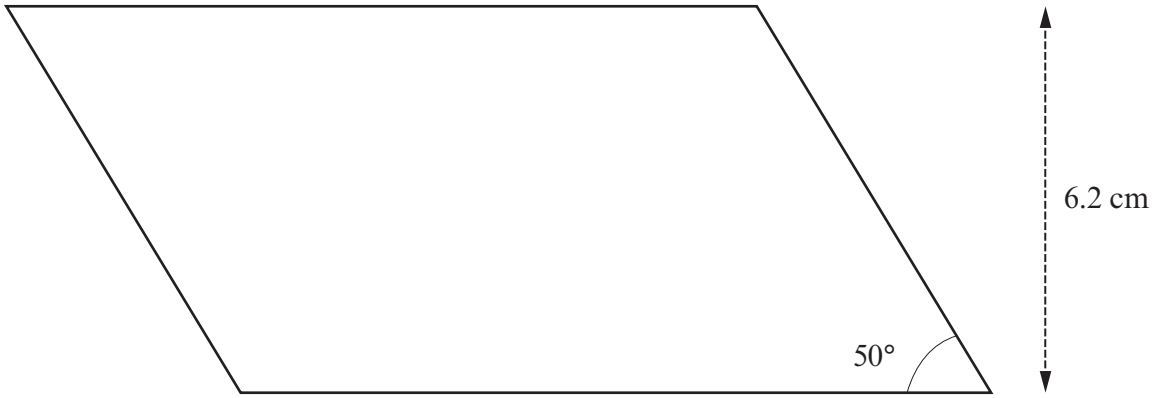


Diagram not drawn to scale

The diagram shows a parallelogram with a base of length 13·8 cm, a perpendicular height of 6·2 cm and one interior angle of 50°. Calculate the perimeter of the parallelogram.

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[5]

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12. Given that y is inversely proportional to x^2, and that $y = 8$ when $x = 0{\cdot}5$,

(a) find an expression for y in terms of x,

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[3]

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

x		0·2	0·5
y	800		8

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[2]

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13. A company manufactures two different sized boxes.
Both boxes are cuboids and are similar in shape.
The total surface area of the smaller box is 132 cm^2 and the length of its longest edge is 12 cm.
The total surface area of the larger box is 297 cm^2.
Calculate the length of the longest edge of the larger box.

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[4]

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14. The diagram below shows a sketch of a company logo.
The company needs to paint the triangle *ACD* blue.

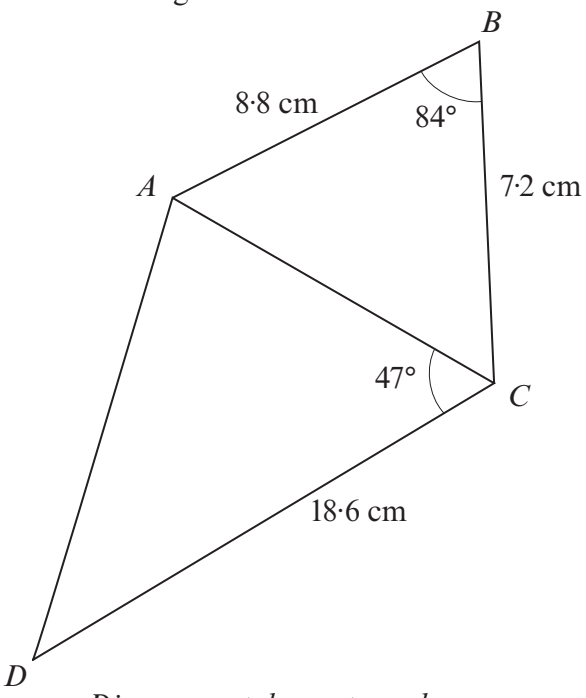


Diagram not drawn to scale

Calculate the area of the triangle *ACD*.

[6]

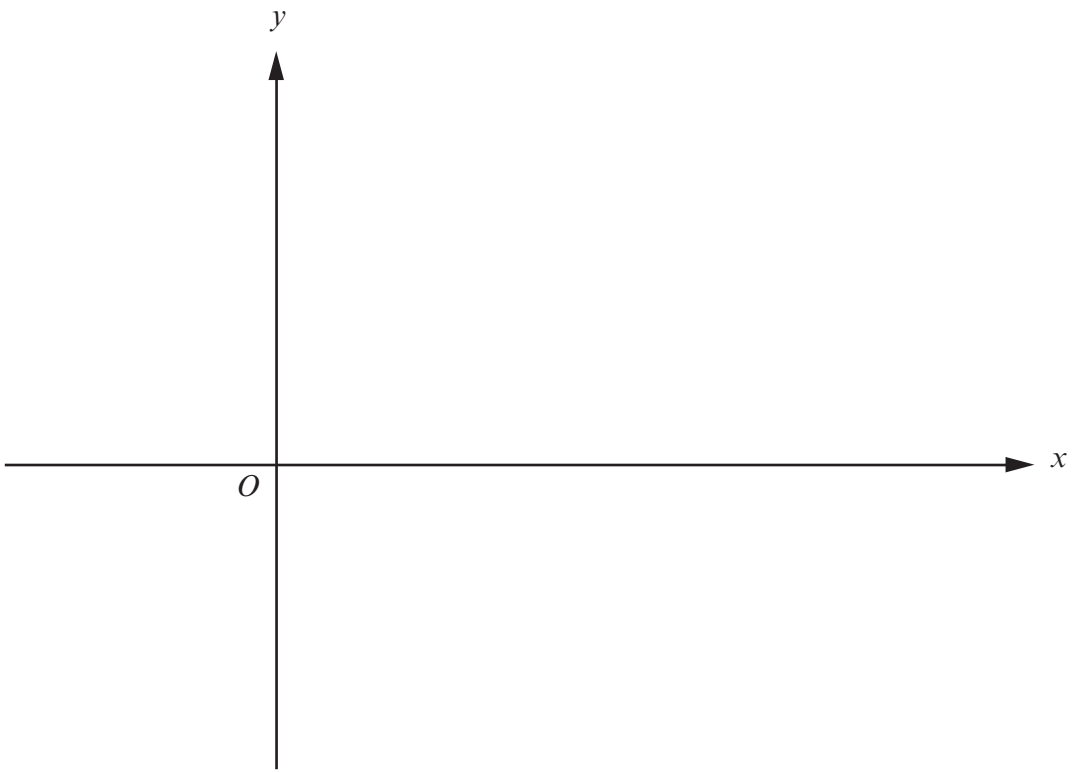
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15. *(a)* Using the axes below, **sketch** the graph of $y = \sin x + 3$ for values of x from 0° to 360°.

[2]



(b) Solve the simultaneous equations $y = 3{\cdot}5$ and $y = \sin x + 3$ for values of x from 0° to 360°.

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[3]

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(c) Denia says that "the graph of $\sin x$ is the same as the graph of $\cos(x - 90°)$".
Explain the transformation from $y = \cos x$ to $y = \cos(x - 90°)$ and hence decide if Denia is correct.

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[2]

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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 - LINEAR

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 - LINEAR. 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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P2 (HIGHER TIER)

Summer 2012 Paper 2 Linear Higher		FINAL MARK SCHEME Comments
1.(a)(i) 0 or equivalent	B1	Do not accept 'not possible' or other written comment *Do not accept incorrect notation throughout this question*
1.(a)(ii) 7/10 or 0.7 or 70%	B1	Do not accept 2/10 + 5/10' without correct evaluation Mark final answer *Do not accept incorrect notation throughout this question*
1.(b) 2/6 or 1/3 or 0.33	B2	B1 for square numbers 1 and 4, OR knowing there are 2 squares numbers on a dice. An answer of 0.3 gets B1 only Or B1 for **stating** that either 1 or 4 is a square number with an answer 1/6
1.(c)(i) 0.09 1.(c)(ii) Red	B2 B1	B1 for evidence of 1 – total of the probabilities given FT Green if their (i) > 0.23
2.(a) Sight of 21 (units) (Cost of all units =) 25×93 + 21×132 (= 2325 + 2772) = (£)50.97 or 5097(p) (Adding on standing charge 7.45 to give) (£)58.42 or 5842(p) Notes: QWC2 can only be awarded if the correct unit is shown in the final answer QWC2 requires words throughout the response, not just connected to the final answer Look for • within process and steps, "25 – 46 = 21" is unacceptable • spelling • clarity of text explanations, • the use of notation (watch for the use of '=', £, p being appropriate) QWC2: Candidates will be expected to • present work clearly, with clear process or steps shown AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar • QWC1: Candidates will be expected to • present work clearly, with clear process or steps shown explaining process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar	B1 M1 A1 A1 <

Summer 2012 Paper 2 Linear Higher		FINAL MARK SCHEME Comments
2.(b) 10×1.5(0) (=15) (x -10)×2 4 + 15 + 2x - 20 = (£) 2x - 1	B1 B1 B1 B1	Sight of '19' implies 15, hence B1 With intention of brackets, may be implied later OR 200x – 100 pence, unit must be given For these answers award the number of marks stated, and **no** other B marks: 2x – 5 award 3 marks 2x + 9 award 3 marks 2x + 5 award 2 marks 2x + 19 award 2 marks 2x – 16 award 2 marks
2.(c) 24 (cubic metres) 100 × 8/24 = 33(.3333….%)	B1 M1 A1	Ignore units FT their 24, provided >8. Multiplication by 100 must be seen or implied Note: Award B1 only, (M0, A0) for an answer of 1/3 or 0.33…. or equivalent. An unsupported answer of 0.3 is awarded no marks
3.(a) 10x – 5×7 = 75 OR 2x – 7 = 75/5 10x = 75 + 35 2x = 15 + 7 x = 11	B1 B1 B1	*FT until 2nd error* Answer needs to be simplified. Mark final answer
3.(b) 7x – 12x + 3 -5x + 3	B1 B1	*FT until 2nd error* Mark final answer *Award B1 only for a final answer of -5x -3* *SC1 if treated as a pair of brackets, but sight of '-12x + 3' or sight of $28x^2 – 19x + 3$*
4.(a) (i)All 10 points correctly plotted	B2	Do not ignore any lines drawn, expect to point the (80, 40) B1 for at least 6 points correctly plotted ignoring any lines drawn *Intention for correct points is that they lie on grid lines, allow tolerance of ± half a square*
4.(a)(ii) 80 (years) (£)40	B2	B1 for each correct response
4.(a)(iii) Implies "no" with a reason (e.g. 'points scattered', or 'not in line', or 'all over the grid', or 'no relationship between price and age', or 'no pattern', 'randomly scattered', etc.)	E1	Do not accept 'does not have a correlation between price and age', or ' points are not all together', or 'the points vary' without further clarification
4.(b) Mid points 75, 125, 175 75×6 + 125×10 + 175×4 (Σfx = 2400) their Σfx/20 (£)120	B1 M1 m1 A1	 FT their mid points from within or at the bounds of the appropriate groups FT their Σfx/20 correctly evaluated
4.(c) Any correct 18% of a value seen in working 2400 – 0.18 × 2400 (= 2400 – 432) 1968 – 0.18 × 1968 (= 1968 – 354.24 = (£)1613.76) (£)786.24	B1 M1 M1 A1	OR B1and M2 for 2400 × 0.82^2 or B1 and M1 for 2400 × 0.82 (=1968) FT their 1968, but not 2400 CAO. Penalise further working -1 *Total marks to award for common errors:* *Appreciation: B1 and SC1 for 3341.76* *Simple depreciation: B1 and M1 for 1536* *Working towards simple depreciation: B1 for sight 864 if 432 not seen*

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Summer 2012 Paper 2 Linear Higher		FINAL MARK SCHEME Comments
5.(a) Sight of 50.5 (cm) or 0.505 (m) 200× 50.5 OR 200× 0.505 101 (m)	B1 M1 A2	If units are given they must be correct FT their 50.5 only if $\geq$50.4 and $\leq$50.5 A1 for 10100(cm). If units are given they must be correct *SC1 for an answer of 100m from 200×0.5, unit m (or metres) must be given* *Use of 10cm or 20cm as length of the kerb stone:* *Award SC2 for* *200×20.5 or 200×0.205 with an answer of 41(m),* *or 200×10.5 or 200×0.105 with an answer of 21(m)* *OR* *Award SC1 for* *this working leading to 41 or 21 with incorrect units, or if the answer above is left in cm, i.e. 4100(cm) or 2100(cm), OR 41 or 21 with incorrect units*
Assumption: e.g. 'no gaps', 'fit together', 'side faces touching'	E1	*Accept 'the road is flat', 'all kerbstones are at the upper bound', 'all kerbstones are 50.5cm long'* *Do not accept 'all kerbstones are 50.4cm'* *Only accept reference to upper bound or maximum length, however accept 'all are at upper bound 50.4'*
5.(b) Scale factor ×1.6, or equivalent	M1	*Alternative method:* *×1.8 to find sand, double sand to gravel, water is half cement. Award M1 for sight of any part of this alternative method*
Sand 28.8 or 29 (kg) Gravel 57.6 or 58 (kg) Water 8 (l)	A3	A1 for each correct answer. Any 1 correct answer implies M1 *Do not accept an answer of 28 for sand, or 57 for gravel, however award M1* *If M1 A1 awarded for water 8(litres), then award SC1 if their gravel = 2×their sand* *If no marks then SC1 if their gravel = 2×their sand*
6. Correct statement of Pythagoras' Theorem ($x^2 =$) $9.2^2 - 8.4^2$ (x^2=) 14.08 or sight of $\sqrt{14.08}$ 3.75(… cm) rounded or truncated	M1 A1 A1	Accept $9.2^2 = x^2 + 8.4^2$ Do not accept x = 14.08 Ignore further rounding to 4, if 3.7… seen in working FT from M1, A0, for correct evaluation of the $\sqrt{}$ of their value for final A1
7.(a) $2(.0) \times 10^7$	B1	
7.(b) (i) 3.3×10^8	B2	B1 for a correct answer 2sf , e.g. 330 000 000, or 33×10^7 B1 for using standard form but not 2 sig. fig., $3.31(2)\times10^8$
7.(b)(ii) 4.9×10^{-12}	B2	B1 for $4.93(5\ldots) \times 10^{-12}$, or 4.94×10^{-12}, or 5×10^{-12}, or 0.49×10^{-11} ***Penalise incorrect notation once only -1 throughout***
8. $x = 85 \times \sin 34$ (or $x = 85 \times \sin 34/\sin 90$) 47.5(mm) or 48(mm)	M2 A2	M1 for $\sin 34 = x/85$ or $x/\sin 34 = 85/\sin 90$ A1 for 47.531….. to 2 or more d.p., or 47 from correct working, or for an answer (whole or 1dp) from premature approximation
9. Any 2 of the lines x+y=6, y=3x+1 and y= 2 correct	B2	B1 for any 1 correct line If y = 2 and x = 2 are both shown do not award a mark unless y = 2 is selected for the region or clearly labelled
Correct region shaded	B1	CAO. Accept indication by 'shading out'

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Summer 2012 Paper 2 Linear Higher		FINAL MARK SCHEME Comments
10.(a) $3g - 6f = ag + 5h$ OR $g - 2f = (ag + 5h)/3$ $3g - ag = 6f + 5h$ or $-6f - 5h = -3g + ag$ $g(3 - a) = 6f + 5h$ or $-6f - 5h = g(-3 + a)$ $g = (6f+5h)/(3-a)$	B1 B1 B1 B1	*FT until 2nd error in (a)* Terms in g one side, with other terms on the other side Or equivalent factorising g Or equivalent
10.(b) $(2x + 13)(2x – 13)$	B2	B1 for (2x-13)(2x-13) or (2x+13)(2x+13)
10.(c) $-6n > -12$ OR $12 > 6n$ $n < 2$ or $2 > n$	M1 A1	CAO. Mark final answer *SC1 for any answer n<-1 from working -6>6n, or* *For an answer of n<1 from working -6n>-6* *Candidates working with '=' gain no marks, however if replaced to give final answer of n<2 or 2>n then award M1, A1*
10.(d) $x = \{ -4 \pm\sqrt{(4^2 – 4 . 3 . -18)}\} / 2\times3$ $= [-4 \pm\sqrt{232}] /6$ $x = 1.87$ and $x = -3.21$ (Answer to 2dp)	M1 A1 A1	Allow 1 slip in substitution, but must be correct formula CAO
11.Side (hypotunese) = 6.2/sin50 = 8(.0935… cm) Perimeter = 13.8 + 13.8 + their side + their side Answers in the range 43.6 to 43.8 (cm)	M2 A1 M1 A1	M1 for sin50=6.2/hyp. Accept alternatives e.g. Hyp =6.2/Cos40 M2, or cos40=6.2/hyp M1 Only FT provided M1 awarded previously, and not 6.2 or 13.8
12.(a) $y \alpha 1/x^2$ OR $y = k/x^2$ $8 = k/0.5^2$ $y = 2/x^2$ 12.(b) x: **0.05**, 0.2, 0.5 y: 800, **50**, 8	B1 M1 A1 B2	 Must be in the correct form, not FT Maybe implied in part (b) FT non linear only FT their non linear expression B1 for each value
13.Ratio of surface areas 9:4 OR scale factor 2.25 or 4/9 Use of ratio of surface areas = (ratio of lengths)^2 or equivalent Ratio of lengths = 3:2 OR scale factor lengths 1.5 or 2/3 Length of longest edge = 18 (cm)	B1 M1 A1 A1	Or sight of division 297/132 or 132/297 *Award B1 for an answer of 27, linear scale factor implied* Or sight of $\sqrt{2.25}$ or equivalent Or equivalent CAO
14.Use of cosine rule with triangle ABC **and** ½ab sinC with triangle ACD $AC^2 = 8.8^2 + 7.2^2 - 2\times8.8\times7.2\times\cos84$ AC = 10.7719… Area ACD = ½ ×18.6 × AC × sin47 Answers in the range 72.7 to 73.5 (cm^2)	S1 M1 A2 M1 A1	Or alternative full strategy A1 for AC^2=116(.03…) FT their AC, but not 8.8, 7.2 or 18.6 CAO
15.(a) Sine curve Correct sine curve with 2 and 4 shown on the y-axes, and 360° shown or implied	M1 A1	Intention to sketch a portion of a sine curve minimum period 360° Accept an implied vertical scale, use of graduations
15.(b) $3.5 = \sin x + 3$ OR $\sin x = 3.5 – 3$ OR $\sin x = 0.5$ 30° and 150° only (no other values)	M1 A2	 A1 for either answer
15.(c) Explanation, e.g. translation horizontal 90°, so implies Denia is correct	E2	E1 for shift horizontal but no conclusion Accept answers illustrated with diagrams provided translation clear E1 for a correct trial, e.g. x=30, sin30 = cos-60 = 0.5

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