CCEA GCSE MATHEMATICS

MATHS



EXAM QUESTION PACK

UNIT T3 HIGHER TIER GMT31 PAPERS

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
January 2016

Mathematics

Unit T3 **(With calculator)**
Higher Tier



[GMT31]

GMT31

MONDAY 11 JANUARY, 9.15 am–11.15 am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page, on blank pages or tracing paper.
Complete in blue or black ink only. **Do not write with a gel pen.**
Answer **all twenty-eight** questions.
All working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

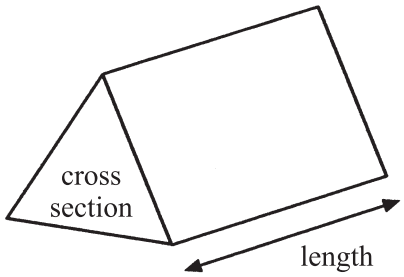
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in Questions **2** and **8(b)**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

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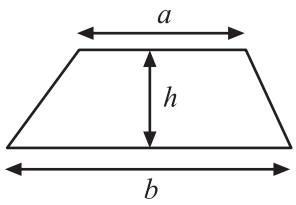
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Formula Sheet

Volume of prism = area of cross section × length

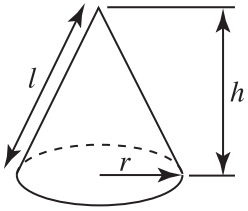


Area of trapezium = $\frac{1}{2}(a+b)h$



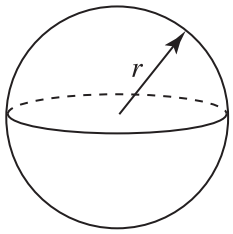
Volume of cone = $\frac{1}{3}\pi r^2 h$

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

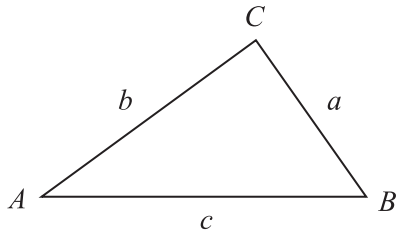


Volume of sphere = $\frac{4}{3}\pi r^3$

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



In any triangle *ABC*



Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

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

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 = $\frac{1}{2}ab\sin C$

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(Questions start overleaf)

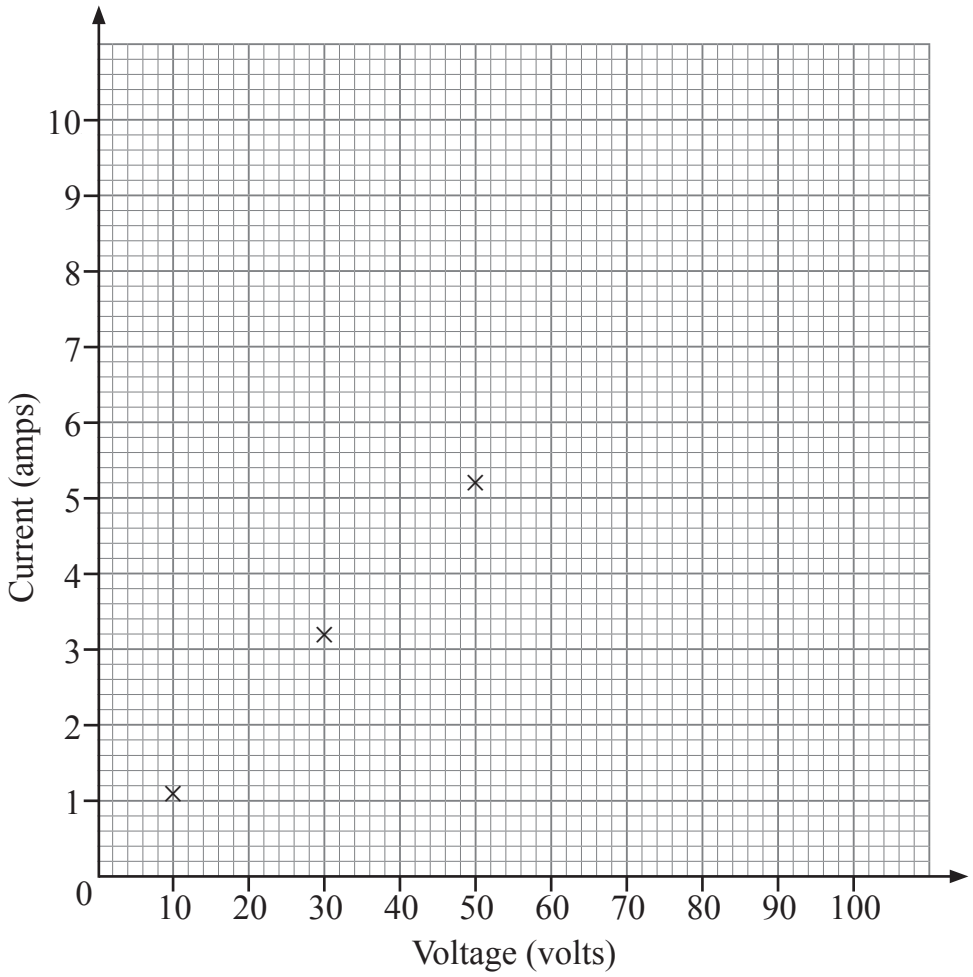
[Turn over

1 Nine science students each measured the current (in amps) that flowed through a circuit at various voltages.

Their results are recorded below.

Student	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Voltage	10	50	30	20	80	40	60	70	90
Current	1.1	5.2	3.2	1.9	8.2	3.7	3.8	6.5	9.3

(a) Draw a scatter graph of the points. The first three points have already been plotted.



[2]

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(b) Which student appears to have taken an incorrect reading?

Answer student _____ [1]

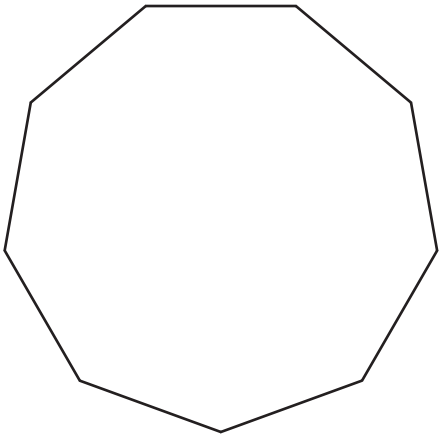
(c) Draw a line of best fit on your scatter graph. [1]

(d) Use the line of best fit to estimate the current for the incorrect reading taken by the student.

Answer current = _____ amps [1]

Quality of written communication will be assessed in this question.

2



This is a drawing of a regular nonagon (a shape with nine sides of equal length).

Explain why the size of an interior angle is 140°

[2]

[Turn over

3 In the diagram lines AB and CD are parallel.

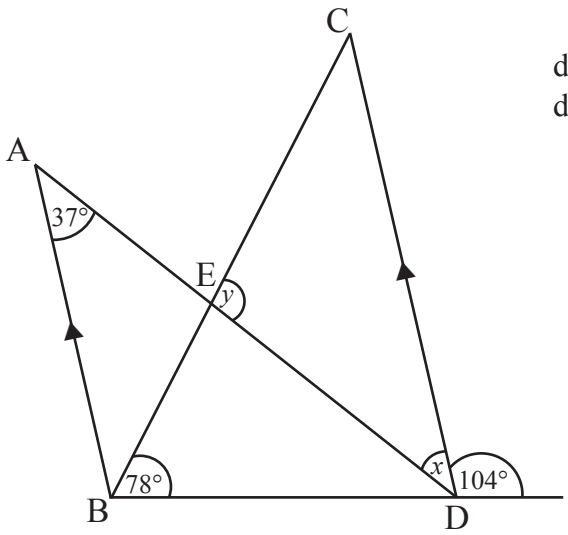


diagram not drawn accurately

(a) Find the size of the angle x.

Answer _____ ° [1]

(b) Calculate the size of the angle y.

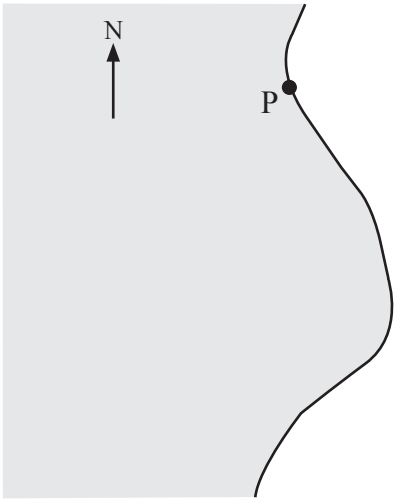
Answer _____ ° [2]

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4 A lifeboat leaves port P to answer an emergency call from a ship S.

The ship is 30 km from P on a bearing of 120°

Using a scale of 1 cm = 4 km, mark the position of the ship S.



[2]

[Turn over

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5 **(a)** What percentage is £35.25 of £47?

Answer _____ % [2]

(b) John bought a new phone for £44 plus 17.5% VAT.

Mark bought a similar phone in a different shop.

Mark paid £50.31 including VAT at 17.5%

Whose phone was more expensive and by how much?

Show all your working.

Answer _____ by £ _____ [3]

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6 Factorise fully each of the following:

(a) $12a + 6$

Answer _____ [1]

(b) $y^2 - 6y$

Answer _____ [1]

(c) $b + b^2$

Answer _____ [1]

[Turn over

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7 ABC is a triangle.

The length of the side AB is $(x + 2)$ cm.

(a) The length of the side AC is twice the length of the side AB.

Find an expression for the length of AC.

Answer _____ cm [1]

(b) The length of the remaining side CB is calculated by adding the lengths of the sides AB and AC together and subtracting 7 cm.

Find an expression for the length of CB.

Answer _____ cm [1]

(c) The perimeter of the triangle ABC is 20 cm.

Form an equation and solve it to find the length of the side AB.

Answer AB = _____ cm [3]

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[Turn over

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Quality of written communication will be assessed in part (b) of this question.

8 Pupils are asked to investigate the number of electronic devices such as mobile phones, tablets, laptops etc. that people own.

(a) Joanne surveys her classmates and her results are recorded in the frequency table below.

Number of devices	Frequency
0	3
1	5
2	6
3	4
4	5
5	2
6	3

Calculate the mean number of devices for Joanne's classmates.

Answer _____ [3]

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(b) Paula surveys 100 people at random coming out of the Leisure Centre one Saturday morning. She calculates the mean for her results to be 3.4

Whose value should give a better estimate for the mean for the whole population?

Give 2 reasons for your answer.

[2]

9 **Without using a calculator** and showing every step in your working, calculate $\frac{2}{9} \div 4$ giving your answer in its simplest form.

Answer _____ [2]

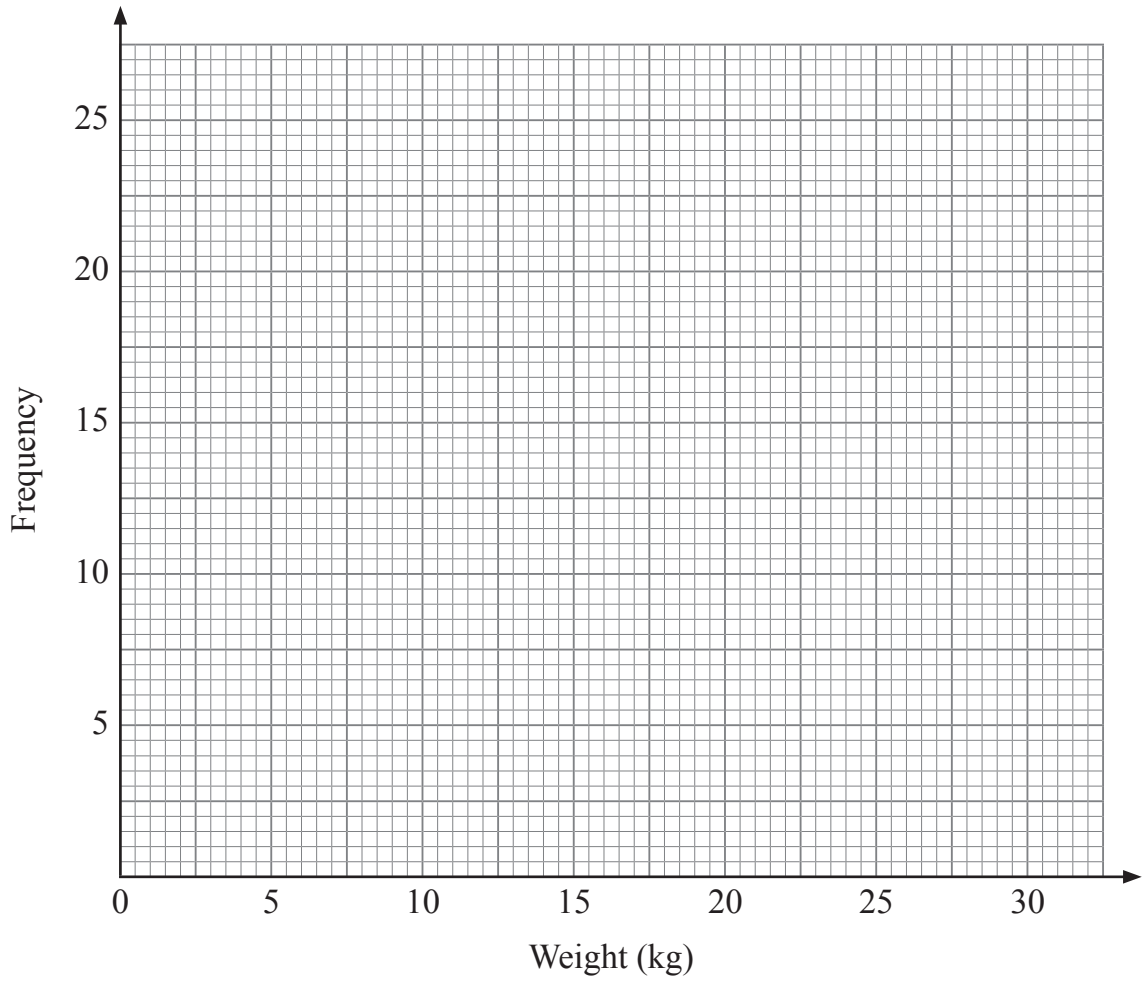
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10 The table below shows the weight of suitcases checked in for a flight.

Weight (kg)	Frequency
$0 < w \leqslant 5$	2
$5 < w \leqslant 10$	11
$10 < w \leqslant 15$	25
$15 < w \leqslant 20$	18
$20 < w \leqslant 25$	13
$25 < w \leqslant 30$	11

(a) Draw a frequency polygon for the data.



[2]

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(b) Which class interval contains the median weight?

Answer _____ [1]

(c) All luggage is charged at £20 per suitcase. A suitcase weighing over 20 kg has an additional charge of £7.50

How much money is charged for all the luggage on this flight?

Answer £ _____ [2]

11 **(a)** Write down the two numbers that are the square roots of 25

Answer _____ and _____ [1]

(b) Simplify the expression

$$\frac{e}{5} - \frac{e}{7}$$

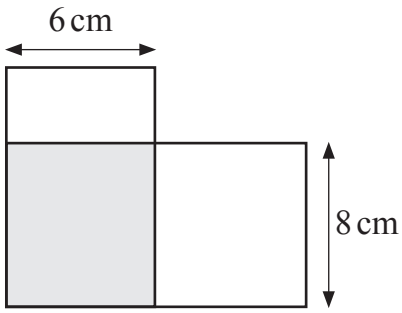
Answer _____ [3]

[Turn over

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12 A 10 cm × 6 cm rectangular card overlaps a 12 cm × 8 cm card as shown.

Calculate the area **not** shaded.



Answer _____ cm^2 [2]

13 A circular glass shaving mirror has a diameter of 21 cm.



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It has glass on both sides.

Calculate the **total** area of glass correct to the nearest whole number.

Answer _____ cm^2 [3]

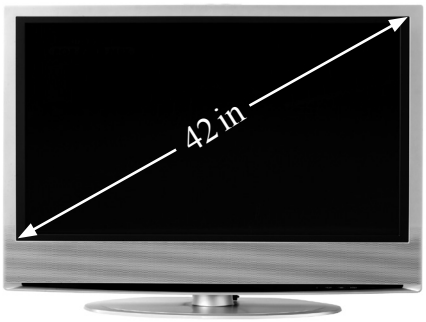
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14 The size of a television is given as the length of the diagonal of the screen.

This television has a size of 42 inches.

The height of the screen is 20.4 inches.

What is the width of the screen?



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Answer _____ inches [3]

15 A Christmas Log cake has a uniform cross-sectional area of 120 cm^2 and a length of 22 cm.

Calculate the volume of the cake.

Answer _____ cm^3 [2]

[Turn over

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16 **(a)** Write 200 as a product of its prime factors.

Give your answer in index notation.

Answer _____ [3]

(b) Hence find the smallest number you can multiply 200 by to make a cube number.

Answer _____ [1]

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17 Calculate the compound interest that £1 600 would earn after three years at 5% interest per annum.

Give your answer correct to the nearest £.

Answer £_____ [4]

[Turn over

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18 Use the method of trial and improvement to solve the equation

$x^3 - 6x = 12$

Give your answer correct to 1 decimal place.

Show all your working.

x	$x^3 - 6x$	

Answer $x =$ _____ [4]

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19 **(a)** Simplify

$5(t - 2) - 3(4 - 2t)$

Answer _____ [2]

(b) Expand and simplify $(e + 4)(e - 7)$.

Answer _____ [2]

20 **(a)** Complete the sentence with appropriate words:

As the age (in years) of a family car increases, its value in pounds (£)

_____ , hence there is _____ correlation. [1]

(b) Write down two variables (quantities) which would display no correlation.

_____ and _____ [1]

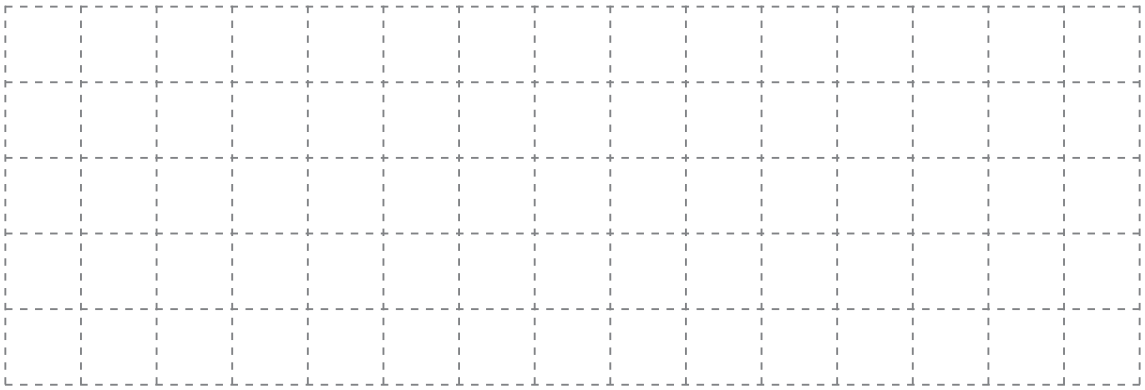
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21 In a group of 11 pupils, the number of days absent from school was recorded as listed below.

12 6 5 2 8 2 3 11 4 10 7

Draw a box plot for this data on the grid.



[4]

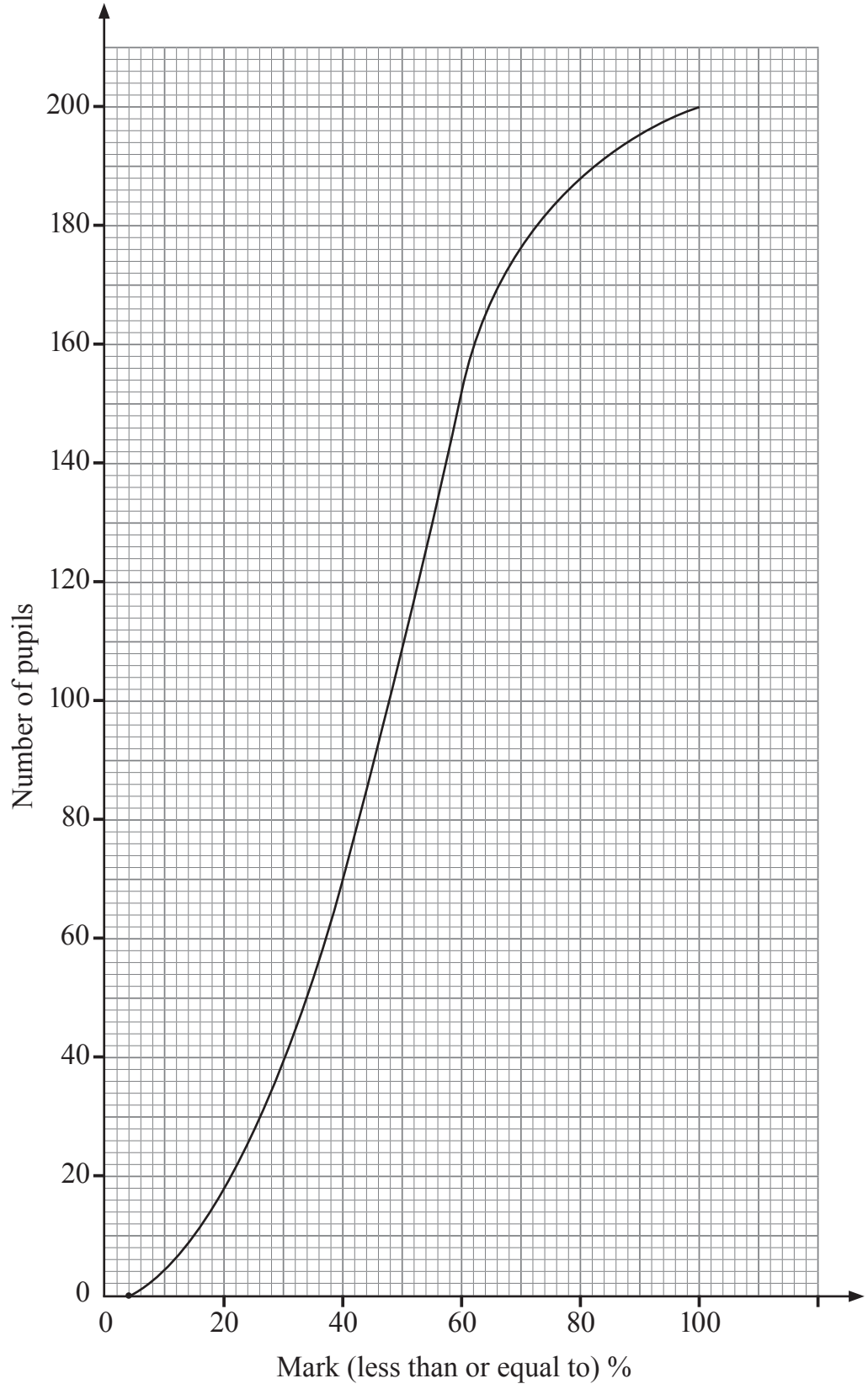
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[Turn over

22 Two hundred pupils sat an English test. The cumulative frequency curve for the percentage marks gained is shown.



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(a) Use the graph to complete table **(i)** and hence table **(ii)** below:

(i)

Percentage Mark	Cumulative Frequency
$\leqslant 20$	18
$\leqslant 40$	70
$\leqslant 60$	
$\leqslant 80$	
$\leqslant 100$	

[1]

(ii)

Percentage Mark	Frequency
$0 < p \leqslant 20$	18
$20 < p \leqslant 40$	52
$40 < p \leqslant 60$	
$60 < p \leqslant 80$	
$80 < p \leqslant 100$	

[2]

(b) Use the graph to estimate the median mark.

Answer _____ [1]

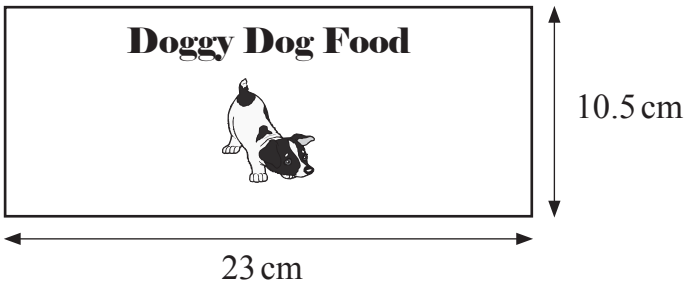
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23 The picture shows the dimensions of a label taken from a cylindrical tin of dog food.

The label covers all the curved surface of the tin with no overlap.

Calculate the volume of the tin.

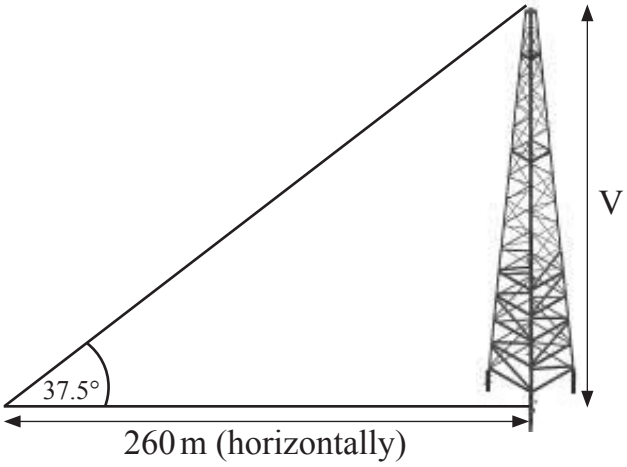


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Answer _____ cm^3 [4]

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24 Calculate the height V of this vertical radio mast.



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Answer _____ m [3]

25 The population of a town in 2014 was 80 058

This was a 65% increase on its population in 1994

What was the population in 1994?

Answer _____ [3]

[Turn over

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26 Solve

$(x - 5)(x + 5) = 24x$

Answer _____ [4]

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27 The total weight of 5 brown and 2 white eggs was 21.6 g.

The total weight of 3 brown and 5 white eggs was 23.6 g.

Write down two simultaneous equations and solve them to find the weight of a brown egg and the weight of a white egg.

You may assume that all brown eggs have the same weight and all white eggs have the same weight.

Show all your working.

Answer Brown egg weighs _____ g

White egg weighs _____ g [5]

[Turn over



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28 Solve

$$\frac{3x-2}{6} - \frac{x-2}{3} = \frac{7}{4}$$

Show all your working.

A solution by trial and improvement will not be accepted.

Answer $x =$ _____ [4]

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For Examiner's use only	
Question Number	**Marks**
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24	
25	
26	
27	
28	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
January 2016

Mathematics

Unit T3
(With calculator)
Higher Tier

[GMT31]

MONDAY 11 JANUARY

9.15 am–11.15 am

MARK SCHEME

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Introduction

The mark scheme normally provides the most popular solution to each question. Other solutions given by candidates are evaluated and credit given as appropriate; these alternative methods are not usually illustrated in the published mark scheme.

The solution to a question gains marks for correct method and marks for accurate working based on this method. The marks awarded for each question are shown in the right hand column and they are prefixed by the letters **M**, **A** and **MA** as appropriate. The key to the mark scheme is given below:

M indicates marks for correct method.

A indicates marks for accurate working, whether in calculation, reading from tables, graphs or answers. Accuracy marks may depend on preceding **M** (method) marks, hence **M**0 **A**1 cannot be awarded, i.e. where the method is not correct no marks can be given.

MA indicates marks for combined method and accurate working.

C indicates marks for quality of written communication.

A later part of a question may require a candidate to use an answer obtained from an earlier part of the same question. A candidate who gets the wrong answer to the earlier part and goes on to the later part is naturally unaware that the wrong data is being used and is actually undertaking the solution of a parallel problem from the point at which the error occurred. If such a candidate continues to apply correct method, then the candidate's individual working must be **followed through** from the error. If no further errors are made, then the candidate is penalised only for the initial error. Solutions containing two or more working or transcription errors are treated in the same way. This process is usually referred to as "follow-through marking" and allows a candidate to gain credit for that part of a solution which follows a working or transcription error.

It should be noted that where an error trivialises a question, or changes the nature of the skills being tested, then as a general rule, it would be the case that not more than half the marks for that question or part of that question would be awarded; in some cases the error may be such that no marks would be awarded.

Positive marking:

It is our intention to reward candidates for any demonstration of relevant knowledge, skills or understanding. For this reason we adopt a policy of **following through** their answers, that is, having penalised a candidate for an error, we mark the succeeding parts of the question using the candidate's value or answers and award marks accordingly.

Some common examples of this occur in the following cases:

(a) a numerical error in one entry in a table of values might lead to several answers being incorrect, but these might not be essentially separate errors;

(b) readings taken from candidates' inaccurate graphs may not agree with the answers expected but might be consistent with the graphs drawn.

When the candidate misreads a question in such a way as to make the question easier, only a proportion of the marks will be available (based on the professional judgement of the examiner).

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General Marking Advice

(i) If the correct answer is seen in the body of the script and the answer given in the answer line is clearly a transcription error, full marks should be awarded.

(ii) If the answer is missing, but the correct answer is seen in the body of the script, full marks should be awarded.

(iii) If the correct answer is seen in working but a completely different answer is seen in the answer space, then some marks will be awarded depending on the severity of the error.

(iv) Work crossed out but not replaced should be marked.

(v) In general, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered (with no solution offered on the answer line), mark the poorest answer.

(vi) For methods not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work.

(vii) Where a follow through mark is indicated on the mark scheme for a particular part question, the marker must ensure that you refer back to the answer of the previous part of the question.

(viii) Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen. E.g. the answer in the mark scheme is 4.65 and the candidate then correctly rounds to 4.7 or 5 on the answer line. Allow full marks for 4.65 seen in the working.

(ix) Anything in the mark scheme which is in brackets (...) is not required for the mark to be earned, but if present it must be correct.

(x) For any question, the range of answers given in the mark scheme is inclusive.

Quality of written communication

In GCSE Mathematics, particular questions are identified where candidates must demonstrate the quality of their written communication.

In particular, candidates must:

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear (i.e. comprehension and meaning is clear by using the correct notation and labelling conventions);

(ii) select and use a form and style of writing appropriate to their purpose and to complex subject matter (i.e. reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning); and

(iii) organise information clearly and coherently, using specialist vocabulary where appropriate (i.e. the mathematical methods and processes used are coherently and clearly organised and appropriate mathematical vocabulary used).

This assessment may be through, for example, an explanation of the geometrical properties of a given shape or, for example, through concise mathematical argument in a multi-step problem.

				AVAILABLE MARKS
1	**(a)**	6 points correct (any 4 correct)	A2 (A1)	
	(b)	Student 7	A1	
	(c)	appropriate lobf	A1	
	(d)	appropriate reading	MA1	5
2		QWC (Exterior angle) = 360 ÷ 9 = 40	C1	
		(Interior angle) = 180 – 40 = 140	C1	2
		or		
		(Interior) = (180 × 7) ÷ 9 = 140	C2	
3	**(a)**	37°	A1	
	(b)	ABE = 104 − 78 = 26° AEB = 180 − (26 + 37) = 117° = y or EDB = 180 − (104 + 37) = 39° BED = 180 − (78 + 39) = 63° y = 180 − 63 = 117° or BDC = 76° BCD = 180 – (76 + 78) = 26° y = 180 – (26 + 37) = 117°	MA1 MA1 MA1 MA1 MA1 MA1	3
4		Correct length of 7.5 cm Correct bearing of 120°	MA1 MA1	2
5	**(a)**	$\frac{35.25}{47} \times 100$	MA1	
		= 75%	A1	
	(b)	John's phone $\frac{17.5}{100} \times 44$ **or** £7.70 John's phone cost £51.70 John's phone is dearer by £51.70 – £50.31 = £1.39	MA1 MA1 MA1	5
6	**(a)**	$6(2a + 1)$	A1	
	(b)	$y(y - 6)$	A1	
	(c)	$b(1 + b)$	A1	3

				AVAILABLE MARKS
7	**(a)**	AC = $2(x + 2)$ or $2x + 4$	MA1	
	(b)	CB = $x + 2 + 2x + 4 - 7$ **or** $3x - 1$ **or** $x + 2 + 2(x + 2) - 7$	MA1	
	(c)	$x + 2 + 2x + 4 + 3x - 1 = 20$	MA1	
		$6x + 5 = 20$		
		$x = 2\frac{1}{2}$	MA1	
		AB = $4\frac{1}{2}$	A1	5
8	**(a)**	$3 \times 0 + 5 \times 1 + 6 \times 2 + 4 \times 3 + 5 \times 4 + 2 \times 5 + 3 \times 6$ $f(x)$	M1	
		$= \frac{77}{28}$	MA1	
		$= 2.75$	A1	
	(b)	Paula (i) bigger sample (ii) age group variety of sample random people	C2	5
9		$\frac{2}{9} \times \frac{1}{4}$	A1	
		$= \frac{2}{36}$		
		$= \frac{1}{18}$	A1	2
10	**(a)**	Frequency polygon	M1	
		All frequencies correct at midpoint with straight lines	A1	
	(b)	$15 < w \leqslant 20$	A1	
	(c)	$80 \times 20 + 24 \times 7.50 =$ £1780	M1 A1	
		alternatively		
		$(2 + 11 + 25 + 18) \times 20 + 24 \times 27.50 =$ £1780	M1 A1	5
11	**(a)**	5 and –5	A1	
	(b)	$\frac{7e}{35} - \frac{5e}{35}$	MA1 MA1	
		$= \frac{2e}{35}$	A1	4
12		Area = $6 \times 2 + 8 \times 6$	MA1	
		$= 60$	A1	2

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			AVAILABLE MARKS
13	Area $= \pi \times 10.5^2$	M1	
	$= 692.7(211801\ldots)$ **or** 2×346.36 **or** $2 \times \pi \times 10.5^2$	MA1	
	$= 693$	A1	3
14	$w^2 + 20.4^2 = 42^2$	MA1	
	$w^2 = 1347.84$	MA1	
	$= 36.7(129405)$	A1	3
15	Volume $= 120 \times 122$	M1	
	$= 2640$	A1	2
16	**(a)** Correct method used	M1	
	$2 \times 2 \times 2 \times 5 \times 5$	A1	
	$2^3 \times 5^2$	A1	
	(b) 5	A1	4
17	Year 1 £1600 × 0.05 = £80	MA1	
	Year 2 £1680 × 0.05 = £84	MA1	
	Year 3 £1764 × 0.05 = £88.20	MA1	
	Total interest = £252.20 = £252	MA1	4
18	$3^3 - 6 \times 3 = 9$		
	$4^3 - 6 \times 4 = 40$	MA1	
	$3.1^3 - 6 \times 3.1 = 11.191$		
	$3.2^3 - 6 \times 3.2 = 13.568$	MA1	
	$3.15^3 - 6 \times 3.15 = 12.355875$	MA1	
	Ans = 3.1	A1	4
19	**(a)** $5t - 10 - 12 + 6t$	MA1	
	$11t - 22$	A1	
	(b) $e^2 - 7e + 4e - 28$	MA1	
	$e^2 - 3e - 28$	A1	4
20	**(a)** Decrease, negative	A1	
	(b) Any suitable **numerical** variables which display no correlation	A1	2

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			AVAILABLE MARKS
21	Arranged in order	MA1	
	Median = 6	A1	
	Minimum/Maximum = 2, 12	A1	
	Quartiles = 3, 10	A1	4
22	**(a)** **(i)** **18**, **70**, 152, 188, 200	A1	
	(ii) **18**, **52**, 82, 36, 12	M1 A1	
	(b) 48	MA1	4
23	Radius $= 23 \div 2\pi = 3.66\,(056369\ldots)$	M1 A1	
	Volume $= \pi \times (3.66)^2 \times 10.5$	MA1	
	$= 442.0\,(130657\ldots)$	A1	4
24	$\text{Tan}\left(37.5 = \frac{V}{260}\right)$	MA1	
	$260 \tan 37.5 = V$	MA1	
	199.5 (050169)	A1	3
25	$165\% = 80058$	MA1	
	$1\% = \frac{80058}{165} = 485.2$	MA1	
	$100\% = 48520$	A1	3
26	$x^2 - 25 = 24x$	MA1	
	$x^2 - 24x - 25 = 0$	MA1	
	$(x - 25)(x + 1) = 0$	MA1	
	$x = 25$ or -1	MA1	4
27	$5b + 2w = 21.6$ $3b + 5w = 23.6$	MA1	
	$25b + 10w = 108$ or $15b + 25w = 118$	MA1	
	$6b + 10w = 47.2$ $\quad$ $15b + 6w = 64.8$	MA1	
	$19b = 60.8$ $\quad$ $19w = 53.2$		
	$b = 3.2$ $\quad$ $w = 2.8$	A1	
	$16 + 2w = 21.6$ $\quad$ $5b + 5.6 = 21.6$		
	$w = 2.8$ $\quad$ $b = 3.2$	A1	5
28	$2(3x - 2) - 4(x - 2) = 21$	MA1	
	$6x - 4 - 4x + 8 = 21$	MA1	
	$2x = 17$	MA1	
	$x = 8.5\left(\frac{17}{2}\right)$	A1	4
		Total	**100**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015

Mathematics

Unit T3 **(With calculator)**

Higher Tier



[GMT31]

GMT31

THURSDAY 21 MAY, 9.15 am–11.15 am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page, on blank pages or tracing paper.
Complete in blue or black ink only. **Do not write with a gel pen**.
Answer **all twenty-seven** questions.
Any working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **Questions 3** and **23**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

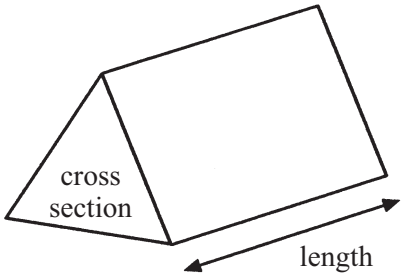
9466

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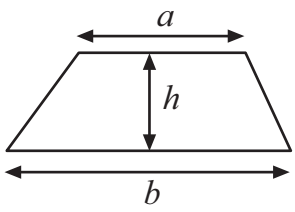
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Formula Sheet

Volume of prism = area of cross section × length

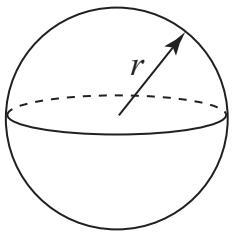


Area of trapezium = $\frac{1}{2}(a+b)h$



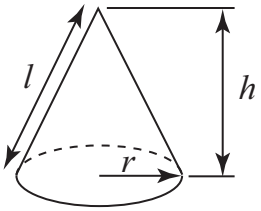
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

Curved surface area of cone = πrl

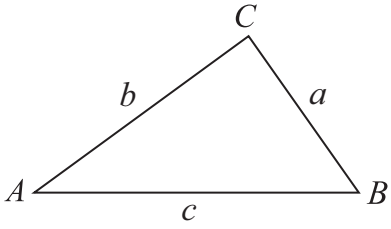


Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

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

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 = $\frac{1}{2}ab\sin C$

9466

1 The number of goals scored in each match in a football tournament are recorded in the table.

Number of Goals	Frequency	
0	2	
1	8	
2	13	
3	10	
4	9	
5	5	
6	2	
7	1	

Calculate the mean number of goals.

Answer _____ [3]

2 A salesman recorded the average temperature (°C) and his cold drink sales (£) during 8 weeks of the summer.

	Week 1	**Week 2**	**Week 3**	Week 4	Week 5	Week 6	Week 7	Week 8
Average Temperature (°C)	**12**	**14**	**18**	13	16	15	14	18
Sales (£)	**204**	**268**	**392**	236	328	298	282	380

The first three points have already been plotted.

(a) Use the data to complete the scatter graph. [2]

(b) Draw the line of best fit. [1]

(c) In week 9 the average temperature was 17°C.

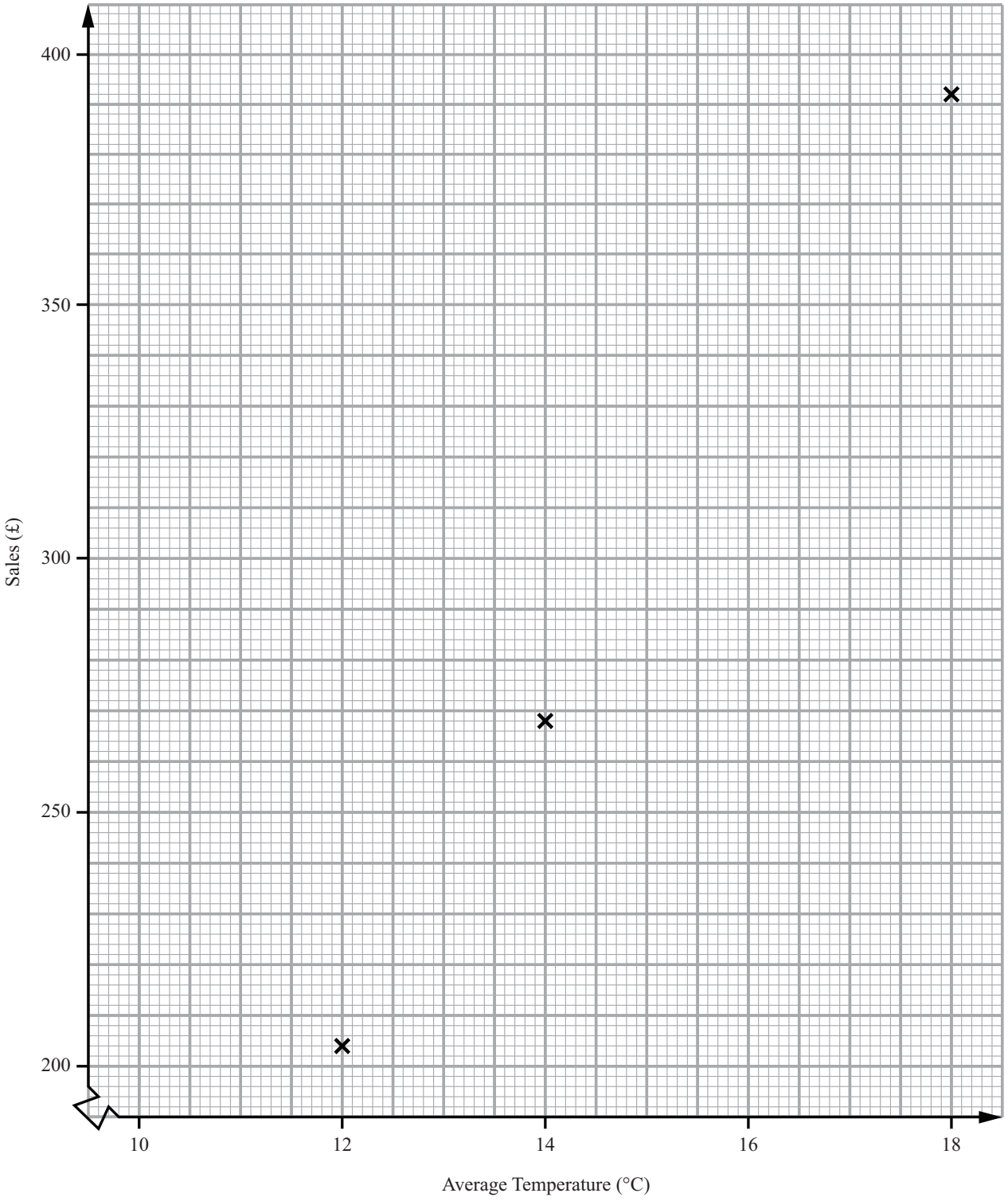
Estimate the sales for week 9

Answer £ _____ [1]

(d) What type of correlation does your graph show?

Answer _____ [1]

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[Turn over

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Quality of written communication will be assessed in this question.

3 Jean and Joyce are both pupils at Eastwood Girls High School and they want to know how many times a month, on average, the people in their town go to church.

(a) Jean asks 300 pupils in her school.

Give **two** reasons why Jean's sample may not be representative of the people in her town.

Reason 1 _____

_____ [1]

Reason 2 _____

_____ [1]

(b) Joyce stands outside her local church and asks 300 people on their way in to church.

Give **one** reason why Joyce's sample is biased.

Reason _____

_____ [1]

4 An airport had 123 planes departing one day.
46 of these planes departed late.
What percentage were late?
Give your answer correct to one decimal place.

Answer _____ % [3]

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5 Grapefruit cost g pence each.
Mangoes cost m pence each.
Sarah buys 3 grapefruit and 4 mangoes.
The total cost is £5.
Write down an equation containing g and m.

Answer _____ [3]

6 **(a)** Expand $m(m + 8)$

Answer _____ [2]

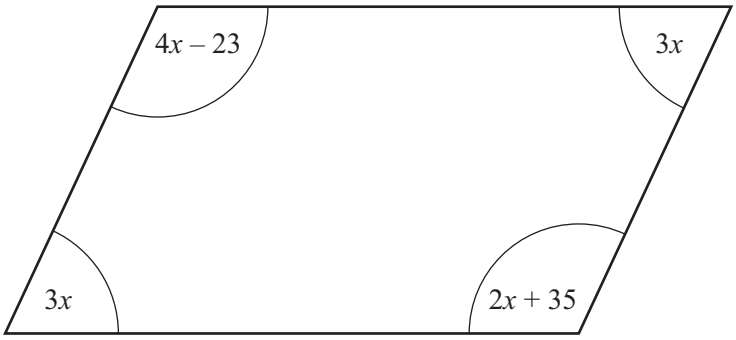
(b) Simplify $\frac{b}{5} - \frac{b}{8}$

Answer _____ [3]

[Turn over

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7



The diagram above is a parallelogram.
The sizes of the angles in degrees are $3x$, $4x - 23$, $3x$ and $2x + 35$
Work out the value of x.

Answer $x =$ _____ [3]

8 The price of a coat in a shop is £129
Pat has £100 but he has also a discount card which allows him 20% off the shop price.
Does he have enough money to buy the coat using his discount card?
You must show working to explain your answer.

[3]

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9 a and b are different prime numbers less than 20

(a) Find a value for a and a value for b so that $a + b$ is a square number.

Answer $a =$ _____ , $b =$ _____ [2]

(b) Find a value for a and a value for b so that $a + b$ is a **different** square number.

Answer $a =$ _____ , $b =$ _____ [2]

[Turn over

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10 A regular polygon has an interior angle of 150°

(a) How many sides does it have?

Answer _____ [2]

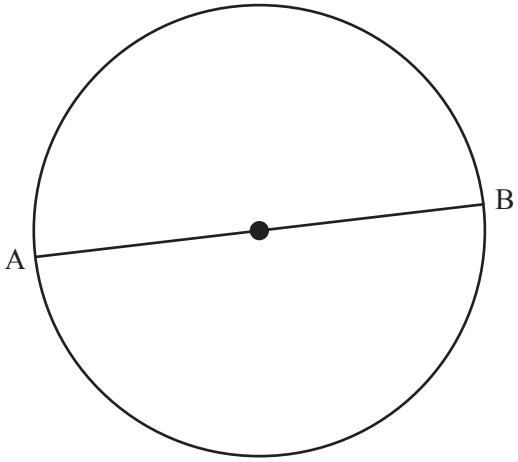
(b) Two of these polygons are placed edge to edge.

What regular shape would fit exactly in the space beside these touching edges?

Answer _____ [2]

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11

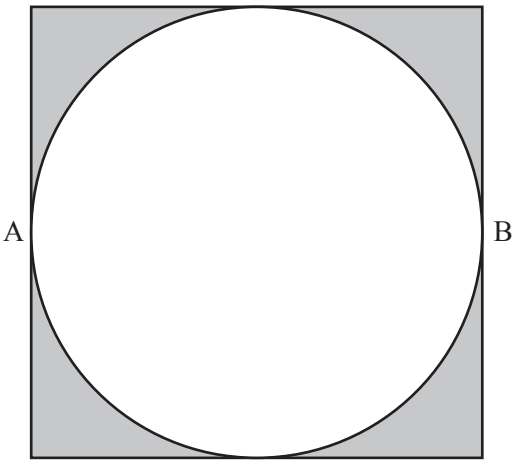


(a) AB is a diameter of the circle. AB is 13 cm.

Calculate the area of the circle.

Answer _____ [3]

(b) This circle is now set inside a square as shown. Find the shaded area.



Answer _____ [2]

[Turn over

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12 Solve the equation $\frac{4y}{5} - 3 = 9$

Answer $y =$ _____ [3]

13 Five years ago 123 million CDs were sold in the UK.
69.4 million were sold last year.
Work out the percentage fall in sales of CDs.

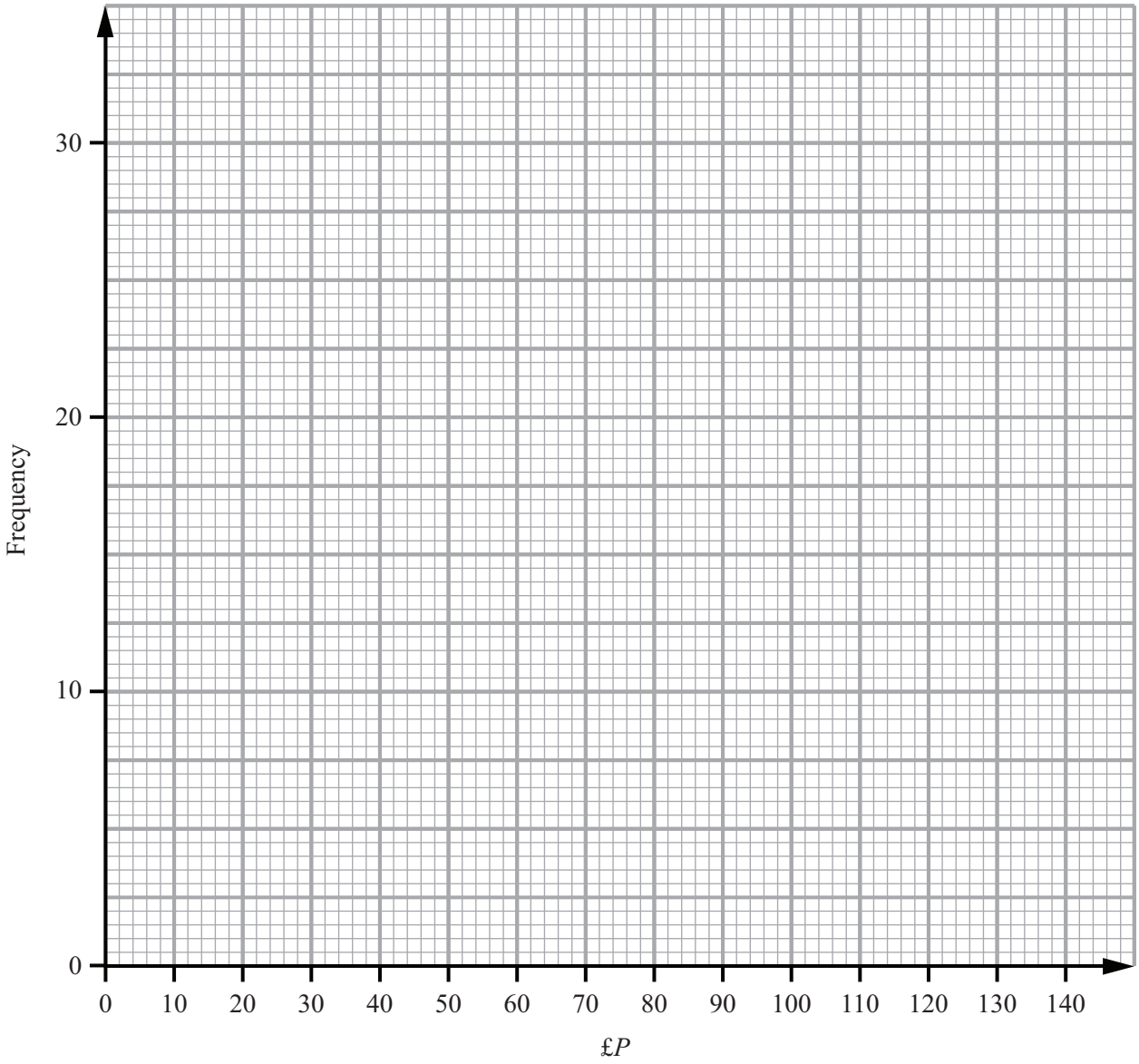
Answer _____% [3]

14 100 shoppers were asked how much they spent on food in one week.

Amount spent (£*P*)	**Frequency**
$20 < P \leqslant 40$	8
$40 < P \leqslant 60$	30
$60 < P \leqslant 80$	28
$80 < P \leqslant 100$	27
$100 < P \leqslant 120$	5
$120 < P \leqslant 140$	2

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



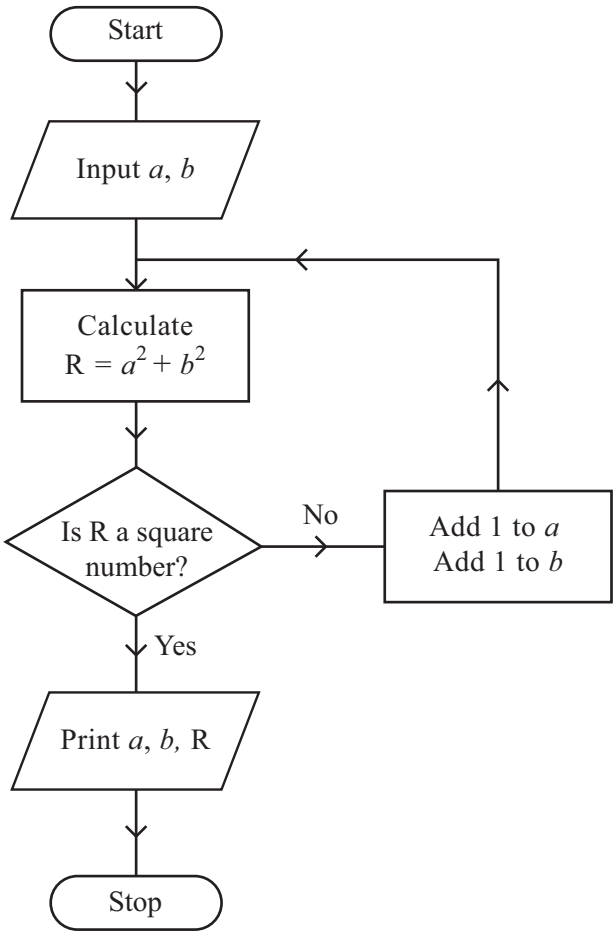
(b) Which class interval contains the median?

Answer _____ [1]

[Turn over

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15

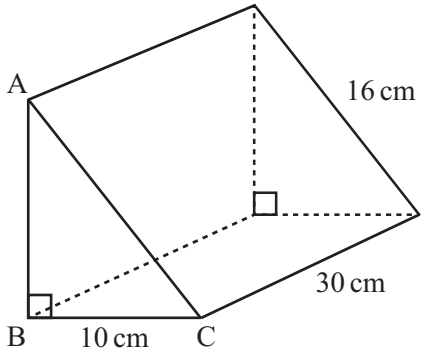


Starting with $a = 6$, $b = 13$ use the flow chart to find the values printed.

a	b	R
6	13	

Answer $a =$ _____ , $b =$ _____ , R = _____ [3]

16 In the triangular prism ABC is a right-angled triangle.



(a) Calculate the length of AB.

Answer _____ cm [3]

(b) Calculate the volume of the prism.

Answer _____ cm^3 [3]

[Turn over

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17 The equation $x^3 + 4x^2 = 100$ has a solution between 1 and 5
Use a trial and improvement method to find this solution.
Give your answer correct to one decimal place.
You must show all your working.

Answer $x =$ _____ [4]

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18 John thinks of a number.
He multiplies it by 9 and subtracts 4
The answer is three times the number he started with.
Work out the starting number.

Answer _____ [2]

[Turn over

19 **(a)** **(i)** Write 30 as a product of prime factors.

Answer 30 = _____ [1]

(ii) Write 22 as a product of prime factors.

Answer 22 = _____ [1]

(b) An airport bus leaves the city hall every 30 minutes.
A shuttle bus leaves the city hall every 22 minutes.
An airport bus and a shuttle bus both leave the city hall at 8.00 am.
At what time will an airport bus and a shuttle bus next leave the city hall at the same time?

Answer _____ [3]

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(Questions continue overleaf)

[Turn over

20 The times that students spent doing homework during one week were recorded as shown in the table.

Time t (hours)	Frequency	Cumulative Frequency
$0 < t \leqslant 5$	18	
$5 < t \leqslant 10$	30	
$10 < t \leqslant 15$	32	
$15 < t \leqslant 20$	15	
$20 < t \leqslant 25$	5	

(a) (i) Complete the table. [1]

(ii) Hence draw the cumulative frequency graph on the opposite page. [3]

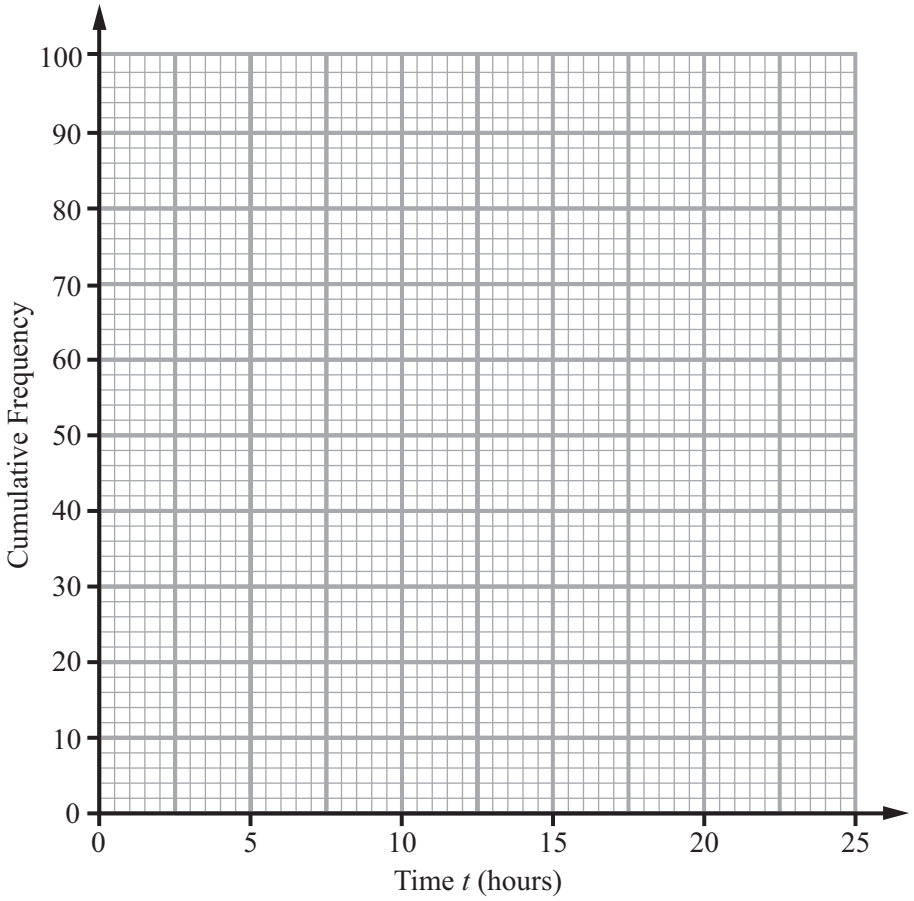
(b) Use the graph to estimate the median.

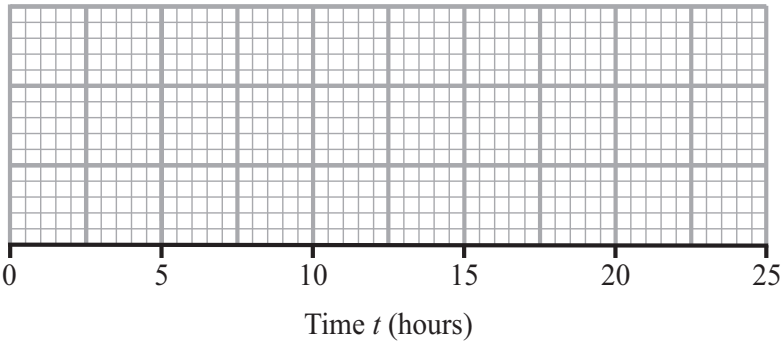
Answer _____ hours [1]

(c) The least time was 2 hours and the greatest time was 24 hours.

Draw a box plot on the grid opposite to illustrate this information. [3]

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[Turn over

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21 Expand and simplify $(3w - 7)(5w - 8)$

Answer _____ [2]

22 The first three terms of a sequence are $\frac{1}{2}, \frac{2}{3}, \frac{3}{4} \ldots$

Write down the n^{th} term.

Answer _____ [1]

Quality of written communication will be assessed in this question.

23 Marie gets a basic monthly salary of £560 plus a commission of 22% of her sales that month.
In April her total salary was £3299
Work out her sales in April.

Answer £ _____ [3]

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24 Solve the simultaneous equations $5x + 2y = 19$
$4x - 3y = 29$

A solution by trial and improvement will not be accepted.

Answer $x =$ _____ , $y =$ _____ [4]

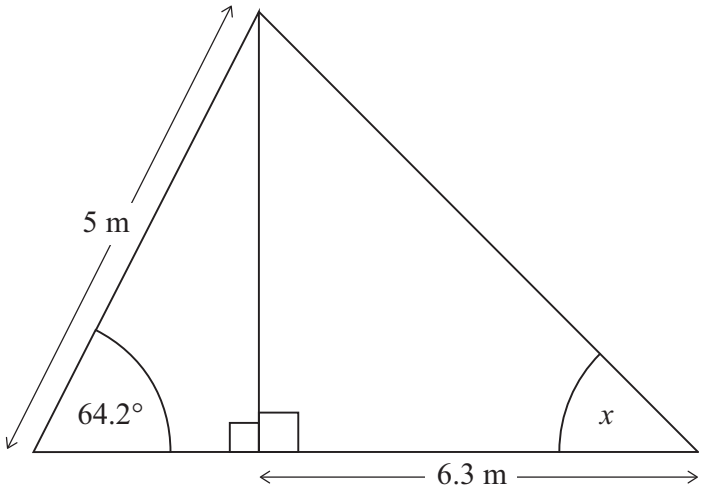
25 Factorise fully $14x^2y - 35x$

Answer _____ [2]

[Turn over

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26 Find the value of the angle marked x in the triangle shown.



Answer $x =$ _____ ° [6]

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27 Solve the equation $\frac{2x+3}{4} + \frac{x-1}{3} = 5$

Show all your work.

Answer $x =$ _____ [4]

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For Examiner's use only	
Question Number	**Marks**
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23	
24	
25	
26	
27	
Total Marks	

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Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2015

Mathematics

Unit T3
Higher Tier

[GMT31]

THURSDAY 21 MAY

9.15 am–11.15 am

MARK SCHEME

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Introduction

The mark scheme normally provides the most popular solution to each question. Other solutions given by candidates are evaluated and credit given as appropriate; these alternative methods are not usually illustrated in the published mark scheme.

The solution to a question gains marks for correct method and marks for accurate working based on this method. The marks awarded for each question are shown in the right hand column and they are prefixed by the letters **M**, **A** and **MA** as appropriate. The key to the mark scheme is given below:

M indicates marks for correct method.
A indicates marks for accurate working, whether in calculation, reading from tables, graphs or answers. Accuracy marks may depend on preceding **M** (method) marks, hence **M**0 **A**1 cannot be awarded, i.e. where the method is not correct no marks can be given.
MA indicates marks for combined method and accurate working.
C indicates marks for quality of written communication
oe indicates "or equivalent" i.e. where a solution can be expressed in an alternative correct form, e.g. $\frac{1}{4} = 0.25$
ft indicates "follow through". See explanation below.

A later part of a question may require a candidate to use an answer obtained from an earlier part of the same question. A candidate who gets the wrong answer to the earlier part and goes on to the later part is naturally unaware that the wrong data is being used and is actually undertaking the solution of a parallel problem from the point at which the error occurred. If such a candidate continues to apply correct method, then the candidate's individual working must be **followed through** from the error. If no further errors are made, then the candidate is penalised only for the initial error. Solutions containing two or more working or transcription errors are treated in the same way. This process is usually referred to as "follow-through marking" and allows a candidate to gain credit for that part of a solution which follows a working or transcription error.

It should be noted that where an error trivialises a question, or changes the nature of the skills being tested, then as a general rule, it would be the case that not more than half the marks for that question or part of that question would be awarded; in some cases the error may be such that no marks would be awarded.

Positive marking

It is our intention to reward candidates for any demonstration of relevant knowledge, skills or understanding. For this reason we adopt a policy of **following through** their answers, that is, having penalised a candidate for an error, we mark the succeeding parts of the question using the candidate's value or answers and award marks accordingly.

Some common examples of this occur in the following cases:

(a) a numerical error in one entry in a table of values might lead to several answers being incorrect, but these might not be essentially separate errors;

(b) readings taken from candidates' inaccurate graphs may not agree with the answers expected but might be consistent with the graphs drawn.

When the candidate misreads a question in such a way as to make the question easier, only a proportion of the marks will be available (based on the professional judgement of the examiner).

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General Marking Advice

(i) If the correct answer is seen in the body of the script and the answer given in the answer line is clearly a transcription error, full marks should be awarded.

(ii) If the answer is missing, but the correct answer is seen in the body of the script, full marks should be awarded.

(iii) If the correct answer is seen in working but a completely different answer is seen in the answer space, then some marks will be awarded depending on the severity of the error.

(iv) Work crossed out but not replaced should be marked.

(v) In general, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered (with no solution offered on the answer line), mark the poorest answer.

(vi) For methods not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work.

(vii) Where a follow through mark is indicated on the mark scheme for a particular part question, the marker must ensure that you refer back to the answer of the previous part of the question.

(viii) Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen. E.g. the answer in the mark scheme is 4.65 and the candidate then correctly rounds to 4.7 or 5 on the answer line. Allow full marks for 4.65 seen in the working.

(ix) Anything in the mark scheme which is in brackets (...) is not required for the mark to be earned, but if present it must be correct.

(x) For any question, the range of answers given in the mark scheme is inclusive.

(xi) Incorrect money notation will generally lose one mark but will be penalised only once per paper.

(xii) In general, a tolerance of ±2° is allowed in drawing angles, and ±2 mm in measuring length.

(xiii) In algebra, if further inaccurate work is done to a correct answer, some marks may be lost.

Quality of written communication

In GCSE Mathematics, particular questions are identified where candidates must demonstrate the quality of their written communication.

In particular, candidates must:

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear (i.e. comprehension and meaning is clear by using the correct notation and labelling conventions);

(ii) select and use a form and style of writing appropriate to their purpose and to complex subject matter (i.e. reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning); and

(iii) organise information clearly and coherently, using specialist vocabulary where appropriate (i.e. the mathematical methods and processes used are coherently and clearly organised and appropriate mathematical vocabulary used).

This assessment may be through, for example, an explanation of the geometrical properties of a given shape or, for example, through concise mathematical argument in a multi-step problem.

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			AVAILABLE MARKS
1			

fx
0
8
26
30
36
25
12
7

fx products	M1	
144 ÷ 50	M1	
2.88	A1	3
2 **(a)** 5 correct points (allow A1 for 3 correct)	A2	
(b) correct line of best fit	A1	
(c) follow candidate's line	A1	
(d) positive	A1	5
3 **(a)** she only asks girls **or** she only asks one age group **or** she doesn't ask any adults **or** the pupils may not be from her town	C2	
(b) she doesn't ask people who never go to church these people are on their way into church (so they are likely to go more often or similar)	C1	3
4 $\frac{46}{123} \times 100$	MA1	
37.398…	A1	
37.4	A1	3
5 $3g + 4m = 500$	A1, A1, A1	3
6 **(a)** $m^2 + 8m$	A1, A1	
(b) $\frac{8b}{40} - \frac{5b}{40}$	MA1, MA1	
$\frac{3b}{40}$	A1	5

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			AVAILABLE MARKS
7	$4x - 23 = 2x + 35$ **or** $3x + 4x - 23 + 3x + 2x + 35 = 360$	M1	
	$2x = 58$ **or** $12x = 348$	MA1	
	$x = 29$ $\quad$ $x = 29$	MA1	
	or $4x - 23 + 3x = 180$ **or** $3x + 2x + 35 = 180$	M1	
	$7x = 203$ $\quad$ $5x = 145$	MA1	
	$x = 29$ $\quad$ $x = 29$	MA1	3
8	20% = £25.80	MA1	
	129 – 25.80 = 103.20 **or** 100 + 25.80 = 125.80	MA1	
	No (as discounted price is more than £100)	A1	3
9	**(a)** (2, 7) **or** (3, 13) **or** (5, 11) **or** (17, 19)	A2	
	(b) values for a different square number	A2	4
10	**(a)** Exterior angle = 30	MA1	
	Number of sides = 360/30 = 12	MA1	
	(b) equilateral triangle	A2	4
	Allow A1 for sight of 60° in calculation or diagram		
11	**(a)** (Radius = 6.5 cm)		
	Area = $\pi \times 6.5^2$	M1	
	= 132.7(32…) cm^2	A1, A1 (units)	
	(b) Area of square = $13^2 = 169$	MA1	
	Area between square and circle = 169 – 132.7 = 36.3	A1	5
	Do not penalise for units in **(b)**		
12	$\frac{4y}{5} = 12$ **or** $4y - 15 = 45$	MA1	
	$4y = 60$ $\quad$ $4y = 60$	MA1	
	$y = 15$ $\quad$ $y = 15$	A1	3
13	53.6 million	MA1	
	$\frac{53.6}{123} \times 100$	M1	
	43.577…	A1	3
14	**(a)** correct points above midpoints	MA1	
	points joined	A1	
	(b) $60 < P \leqslant 80$	A1	3

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						AVAILABLE MARKS
15		6	13	205		
		7	14	245	MA1	
		8	15	289	MA1	
	Print	8	15	289	MA1	3
16	**(a)**	$x^2 + 10^2 = 16^2$			MA1	
		$x^2 = 256 - 100 = 156$			A1	
		$x = \sqrt{156} = 12.5$			A1	
	(b)	area of base $= \frac{1}{2}(10)(12.5) = 62.5$ (cm^2)			MA2	
		Volume $= 62.5 \times 30 = 1875$			MA1	6

17

x	$x^3 + 4x^2$	Comment
3.5	91.875	too low
3.6	98.496	too low
3.7	105.413	too high
3.65	101.917125	too high

between 3 and 4	MA1	
between 3.6 and 3.7	MA1	
Using 3.65	MA1	
3.6	A1	4

18 $9x - 4 = 3x$ M1

$6x = 4$

$x = \frac{2}{3}$ A1 2

19 **(a)** **(i)** $30 = 5 \times 3 \times 2$ A1

(ii) $22 = 11 \times 2$ A1

(b) use LCM of 30 and 22 M1

$11 \times 5 \times 3 \times 2 = 330$ minutes (= 5.5 hours) A1

1.30(pm) **or** 1330 A1 5

20 **(a)** **(i)** 18 48 80 95 100 A1

(ii) points at upper boundaries A1

points plotted correctly A1

smooth curve A1

(b) 10.3 follow candidate's curve MA1

(c) Median at 10.3, follow candidate's curve MA1

Quartiles at 6.3 and 14, follow candidate's curve MA1

Range: Start 2, End 24 MA1 8

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					AVAILABLE MARKS
21	$15w^2 - 24w - 35w + 56$			M1	
	$15w^2 - 59w + 56$			A1	2
22	$\frac{n}{n+1}$			A1	1
23	$3299 - 560 = 2739$			C1	
	$2739 = 22\%$			C1	
	12 450			C1	3
24	$15x + 6y = 57$	**or**	$20x + 8y = 76$	M1	
	$8x - 6y = 58$		$20x - 15y = 145$	M1	
	$23x = 115 \Rightarrow x = 5$		$23y = -69 \Rightarrow y = -3$	A1	
	$25 + 2y = 19$		$5x - 6 = 19$		
	$y = -3$		$x = 5$	A1	4
25	$7x(2xy - 5)$			A2	2
	(A1 for correct partial factorisation)				
26	$\sin 64.2 = h/5$			MA1	
	$h = 5 \sin 64.2$			A1	
	$h = 4.50159 \ldots$			A1	
	$\tan x = 4.50159 \ldots/6.3$			M1A1	
	$x = 35.547\ldots$			A1	6
27	$3(2x + 3) + 4(x - 1) = 60$			M1	
	$6x + 9 + 4x - 4 = 60$			MA1	
	$10x = 55$			MA1	
	$x = 5.5$ (or equivalent)			A1	4
				Total	**100**

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Rewarding Learning

Centre Number

7	1			

Candidate Number

General Certificate of Secondary Education
January 2015

Mathematics

Unit T3
(With calculator)
Higher Tier



[GMT31]

GMT31

FRIDAY 9 JANUARY, 9.15am–11.15am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided. Do not write outside the box, around each page, on blank pages or tracing paper.
Complete in blue or black ink only. **Do not write with a gel pen**.
Answer **all twenty-seven** questions.
Any working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

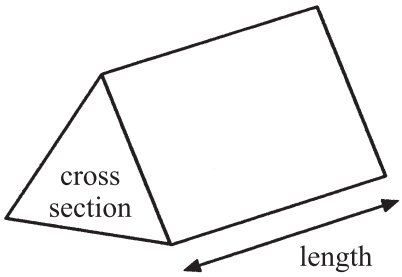
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **Questions 2 and 10**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

9312

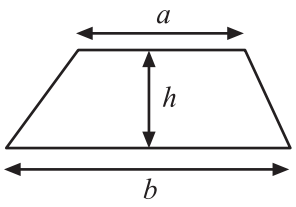
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Formula Sheet

Volume of prism = area of cross section × length

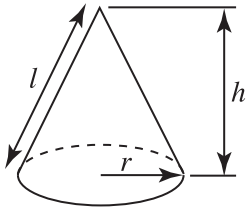


Area of trapezium $= \frac{1}{2}(a+b)h$



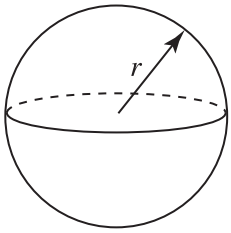
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

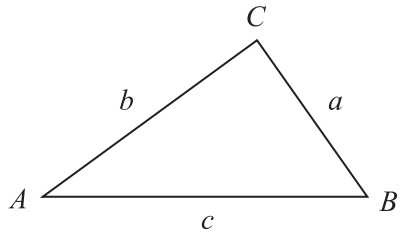


Volume of sphere $= \frac{4}{3}\pi r^3$

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



In any triangle *ABC*



Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

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

Sine Rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

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

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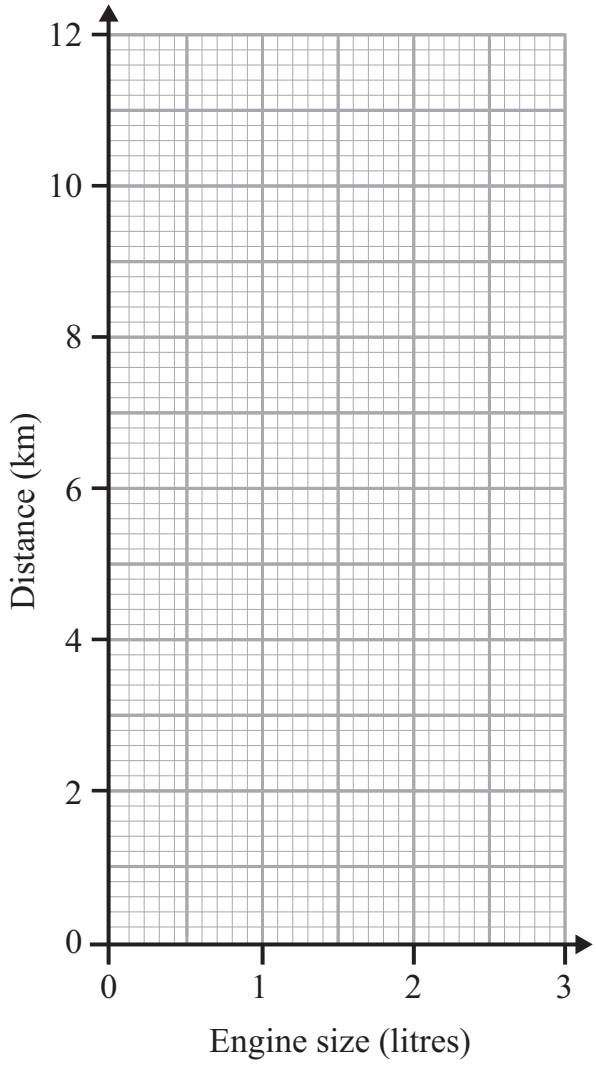
(Questions start overleaf)

[Turn over

1 The table shows the engine size (litres) of different cars and the distance (km) that the cars can travel on one litre of petrol.

Engine size	1.0	1.8	2.4	1.2	2.1	1.5	2.7
Distance	12	8.6	5	9.4	5.9	10.2	3.8

(a) Draw a scatter graph. [2]



(b) Draw a line of best fit. [1]

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(c) Another car travels 7 km on one litre of petrol. Use your line of best fit to estimate the engine size of this car.

Answer _____ litres [1]

[Turn over

Quality of written communication will be assessed in this question.

2 Joanne is having a party. She needs forty packets of crisps.
A single packet of crisps costs 30 pence in each of two local stores.
Each store has a special offer on packets of crisps.

Bargain Store	Discount Store
20% off	buy 3 and get
every ten packets	one more free

Which is better value?

Show your working clearly.

Answer _____ [4]

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3 Complete the spaces **(a)**, **(b)**, **(c)** and **(d)** on the electricity bill.

Northern Electricity					
	Meter Reading				
Date	Current units	Previous units	Units used	Price per unit	Total (£)
30 June	43458	42763	**(a)**	15 pence	**(b)** £
				VAT @ 5%	**(c)** £
				Total Charge	**(d)** £

[5]

[Turn over

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4 **(a)** Write the recurring decimal 0.375375375... using dot notation.

Answer _____ [1]

(b) Write $0.\dot{2}\dot{8}$ correct to 4 decimal places.

Answer _____ [1]

(c) Fill in the box to make the statement correct.

Explain how you get the missing number.

$$\frac{1}{\square} + \frac{2}{9} = \frac{5}{9}$$

[2]

5 **(a)** A toy lorry has 6 wheels and a toy car has 4 wheels.

Write down an expression for the **total** number of wheels on x lorries and y cars.

Answer _____ [2]

(b) Write down the first 3 terms of the sequence whose n^{th} term is $n^2 + 3$

Answer _____ , _____ , _____ [2]

[Turn over

6 The diagram shows a regular pentagon placed on top of a regular hexagon.

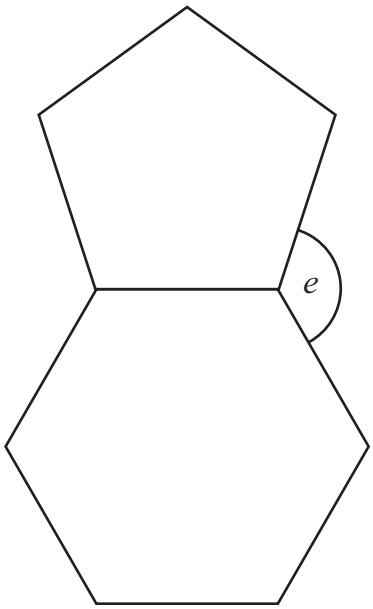


diagram not
drawn accurately

Calculate the size of the angle marked e.

Show all your working.

Answer e = _____ ° [4]

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7 ABCD is a parallelogram.

Angle DAB = 125°

Angle ADB = 37°

Angle CEB = 51°

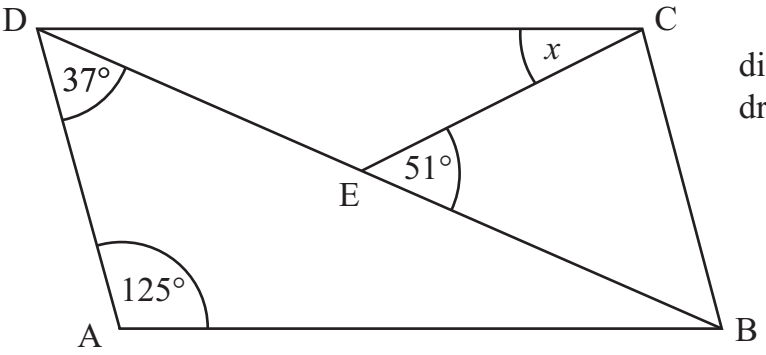


diagram not drawn accurately

Calculate the size of the angle x.

Answer x = _____ ° [4]

[Turn over

8 The bearing of a fishing boat from a lighthouse is 118°.

Work out the bearing of the lighthouse from the fishing boat.

Answer _____ ° [2]

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9 The marks for pupils in a test are shown.

12	58	39	40	52	59	43
59	26	39	44	42	56	54
58	43	47	24	27	26	30
26	38	56	36	36	35	12

Construct a stem and leaf diagram for these marks.

[3]

[Turn over

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Quality of written communication will be assessed in this question.

10 A questionnaire about their use of a mobile phone was given out to a sample of 20 people who left a supermarket between 10 am and 11 am on a Monday morning.

Give two reasons why this sample may not be very suitable.

Reason 1 _____

Reason 2 _____ [2]

11 Factorise

(a) $8x + 12$

Answer _____ [1]

(b) $x^2 + 7x$

Answer _____ [1]

12 P is the point (2, 3) and Q is the point (–4, –1).

Work out the coordinates of the midpoint of the line PQ.

Answer (_____ , _____) [2]

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13 The volume of oil in a tank **decreases** by 5% every hour.
At 11am there are 9000 litres of oil in the tank.
What will the volume of oil be at 2pm?

Answer _____ litres [3]

14 In a group of golfers there are 37 males and 23 females.
19 of the males are wearing glasses and 14 of the females are wearing glasses.
What percentage of the group are wearing glasses?

Answer _____ % [3]

[Turn over

15 The masses of 300 stones found on a beach are shown in the table.

Mass (g)	Number of stones		
$10 < m \leqslant 20$	33		
$20 < m \leqslant 30$	88		
$30 < m \leqslant 40$	57		
$40 < m \leqslant 50$	52		
$50 < m \leqslant 60$	43		
$60 < m \leqslant 70$	17		
$70 < m \leqslant 80$	10		

(a) Which interval contains the median mass?

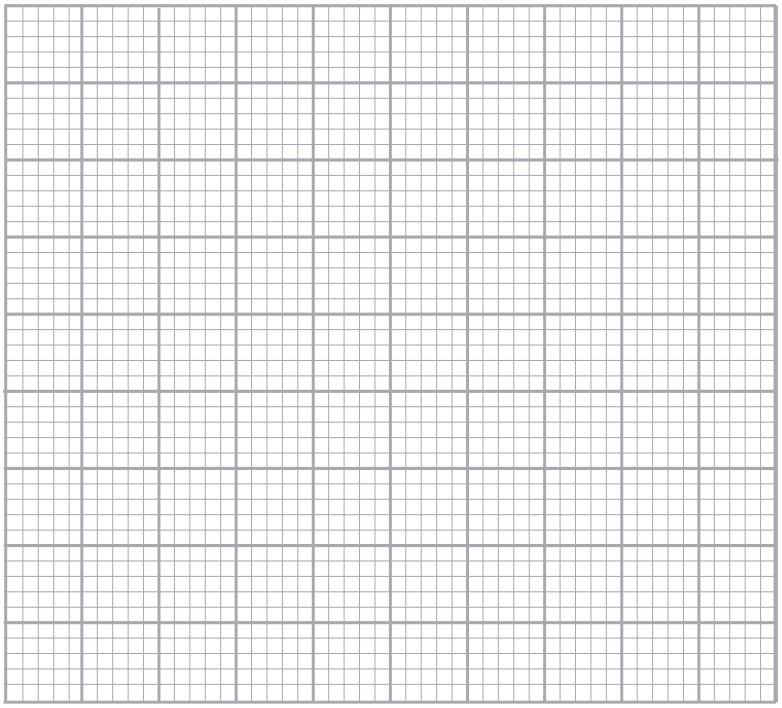
Answer _____ [1]

(b) Calculate an estimate of the mean mass of the stones.

Answer _____ g [3]

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(c) Draw a frequency polygon to represent the data. [4]



[Turn over

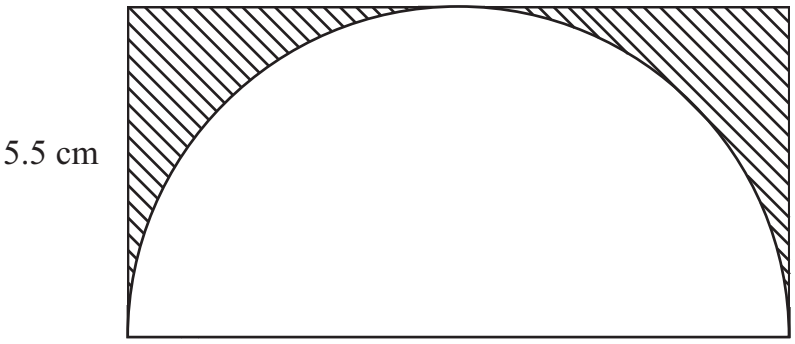
16 Write 600 as a product of prime factors.

Express your answer in index notation.

Answer _____ [3]

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17 The diagram shows a semicircle inside a rectangle.



Work out the area of the shaded region.

Answer _____ cm^2 [3]

18 A sheet of A4 paper measures 297 mm by 210 mm.
Work out the length between diagonally opposite corners.

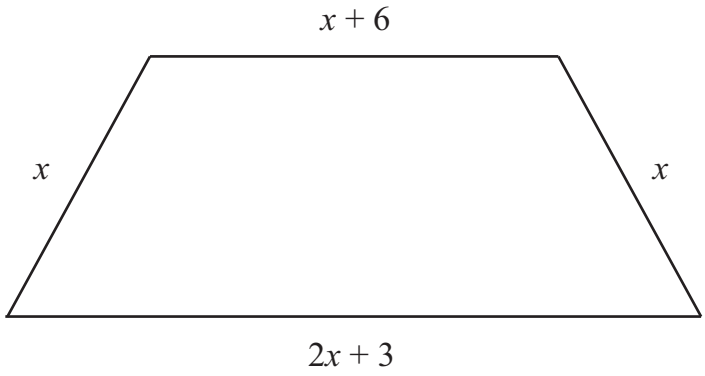
Answer _____ mm [3]

[Turn over

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19 **(a)** Write an expression, in terms of x, for the perimeter of the trapezium shown.

Give your answer in its simplest form.



Answer _____ [2]

(b) The perimeter of this trapezium is 34 cm.

(i) Using the perimeter, write down an equation in terms of x.

Equation _____ [1]

(ii) Solve the equation to find x.

Answer x = _____ [1]

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20 A solution to the equation $x^3 - 4x = 26$ lies between 3 and 4
Use trial and improvement to solve this equation.
Give your answer correct to 1 decimal place.
Show each stage of your working.

x	$x^3 - 4x$	

Answer $x =$ _____ [3]

[Turn over

21 In a survey, a group of people were asked to state their weekly wage. The results are shown.

Weekly wage (£)	Frequency	$\leqslant$(£)	Cumulative frequency
$0 < w \leqslant 100$	4	100	4
$100 < w \leqslant 200$	16	200	20
$200 < w \leqslant 300$	25	300	
$300 < w \leqslant 400$	32	400	
$400 < w \leqslant 500$	54	500	
$500 < w \leqslant 600$	25	600	
$600 < w \leqslant 700$	20	700	
$700 < w \leqslant 800$	6	800	
$800 < w \leqslant 900$	2	900	

(a) Complete the cumulative frequency column. [1]

(b) Draw the cumulative frequency graph on the axes provided opposite. [3]

(c) Use your graph to estimate

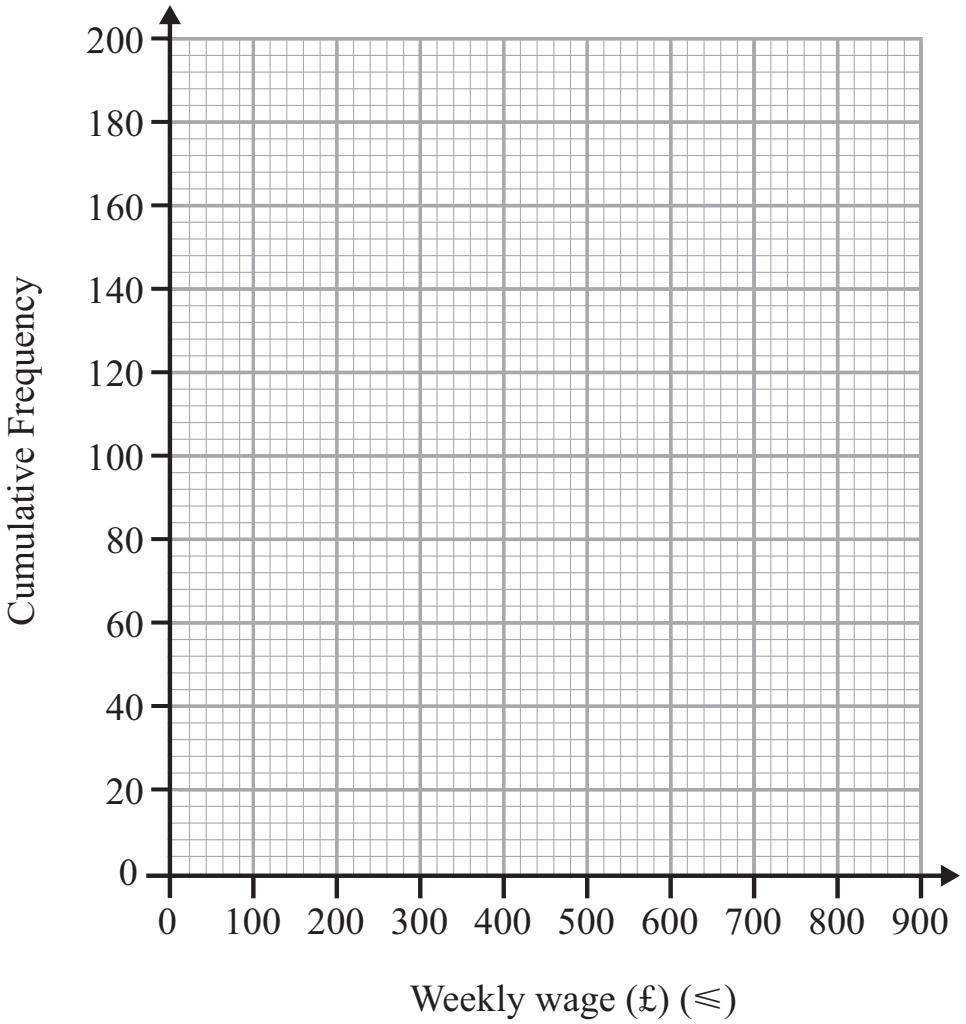
(i) the median,

Answer £ _____ [1]

(ii) the percentage of people who earn more than £640 per week.

Answer _____ % [2]

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[Turn over

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22 A bed has a sale price of £257.40
This is a saving of 22% on the original price.

What was the original price of the bed?

Answer £ _____ [3]

23 Find the lowest common multiple (LCM) of 54 and 90

Answer _____ [2]

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24 **(a)** Solve the simultaneous equations $9x + 4y = 51$
$5x + 4y = 23$

Show all working. A solution by trial and improvement will not be accepted.

Answer $x =$ _____ , $y =$ _____ [2]

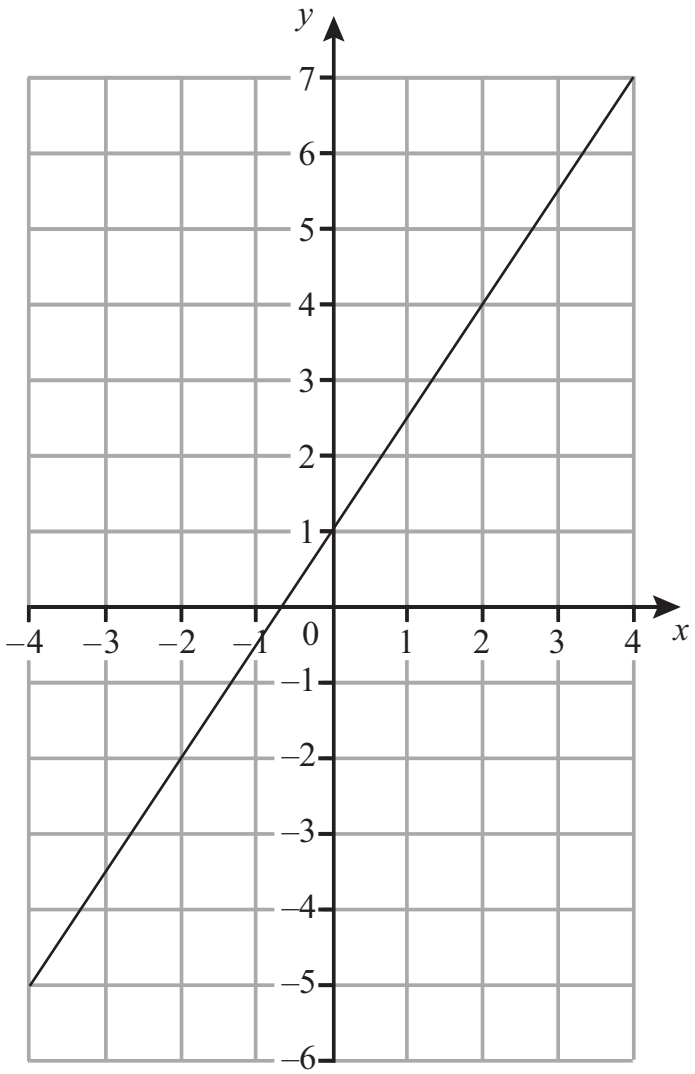
(b) Solve the equation $\frac{2x - 1}{5} + \frac{4x + 5}{10} = \frac{5}{2}$

Answer $x =$ _____ [4]

[Turn over

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25



(a) Write down the gradient of the line drawn above.

Answer _____ [1]

(b) Hence write down the equation of this line.

Answer _____ [2]

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26

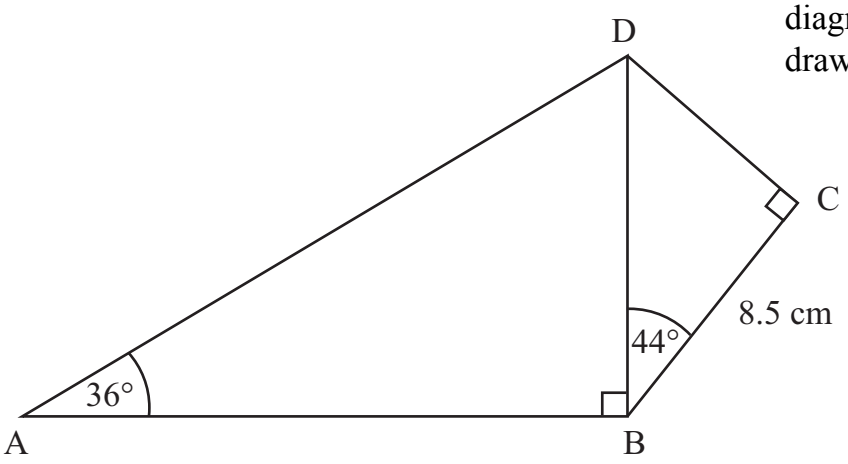


diagram not drawn accurately

ABCD is a quadrilateral. Angles ABD and BCD are both right angles.

Angle DBC = 44° Angle DAB = 36°

BC = 8.5 cm.

Calculate the length of AD.

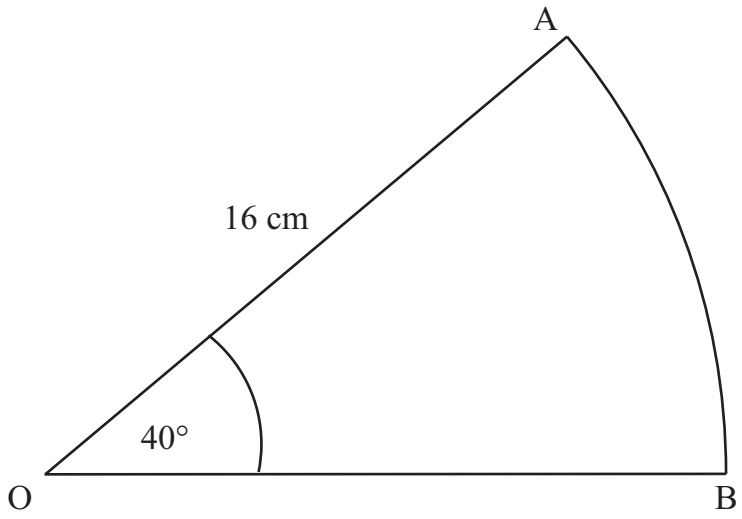
Answer _____ cm [6]

[Turn over

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27 AOB is a sector of a circle, radius 16 cm.

Angle AOB = 40°



Work out the perimeter of the sector AOB.

Answer _____ cm [3]

THIS IS THE END OF THE QUESTION PAPER

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For Examiner's use only	
Question Number	**Marks**
1	
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27	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
January 2015

Mathematics

Unit T3

(With calculator)

Higher Tier

[GMT31]

FRIDAY 9 JANUARY

9.15 am–11.15 am

MARK SCHEME

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GCSE MATHEMATICS

Introduction

The mark scheme normally provides the most popular solution to each question. Other solutions given by candidates are evaluated and credit given as appropriate; these alternative methods are not usually illustrated in the published mark scheme.

The solution to a question gains marks for correct method and marks for accurate working based on this method. The marks awarded for each question are shown in the right hand column and they are prefixed by the letters **M**, **A** and **MA** as appropriate. The key to the mark scheme is given below:

M indicates marks for correct method.

A indicates marks for accurate working, whether in calculation, reading from tables, graphs or answers. Accuracy marks may depend on preceding **M** (method) marks, hence **M**0 **A**1 cannot be awarded, i.e. where the method is not correct no marks can be given.

MA indicates marks for combined method and accurate working.

C indicates marks for quality of written communication

oe indicates "or equivalent" i.e. where a solution can be expressed in an alternative correct form, e.g. $\frac{1}{4} = 0.25$

ft indicates "follow through". See explanation below.

A later part of a question may require a candidate to use an answer obtained from an earlier part of the same question. A candidate who gets the wrong answer to the earlier part and goes on to the later part is naturally unaware that the wrong data is being used and is actually undertaking the solution of a parallel problem from the point at which the error occurred. If such a candidate continues to apply correct method, then the candidate's individual working must be **followed through** from the error. If no further errors are made, then the candidate is penalised only for the initial error. Solutions containing two or more working or transcription errors are treated in the same way. This process is usually referred to as "follow-through marking" and allows a candidate to gain credit for that part of a solution which follows a working or transcription error.

It should be noted that where an error trivialises a question, or changes the nature of the skills being tested, then as a general rule, it would be the case that not more than half the marks for that question or part of that question would be awarded; in some cases the error may be such that no marks would be awarded.

Positive marking:

It is our intention to reward candidates for any demonstration of relevant knowledge, skills or understanding. For this reason we adopt a policy of **following through** their answers, that is, having penalised a candidate for an error, we mark the succeeding parts of the question using the candidate's value or answers and award marks accordingly.

Some common examples of this occur in the following cases:

(a) a numerical error in one entry in a table of values might lead to several answers being incorrect, but these might not be essentially separate errors;

(b) readings taken from candidates' inaccurate graphs may not agree with the answers expected but might be consistent with the graphs drawn.

When the candidate misreads a question in such a way as to make the question easier, only a proportion of the marks will be available (based on the professional judgement of the examiner).

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General Marking Advice

(i) If the correct answer is seen in the body of the script and the answer given in the answer line is clearly a transcription error, full marks should be awarded.

(ii) If the answer is missing, but the correct answer is seen in the body of the script, full marks should be awarded.

(iii) If the correct answer is seen in working but a completely different answer is seen in the answer space, then some marks will be awarded depending on the severity of the error.

(iv) Work crossed out but not replaced should be marked.

(v) In general, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered (with no solution offered on the answer line), mark the poorest answer.

(vi) For methods not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work.

(vii) Where a follow through mark is indicated on the mark scheme for a particular part question, the marker must ensure that you refer back to the answer of the previous part of the question.

(viii) Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen. E.g. the answer in the mark scheme is 4.65 and the candidate then correctly rounds to 4.7 or 5 on the answer line. Allow full marks for 4.65 seen in the working.

(ix) Anything in the mark scheme which is in brackets (...) is not required for the mark to be earned, but if present it must be correct.

(x) For any question, the range of answers given in the mark scheme is inclusive.

(xi) Incorrect money notation will generally lose one mark but will be penalised only once per paper.

(xii) In general, a tolerance of ±2° is allowed in drawing angles, and ±2 mm in measuring length.

(xiii) In algebra, if further inaccurate work is done to a correct answer, some marks may be lost.

Quality of written communication

In GCSE Mathematics, particular questions are identified where candidates must demonstrate the quality of their written communication.

In particular, candidates must:

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear (i.e. comprehension and meaning is clear by using the correct notation and labelling conventions);

(ii) select and use a form and style of writing appropriate to their purpose and to complex subject matter (i.e. reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning); and

(iii) organise information clearly and coherently, using specialist vocabulary where appropriate (i.e. the mathematical methods and processes used are coherently and clearly organised and appropriate mathematical vocabulary used).

This assessment may be through, for example, an explanation of the geometrical properties of a given shape or, for example, through concise mathematical argument in a multi-step problem.

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			AVAILABLE MARKS
1	**(a)** 7 points correct (Allow A1 for 4 correct)	A2	
	(b) Correct line	A1	
	(c) Their correct reading	A1	4
2	Bargain £12.00 – £2.40 = £9.60 or Discount = £9.00	C2	
	2nd store correct	C1	
	Discount is better	C1	4
3	**(a)** 695	MA1	
	(b) 695 × 15 or 10425	M1	
	104.25	A1	
	(c) 5.21	MA1	
	(d) 109.46	MA1	5
4	**(a)** $0.\dot{3}\dot{7}\dot{5}$	A1	
	(b) 0.2828	A1	
	(c) $\frac{5}{9} - \frac{2}{9} = \frac{3}{9}$	MA1	
	3 in box	MA1	4
5	**(a)** $6x + 4y$	A2	
	(b) 4, 7, 12	A2	4

6

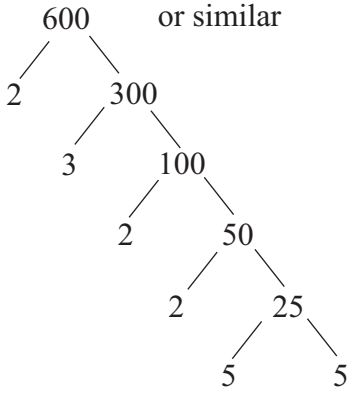
360/5 = 72	MA1	or	360/5 = 72	MA1	or	540/5 = 108	MA1
360/6 = 60	MA1		360/6 = 60	MA1		720/6 = 120	MA1
72 + 60	M1		108 + 120	MA1		108 + 120 = 228	MA1
= 132	A1		360 – (108 +120) = 132	MA1		360 – 228 = 132	MA1

4

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			AVAILABLE MARKS
7	∠DBC = 37° even in diagram ∠ECB = 92° even in diagram 125 – 92 or 180 – (92 + 37 + 18) $x = 33$	MA1 MA1 MA1 A1	
	or ∠DBA = 18, ∠EDC = 18 ∠DEC = 129, $x = 33$	Al A1 Al A1	4
8	360 – 62 or 118 + 180 298	MA1 A1	2
9	Correct stem and leaf (28 correct) Key	M1 A1 A1	3
10	2 from Older generation, very young children, too small a sample, more women than men	A1 A1	2
11	**(a)** $4(2x + 3)$	MA1	
	(b) $x(x + 7)$	MA1	2
12	–1, 1	A1 A1	2
13	8550 8122.5 7716.375 (accept 7716) or (7716.38) or (7716.4)	MA1 MA1 MA1	3
14	$\frac{33}{60}$	MA1	
	$\frac{33}{60} \times 100 = 55\%$	M1 A1	3
15	**(a)** $30 < m \leqslant 40$	A1	
	(b) fx 495, 2200, 1995, 2340, 2365, 1105, 750 Mean = 11250/300 = 37.5	M1 A1 A1	
	(c) Frequency polygon (Scales, points, lines)	M1 A3	8

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			AVAILABLE MARKS
16	$\begin{array}{r\|l} 2 & 600 \\ 2 & 300 \\ 2 & 150 \\ 3 & 75 \\ 5 & 25 \\ & 5 \end{array}$ or $\begin{array}{r\|l} 5 & 600 \\ 5 & 120 \\ 3 & 24 \\ 2 & 8 \\ 2 & 4 \\ & 2 \end{array}$ 	M1 A1	
	$2^3 \times 3 \times 5^2$	MA1	3
17	$\pi \times 5.5^2 = 95.0333$ or $11 \times 5.5 = 60.5$	MA1	
	$\frac{1}{2} \times \pi \times 5.5^2 = 47.5166$	MA1	
	$60.5 - 47.5166 = 12.98$	MA1	3
18	$d^2 = 297^2 + 210^2$	MA1	
	132309	A1	
	364 or 363.743	A1	3
19	**(a)** $2x + 3 + x + 6 + x + x$	MA1	
	$5x + 9$	A1	
	(b) **(i)** $5x + 9 = 34$	MA1	
	(ii) $5x = 25$		
	$x = 5$	MA1	4
20	$x = 3.5 \rightarrow 28.875$ and		
	$x = 3.4 \rightarrow 25.704$	MA1	
	$x = 3.45 \rightarrow 27.263625$	MA1	
	$x = 3.4$	MA1	3
21	**(a)** 45, 77, 131, 156, 176, 182, 184	A1	
	(b) 9 correct points (5 correct gets [1])	A2	
	Lines, curve	A1	
	(c) **(i)** reading at 92	A1	
	(ii) 184 – (their reading at 640)	MA1	
	Their answer/184 × 100	MA1	7

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			AVAILABLE MARKS
22	78% = 257.40	MA1	
	257.40 ÷ 0.78 = 330	M1 A1	3
23	54 = 2 × 3 × 3 × 3 and 90 = 2 × 3 × 3 × 5	MA1	
	270	A1	2
24	**(a)** $4x = 28$		
	$x = 7$	MA1	
	$y = -3$	MA1	
	(b) $\frac{4x - 2 + 4x + 5}{10}\left(= \frac{5}{2}\right)$	MA1	
	$4x - 2 + 4x + 5 = 25$	MA1	
	$8x = 22$	MA1	
	$x = \frac{22}{8}$ or $\frac{11}{4}$ or 2.75	MA1	6
	or any equivalent		
25	**(a)** $\frac{3}{2}$	MA1	
	(b) $y = \frac{3}{2}x + 1$	MA2	3
26	$\cos 44° = \frac{8.5}{BD}$	M1	
	$BD = \frac{8.5}{\cos 44°}$	M1	
	BD = 11.816	A1	
	$\sin 36° = \frac{\text{“11.816”}}{AD}$	M1	
	$AD = \frac{\text{“11.816”}}{\sin 36°}$	M1	
	20.1	A1	6
27	$2\pi r = 100.5309649$	MA1	
	$\frac{1}{9}$ of (100.5309649) = 11.17	MA1	
	43.17	A1	3
		Total	**100**

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Centre Number

Candidate Number

Rewarding Learning

General Certificate of Secondary Education
January 2014

Mathematics

Unit T3
(With calculator)
Higher Tier



[GMT31]

GMT31

FRIDAY 10 JANUARY, 9.15am–11.15am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided. Do not write outside the box, around each page, on blank pages or tracing paper.
Complete in blue or black ink only. **Do not write with a gel pen**.
Answer **all twenty-nine** questions.
Any working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **questions 6(b) and 24(b)**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

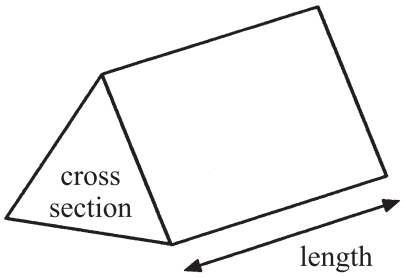
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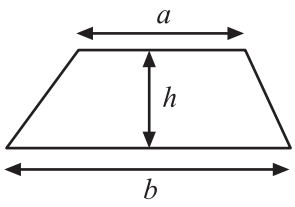
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Formula Sheet

Volume of prism = area of cross section × length

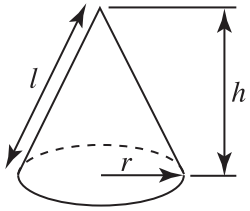


Area of trapezium $= \frac{1}{2}(a+b)h$



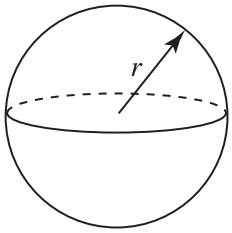
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

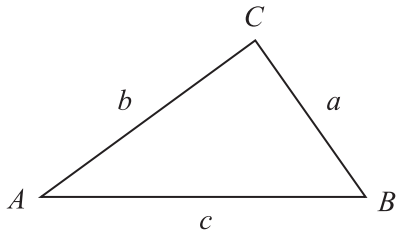


Volume of sphere $= \frac{4}{3}\pi r^3$

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



In any triangle *ABC*



Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

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

Sine Rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

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

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1 Without using a calculator, show how to find the answer to

$$\frac{3}{7} - \frac{1}{5}$$

Answer _____ [2]

Examiner Only	
Marks	Remark
Total Question 1	

[Turn over

2 Hugh is a travelling salesman. He claims 24.6p for each km he travels and £27.60 for meals on each day he is travelling.

If he travels more than 700 km in any week he adds 12.5% to his total claim.

Last week Hugh travelled 915 km in 5 days.

How much did Hugh claim for last week?

Show clearly how you arrived at your answer.

Answer £ _____ [5]

Examiner Only	
Marks	Remark
Total Question 2	

3 **(a)** Write down two numbers which are square roots of 49

Answer _____ and _____ [1]

(b) Explain the meaning of $0.\dot{1}0\dot{3}$

Answer _____ [1]

Total Question 3

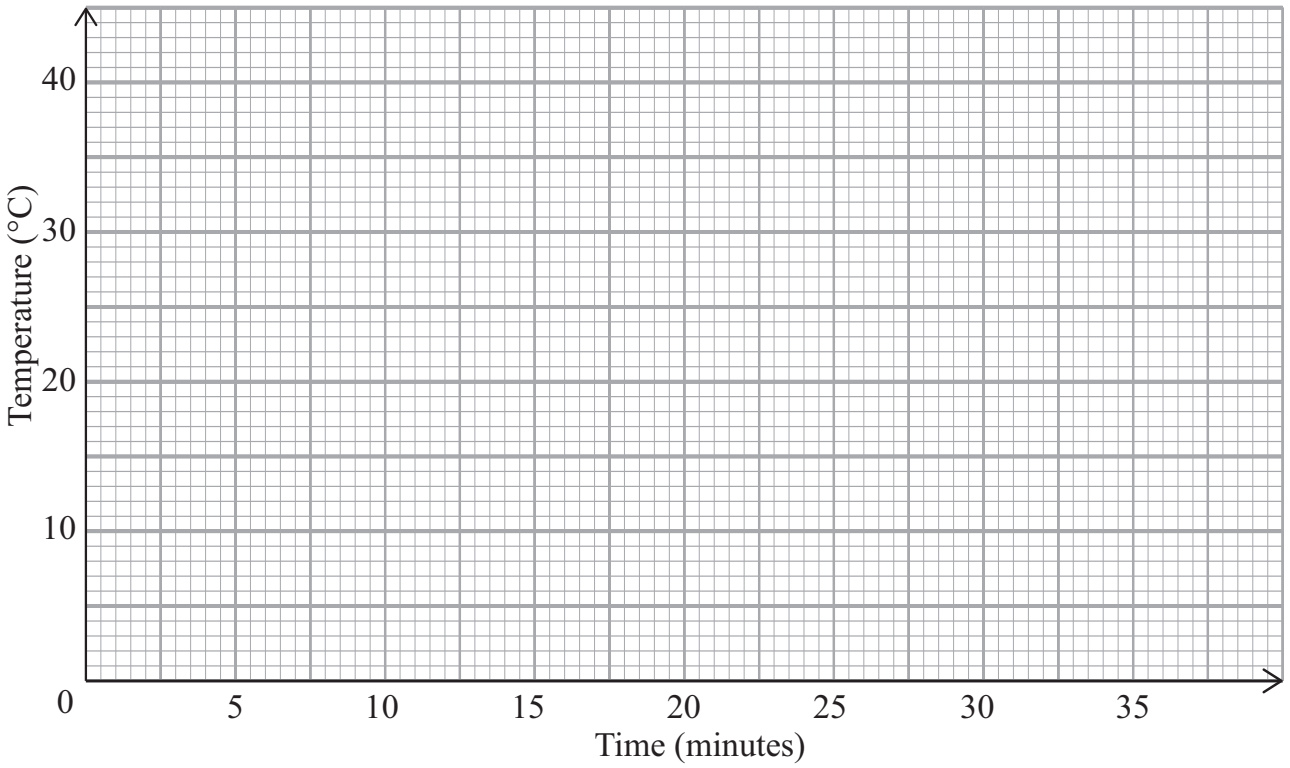
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4 The table shows the temperature of some liquids as they cool in a freezer.

Time (minutes)	5	10	15	18	25	30	30
Temperature (°C)	35	31	24	22	12	7	6

Examiner Only	
Marks	Remark

(a) Draw a scatter graph for this data. [2]



Examiner Only	
Marks	Remark

(b) Draw a line of best fit. [1]

(c) Estimate the time taken for a liquid to reach freezing point (0 °C).

Answer _____ minutes [1]

Total Question 4

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5 Twenty two pupils were asked to record the time (in minutes) they spent on their homework last Monday night.
Their responses are listed below.

40	55	80	60	50	55	65	40	120	100	90
55	60	110	100	120	75	50	80	85	60	45

Construct a stem and leaf diagram to illustrate this data.

[3]

Examiner Only	
Marks	Remark
Total Question 5	

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Quality of written communication will be assessed in part (b) of this question.

Examiner Only	
Marks	Remark

6 **(a)** Calculate the size of the interior angle of a regular pentagon.

Answer _____ ° [2]

(b) Three regular pentagons are placed together as shown below.

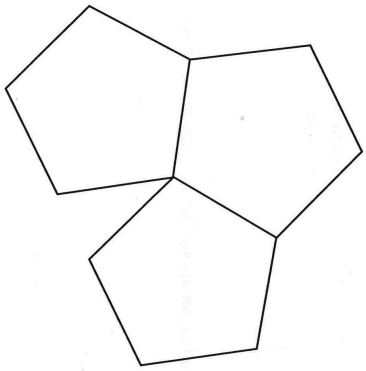


diagram not drawn accurately

Explain why you cannot cover a floor with regular pentagonal tiles.

Answer _____

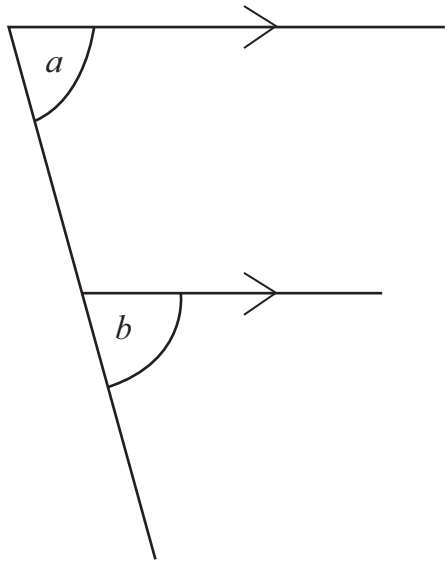
_____ [2]

Total Question 6

[Turn over

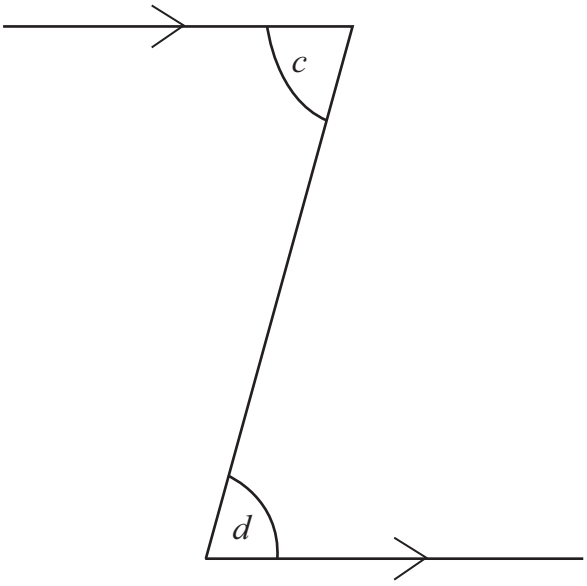
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7 **(a)** What mathematical name is given to the pair of acute angles a and b below?



Answer _____ [1]

(b) What mathematical name is given to the pair of acute angles c and d below?



Answer _____ [1]

Examiner Only	
Marks	Remark
Total Question 7	

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8 **(a)** Factorise $c^2 - 5c$

Answer _____ [1]

(b) Simplify $\frac{d}{4} - \frac{d}{5}$

Answer _____ [3]

Total Question 8

9 Solve $7e + 3 = 4e + 5$

Answer e = _____ [3]

Total Question 9

10 The n^{th} term of a sequence is given by $n^2 - 1$

(a) Write down the first 3 terms of this sequence.

Answer _____, _____, _____ [2]

(b) Explain why 101 cannot be a term in this sequence.

Answer _____ [1]

Total Question 10

11 Angela buys 5 DVDs and 4 CDs.
Each DVD costs d pounds.
Each CD costs c pounds.
Write down an expression for the total cost.

Answer _____ [2]

Total Question 11

Examiner Only

Marks	Remark

[Turn over

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12 **(a)** Express 84 as a product of its prime factors **in index form**.

Answer _____ [3]

(b) Find the Lowest Common Multiple (LCM) of 63 and 84

Answer _____ [2]

Examiner Only	
Marks	Remark
Total Question 12	

13 £4000 is invested in a bank for 3 years and earns 5% per annum compound interest.

How much will it earn in interest over the 3 years?

Show clearly all your working.

Answer £ _____ [3]

Total Question 13	

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14 On every swing, a pendulum reaches 60% of the previous distance.

The pendulum swings 1.8 metres on its first swing.

How far does it swing during the third swing?

Answer _____ m [2]

Examiner Only	
Marks	Remark
Total Question 14	

15 The table below shows the weights of fish caught in a competition.

Weight (g)	Frequency
$0 < w \leqslant 150$	10
$150 < w \leqslant 300$	25
$300 < w \leqslant 450$	18
$450 < w \leqslant 600$	12
$600 < w \leqslant 750$	10
$750 < w \leqslant 900$	5

(a) Write down the modal class interval.

Answer _____ [1]

(b) Write down the class interval which contains the median weight.

Answer _____ [1]

(c) Calculate an estimate for the mean weight of a fish caught in this competition.

Answer _____ g [4]

Total Question 15

[Turn over



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16 A student wishes to carry out a survey relating to television viewing by the general public.
Her first question is

"What age are you?" **Answer**

(a) Give one criticism of this question.

_____ [1]

(b) Design a more suitable question with appropriate response boxes for her to record the age of those being surveyed.

[2]

Examiner Only	
Marks	Remark
Total Question 16	

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17 The radius of the base of a cylindrical oil tank is 60 cm.

(a) Calculate the area of the base of the oil tank.

Answer _____ cm^2 [2]

The height of the oil tank is 70 cm.

(b) Calculate the volume of the oil tank. Give your answer in **litres**.

Answer _____ litres [3]

Examiner Only	
Marks	Remark
Total Question 17	

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24GMT3113

18 The sketch shows a field which is in the shape of a right-angled triangle.
The side PQ = 10 m and the side QR = 26 m.

Calculate the length of the side PR.

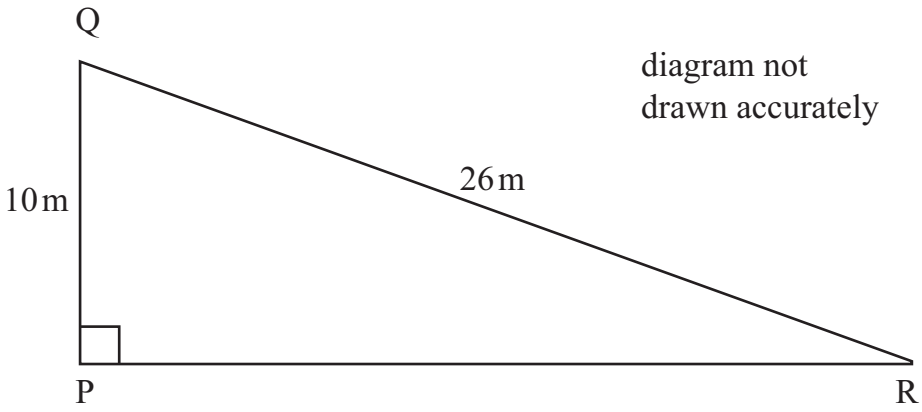


diagram not
drawn accurately

Answer _____ m [3]

Examiner Only	
Marks	Remark
Total Question 18	

19 A glass window is in the shape of a semi-circle with diameter 40 cm.

Calculate the perimeter of the semi-circle.

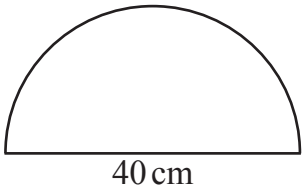


diagram not
drawn accurately

Answer _____ cm [3]

Total Question 19	

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20 Use the method of trial and improvement to find the solution of the equation $x^3 + 3x = 47$

Give your answer correct to 1 decimal place.

Show all your working.

Answer $x =$ _____ [4]

Examiner Only	
Marks	Remark
Total Question 20	

21 Expand and simplify $3(2w - 1) - 2(w - 4)$

Answer _____ [2]

Total Question 21	

[Turn over

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22 The first five terms of a sequence are 9, 13, 17, 21, 25.
Find an expression, in terms of n, for the n^{th} term of this sequence.

Answer _____ [2]

Total Question 22

23 During a very cold winter a glacier increased in volume by 32%.
At the end of the winter its volume was found to be 6864 km^3
What was its volume at the start of that winter?

Answer _____ km^3 [3]

Total Question 23

Examiner Only

Marks	Remark

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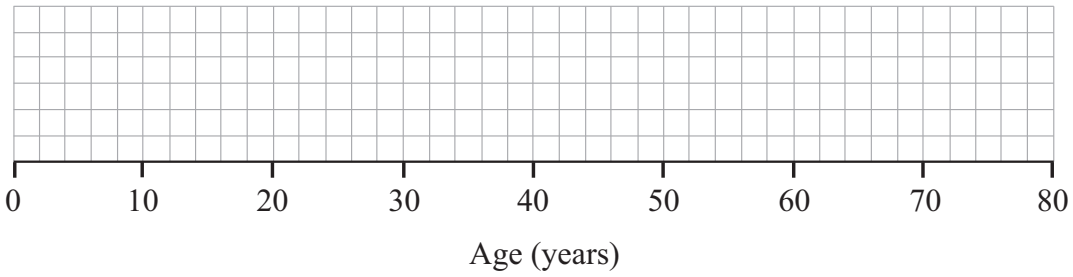
Quality of written communication will be assessed in part (b) of this question.

Examiner Only	
Marks	Remark

24 The information given below relates to the ages (in years) of members of a badminton club.

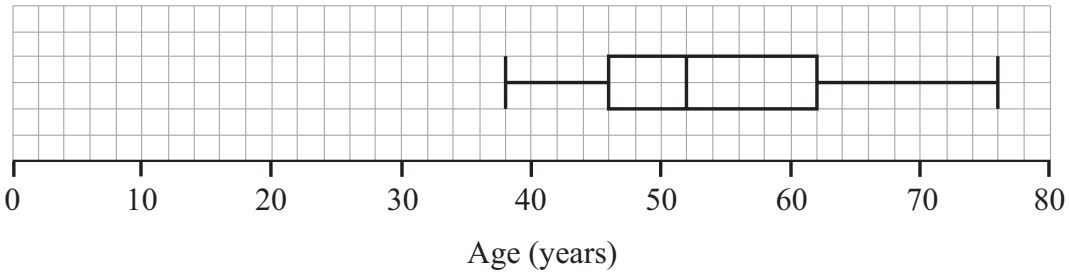
Lower Quartile = 28
Median = 32
Upper Quartile = 54
Youngest = 12
Range = 58

(a) Draw a box plot to show this information.



[3]

(b) The box plot below shows the age distribution of members of a bowls club.



Compare the age distributions of the members of the badminton club and the bowls club.

_____

_____

_____

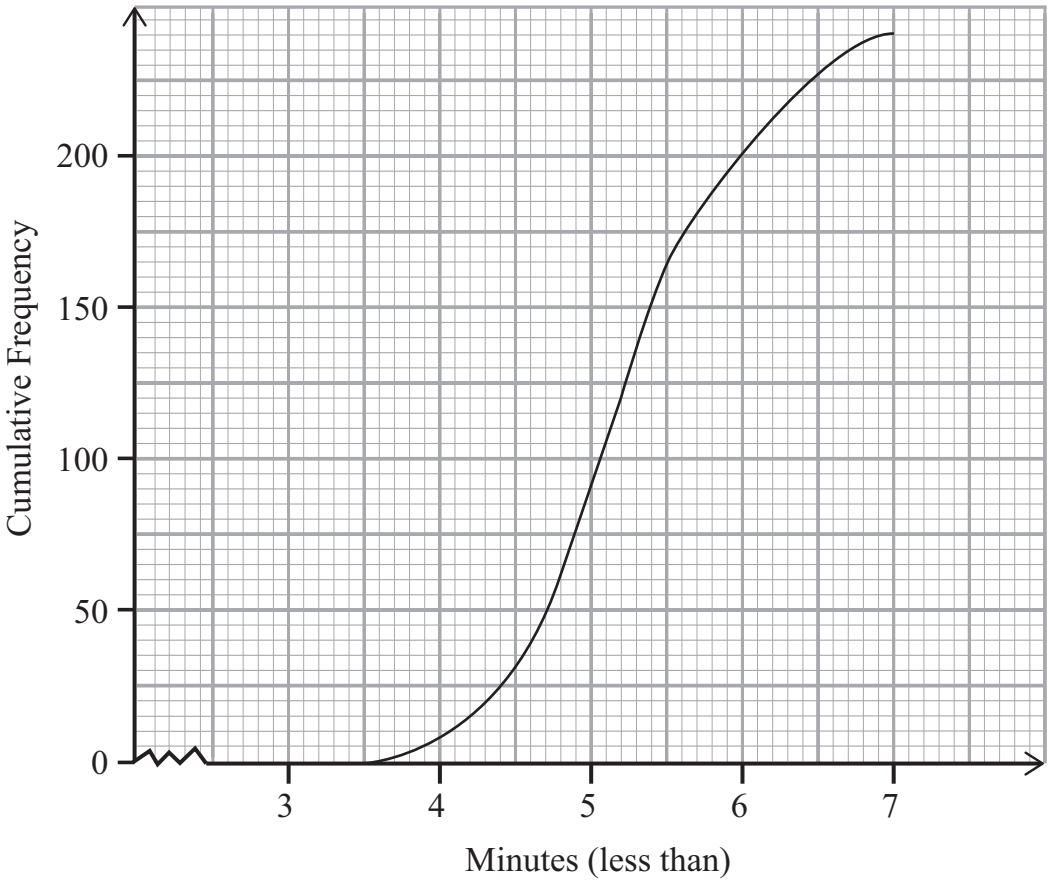
_____ [2]

Total Question 24

[Turn over

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24GMT3117

25 The cumulative frequency curve represents the times taken to run 1500 m by each of the members of a running club.



(a) Use the graph to estimate the median time.

Answer _____ minutes [1]

(b) Any member taking more than $5\frac{1}{2}$ minutes has to do extra training. Use the graph to estimate the percentage of runners who have to undertake extra training.

Answer _____ % [2]

Examiner Only	
Marks	Remark
Total Question 25	

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26 PQRS represents a rectangular gate. PS = 200 cm and SR = 300 cm.

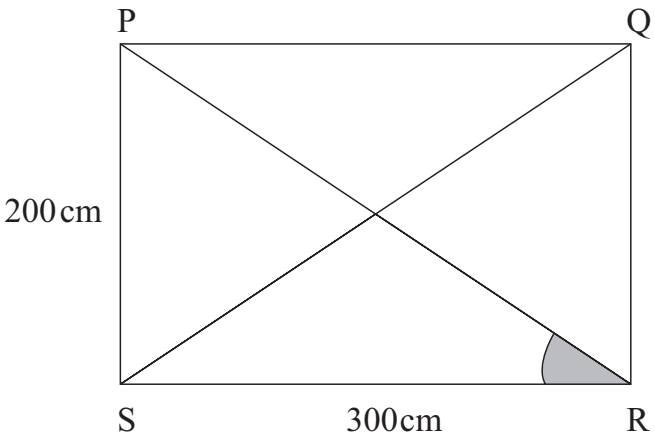


diagram not drawn accurately

(a) Calculate the size of angle PRS.

Answer _____ ° [3]

(b) The measurements of the gate are all to the nearest centimetre. What is the smallest possible perimeter of the gate?

Answer _____ cm [2]

Examiner Only	
Marks	Remark
Total Question 26	

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24GMT3119

27

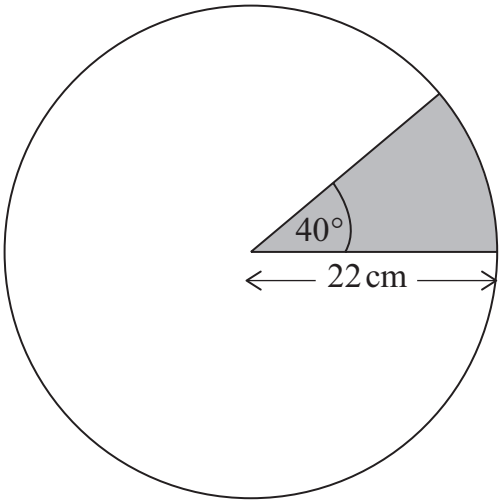


diagram not drawn accurately

A large circular pizza has radius 22 cm.
Josh cuts a sector with angle 40° from the pizza.
Calculate the area of this sector.

Answer _____ cm^2 [3]

Examiner Only	
Marks	Remark
Total Question 27	

28 Solve the simultaneous equations

$3x + 2y = 10$

$2x - 6y = 3$

Show your working.
A solution by trial and improvement will not be accepted.

Answer x = _____ , y = _____ [3]

Total Question 28

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29 The breadth of a cuboid is 1 cm less than the length y cm.
The height is 6 cm.
The volume of the cuboid is 72 cm^3.

(a) Show that $y^2 - y - 12 = 0$

[3]

(b) Solve the equation $y^2 - y - 12 = 0$ by factorising.
Explain why only one answer makes sense in the question.

Answer _____

_____ [3]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark
Total Question 29	

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For Examiner's use only	
Question Number	**Marks**
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29	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
January 2014

Mathematics

Unit T3
Higher Tier

[GMT31]

FRIDAY 10 JANUARY
9.15 am–11.15 am

MARK SCHEME

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Introduction

The mark scheme normally provides the most popular solution to each question. Other solutions given by candidates are evaluated and credit given as appropriate; these alternative methods are not usually illustrated in the published mark scheme.

The solution to a question gains marks for correct method and marks for accurate working based on this method. The marks awarded for each question are shown in the right hand column and they are prefixed by the letters **M**, **A** and **MA** as appropriate. The key to the mark scheme is given below:

M indicates marks for correct method.

A indicates marks for accurate working, whether in calculation, reading from tables, graphs or answers. Accuracy marks may depend on preceding **M** (method) marks, hence **M**0 **A**1 cannot be awarded, i.e. where the method is not correct no marks can be given.

MA indicates marks for combined method and accurate working.

C indicates marks for quality of written communication

oe indicates "or equivalent" i.e. where a solution can be expressed in an alternative correct form, e.g. $\frac{1}{4} = 0.25$

ft indicates "follow through". See explanation below.

A later part of a question may require a candidate to use an answer obtained from an earlier part of the same question. A candidate who gets the wrong answer to the earlier part and goes on to the later part is naturally unaware that the wrong data is being used and is actually undertaking the solution of a parallel problem from the point at which the error occurred. If such a candidate continues to apply correct method, then the candidate's individual working must be **followed through** from the error. If no further errors are made, then the candidate is penalised only for the initial error. Solutions containing two or more working or transcription errors are treated in the same way. This process is usually referred to as "follow-through marking" and allows a candidate to gain credit for that part of a solution which follows a working or transcription error.

It should be noted that where an error trivialises a question, or changes the nature of the skills being tested, then as a general rule, it would be the case that not more than half the marks for that question or part of that question would be awarded; in some cases the error may be such that no marks would be awarded.

Positive marking:

It is our intention to reward candidates for any demonstration of relevant knowledge, skills or understanding. For this reason we adopt a policy of **following through** their answers, that is, having penalised a candidate for an error, we mark the succeeding parts of the question using the candidate's value or answers and award marks accordingly.

Some common examples of this occur in the following cases:

(a) a numerical error in one entry in a table of values might lead to several answers being incorrect, but these might not be essentially separate errors;

(b) readings taken from candidates' inaccurate graphs may not agree with the answers expected but might be consistent with the graphs drawn.

When the candidate misreads a question in such a way as to make the question easier, only a proportion of the marks will be available (based on the professional judgement of the examiner).

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General Marking Advice

(i) If the correct answer is seen in the body of the script and the answer given in the answer line is clearly a transcription error, full marks should be awarded.

(ii) If the answer is missing, but the correct answer is seen in the body of the script, full marks should be awarded.

(iii) If the correct answer is seen in working but a completely different answer is seen in the answer space, then some marks will be awarded depending on the severity of the error.

(iv) Work crossed out but not replaced should be marked.

(v) In general, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered (with no solution offered on the answer line), mark the poorest answer.

(vi) For methods not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work.

(vii) Where a follow through mark is indicated on the mark scheme for a particular part question, the marker must ensure that you refer back to the answer of the previous part of the question.

(viii) Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen. E.g. the answer in the mark scheme is 4.65 and the candidate then correctly rounds to 4.7 or 5 on the answer line. Allow full marks for 4.65 seen in the working.

(ix) Anything in the mark scheme which is in brackets (...) is not required for the mark to be earned, but if present it must be correct.

(x) For any question, the range of answers given in the mark scheme is inclusive.

(xi) Incorrect money notation will generally lose one mark but will be penalised only once per paper.

(xii) In general, a tolerance of ±2° is allowed in drawing angles, and ±2 mm in measuring length.

(xiii) In algebra, if further inaccurate work is done to a correct answer, some marks may be lost.

Quality of written communication

In GCSE Mathematics, particular questions are identified where candidates must demonstrate the quality of their written communication.

In particular, candidates must:

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear (i.e. comprehension and meaning is clear by using the correct notation and labelling conventions);

(ii) select and use a form and style of writing appropriate to their purpose and to complex subject matter (i.e. reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning); and

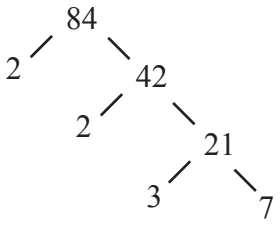
(iii) organise information clearly and coherently, using specialist vocabulary where appropriate (i.e. the mathematical methods and processes used are coherently and clearly organised and appropriate mathematical vocabulary used).

This assessment may be through, for example, an explanation of the geometrical properties of a given shape or, for example, through concise mathematical argument in a multi-step problem.

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			AVAILABLE MARKS
1	$\frac{3}{7} - \frac{1}{5}$ $\frac{15}{35} - \frac{7}{35}$ $\frac{8}{35}$	M1, A1	2
2	915 × 24.6 = £225.09 Meals = 5 × £27.60 = £138 Total claim = £363.09 Including bonus = £363.09 × 12.5% = £45.39 Total = £408.48 (7)	MA1 MA1 A1 MA1 A1	5
3	**(a)** 7 and –7	A1	
	(b) 0.103 103 103 …	A1	2
4	**(a)** 7 points correct (4 points correct A1)	A2	
	(b) accurate line of best fit	A1	
	(c) reading from pupils graph (approx. 36/37)	MA1	4
5	4 | 0 0 5 5 | 0 0 5 5 5 6 | 0 0 0 5 7 | 5 8 | 0 0 5 9 | 0 10 | 0 0 11 | 0 12 | 0 0 **Key**: 11 | 0 = 110	M1, A1 A1	3
6	**(a)** Exterior = 72° or total interior = 540° 108°	MA1 MA1	
	(b) Each interior angle = 108° and 3 × 108° = 324° 360° – 324° = 36° which leaves a gap (Alternatively 360° ÷ 108° = 3.33 … which is **not** a whole number)	C1 C1	4

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				AVAILABLE MARKS
7	**(a)**	corresponding	A1	
	(b)	alternate	A1	2
8	**(a)**	$c(c-5)$	A1	
	(b)	$\frac{5d-4d}{20}$	MA2	
		$\frac{d}{20}$	A1	4
9		$7e-4e=5-3$	MA1	
		$3e=2$	MA1	
		$e=\frac{2}{3}$	MA1	3
10	**(a)**	0, 3, 8 (A1 for 2 correct)	A2	
	(b)	102 is not a square number	A1	3
11		$5d+4c$	A1, A1	2
12	**(a)**	$\begin{array}{c\|l} 2 & 84 \\ 2 & 42 \\ 3 & 21 \\ 7 & 7 \\ & 1 \end{array}$ **or**  **or** similar	M1, A1	
		$=2^2\times3\times7$	A1	
	(b)	$63=3\times3\times7$	MA1	
		LCM $=2\times2\times3\times3\times7=252$	A1	5
13	Year 1	Interest $=\frac{5}{100}\times£4000=£200$	MA1	
	Year 2	Interest $=\frac{5}{100}\times£4200=£210$	MA1	
	Year 3	Interest $=\frac{5}{100}\times£4410=£220.50$		
		Total interest $=£630.50$	A1	3

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			AVAILABLE MARKS
14	1st = 1.8		
	2nd = 1.8 × 0.6 = 1.08 m	MA1	
	3rd = 1.08 × 0.6 = 0.648 m	MA1	2
15	**(a)** $150 < w \leqslant 300$	A1	
	(b) $300 < w \leqslant 450$	A1	
	(c) 75 750		
	225 5625		
	375 6750	(fx)	
	525 6300	M1 A1	
	675 6750		
	825 4125		
	$\frac{30300}{80}$	MA1	
	= 378.75	A1	6
16	**(a)** suitable criticism – too big a variety of ages to be recorded, people may find it too personal, does not state required accuracy etc.	A1	
	(b) "What age range are you in?" Tick one box		
	Response boxes given.	A1	
	Response boxes must be exhaustive and non-overlapping.	A1	3
17	**(a)** $\pi \times 60^2$	MA1	
	11309.73355 (any correct rounding)	A1	
	(b) 11309.7335 × 70	MA1	
	791681.3487	A1	
	= 791.68 litres (any correct rounding)	MA1	5
18	$26^2 = 10^2 + PR^2$	MA1	
	$PR^2 = 676 - 100 = 576$	A1	
	PR = 24	A1	3
19	$\pi \times 40 = 125.663$	MA1	
	125.663 ÷ 2 = 62.83	MA1	
	62.83 + 40 = 102.83	MA1	3
20	Value between 3 and 4	MA1	
	x $x^3 + 3x$		
	3.4 49.504	A1	
	3.3 45.837		
	3.35 47.645375	A1	
	x = 3.3	A1	4

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			AVAILABLE MARKS
21	$6w - 3 - 2w + 8$ $4w + 5$	MA1 MA1	2
22	$4n + 5$	A1, A1	2
23	$132\% = 6864$ $1\% = \frac{6864}{132} = (52)$ $100\% = \frac{6864}{132} \times 100 = 5200$	M1 MA1 A1	3
24	**(a)** median quartiles max/min	A1 A1 A1	
	(b) 1 comment relating to average median for ages of members of bowls club greater 1 comment relating to dispersion, e.g. smaller range in ages of bowls members	C1 C1	5
25	**(a)** 5.2	A1	
	(b) $240 - 165 = 75$ $\frac{75}{240} \times 100 = 31.25\%$	MA1 MA1	3
26	**(a)** $\tan x = \frac{200}{300}$ $x = 33.69°$	M1 A1 MA1	
	(b) 199.5 and 299.5 identified $2(499) = 998$	MA1 A1	5
27	$\pi \times r^2 = 1520.53084$ $\div 9 (\times \frac{40}{360})$ $=168.9(478716)$	MA1 M1 A1	3
28	$9x + 6y = 30$ or $6x + 4y = 20$ $(2x - 6y = 3)$ $6x - 18y = 9$ $x = 3,\ y = \frac{1}{2}$	MA1 A1, A1	3

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							AVAILABLE MARKS
29	**(a)**	$y - 1$ seen	MA1	**or**	$y - 1$	MA1	
		$6y\,(y - 1) = 72$			$6y\,(y - 1) = 72$		
		$6y^2 - 6y - 72 = 0$	A1		$y(y - 1) = 12$	A1	
		$(\div 6)\ y^2 - y - 12 = 0$	MA1		$y^2 - y - 12 = 0$	MA1	
	(b)	$(y - 4)\,(y + 3) = 0$				MA1	
		$y = 4, y = -3$				A1	
		$y = 4$ only answer y cannot be negative				A1	6
					Total		**100**

Centre Number

Candidate Number

Rewarding Learning

General Certificate of Secondary Education
2013

Mathematics

Unit T3
(With calculator)
Higher Tier



[GMT31]

GMT31

TUESDAY 11 JUNE 9.15 am–11.15 am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided. Do not write outside the box, around each page, on blank pages or tracing paper.
Complete in blue or black ink only. **Do not write with a gel pen**.
Answer **all twenty-six** questions.
Any working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **questions 17 and 26.**
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

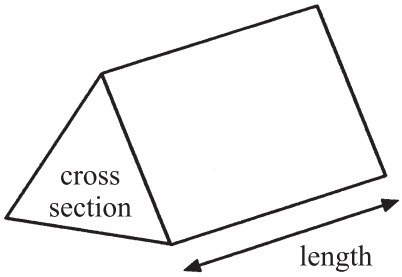
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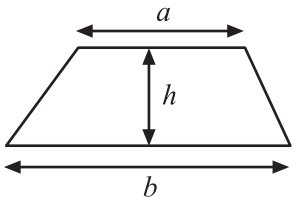
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Formula Sheet

Volume of prism = area of cross section × length

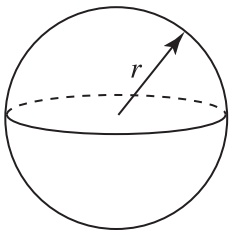


Area of trapezium = $\frac{1}{2}(a+b)h$



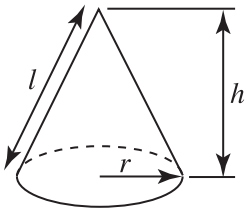
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

Curved surface area of cone = πrl

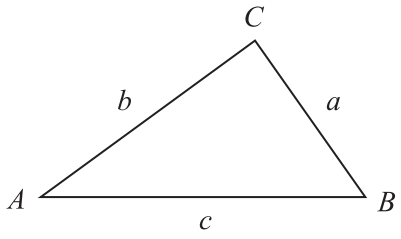


Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

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

In any triangle *ABC*



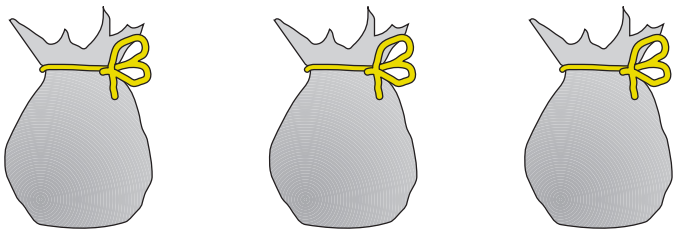
Sine Rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

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1



1 **2** **3**

Bag 1 contains m marbles.

Bag 2 contains 5 less marbles than Bag 1

(a) Write down an expression in terms of m for the number of marbles in Bag 2

Answer _____ [1]

Bag 3 contains twice as many as in Bag 1 **plus** the number of marbles that are in Bag 2

(b) Write down an expression in terms of m for the number of marbles in Bag 3
Give your answer in its simplest form.

Answer _____ [2]

The total number of marbles in Bag 3 is 22

(c) Set up and solve an equation to help find how many marbles are **in Bag 2**

Answer In Bag 2 there are _____ marbles [3]

Examiner Only	
Marks	Remark
Total Question 1	

[Turn over

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Examiner Only	
Marks	Remark

2 **(a)** Solve $6x + 9 = 11 - 2x$

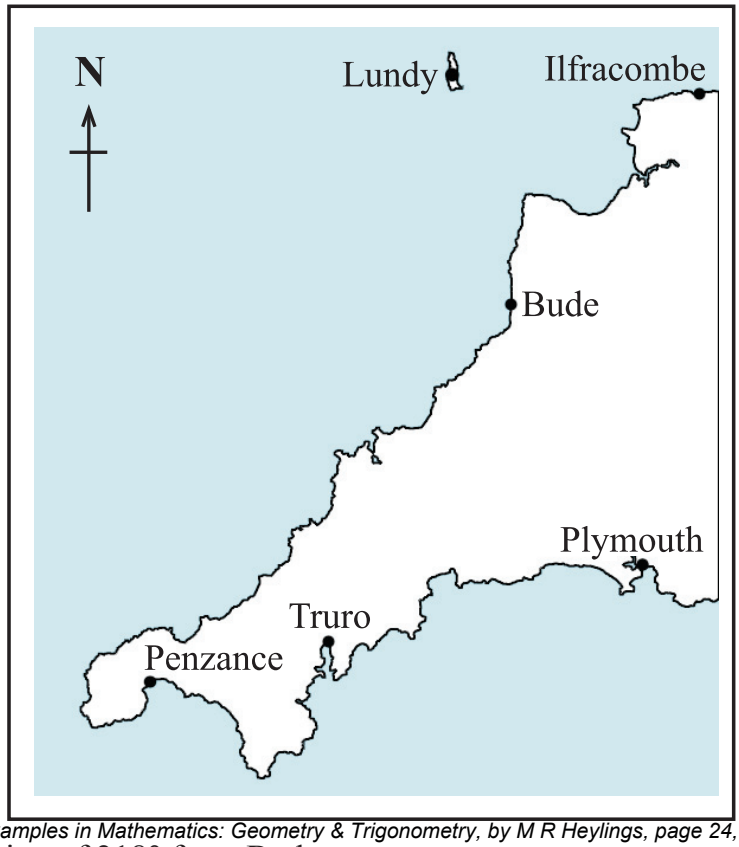
Answer _____ [3]

(b) Simplify $\frac{x}{3} - \frac{x}{5}$

Answer _____ [2]

Total Question 2

3



© Graded examples in Mathematics: Geometry & Trigonometry, by M R Heylings, page 24, published by Schofield & Sims, 1984. ISBN 0721722314

Boscastle is on a bearing of 218° from Bude.
Boscastle is on a bearing of 310° from Plymouth.
Locate the position of Boscastle on the map above. Indicate Boscastle with a point marked B. [3]

Total Question 3

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4 **(a)** Show how to work out the answer to the following without using a calculator.

$$\frac{3}{8} \div \frac{3}{4}$$

[2]

(b) What percentage is £24 of £320?

Answer _____ % [2]

Total Question 4

5 The correlation in a scatter graph may be described as one of the following:

no correlation positive correlation negative correlation

Write down the type of correlation you would expect to find in scatter graphs which show the following information:

(a) average daily temperature and cold drinks sales,

Answer _____ [1]

(b) marks in a test and distance travelled to school,

Answer _____ [1]

(c) number in family and average weekly amount spent on food,

Answer _____ [1]

(d) average speed for journey to school and average time for journey to school.

Answer _____ [1]

Total Question 5

[Turn over

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6 The heights (in centimetres) of fifteen girls in a Dance Class are:

151	173	157	165	166	168	170	169
169	169	168	171	154	176	177	

Construct a stem and leaf diagram to illustrate these heights.

[3]

Examiner Only	
Marks	Remark
Total Question 6	

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7

Primus Energy Gas Tariff

Standing charge is 7.93p per day

Gas used is 4.433p per unit

Marie's gas meter was read on 1st March.

The reading was

0	1	9	5	7

The meter was read again on 1st June.

The reading was

0	4	1	0	8

Calculate the total gas bill that Marie will have to pay for the 92 days from 1st March, if VAT is charged at 5% on the total.

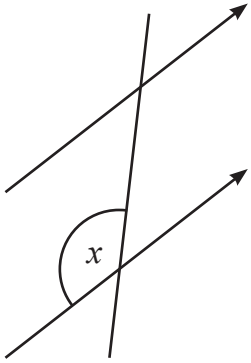
Answer £ _____ [5]

Examiner Only	
Marks	Remark
Total Question 7	

[Turn over

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8 **(a)** Mark the angle corresponding to angle x on the diagram.



[1]

(b) Write down the size of angle y.

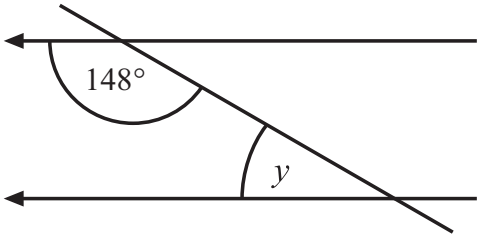


diagram not drawn accurately

Answer _____° [1]

(c) Calculate the sum of the interior angles of a regular octagon.

Answer _____° [2]

(d) Is it possible to have a regular polygon with an interior angle of 130°?
Explain your answer.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 8	

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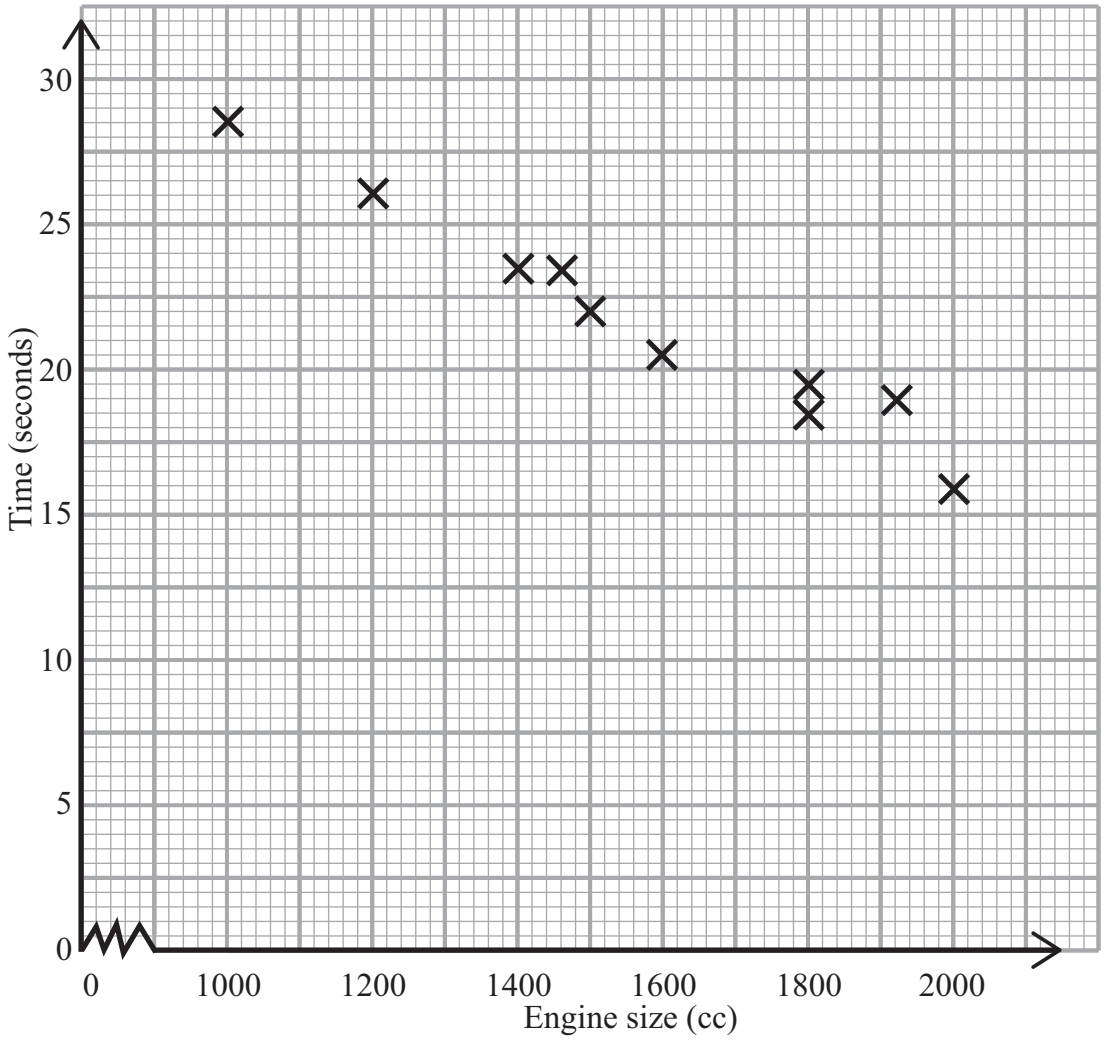
9 Convert 62 000 cm^2 into m^2.

Answer _____ m^2 [2]

Examiner Only	
Marks	Remark

Total Question 9

10 Ten models of car were tested to find how long it took each car to travel 500 metres. The times and engine sizes are plotted below.



(a) Draw a line of best fit. [1]

(b) Use your line to predict the time for a car with engine size 1700 cc to travel 500 metres.

Answer: _____ seconds [1]

Total Question 10

[Turn over

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11 Solve $\frac{2x}{5} - 3 = 7$

Answer $x =$ _____ [2]

Examiner Only	
Marks	Remark
Total Question 11	

12 Derek is trying to find a number x such that $x^2 + \sqrt{x} = 90$

He knows the answer is between 9 and 10
Use trial and improvement to find Derek's number to **2 decimal places**.
Show your work.

Answer Derek's number is _____ [4]

Total Question 12	

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13 Expand $y(4 - 2y)$

Answer _____ [2]

Examiner Only	
Marks	Remark
Total Question 13	

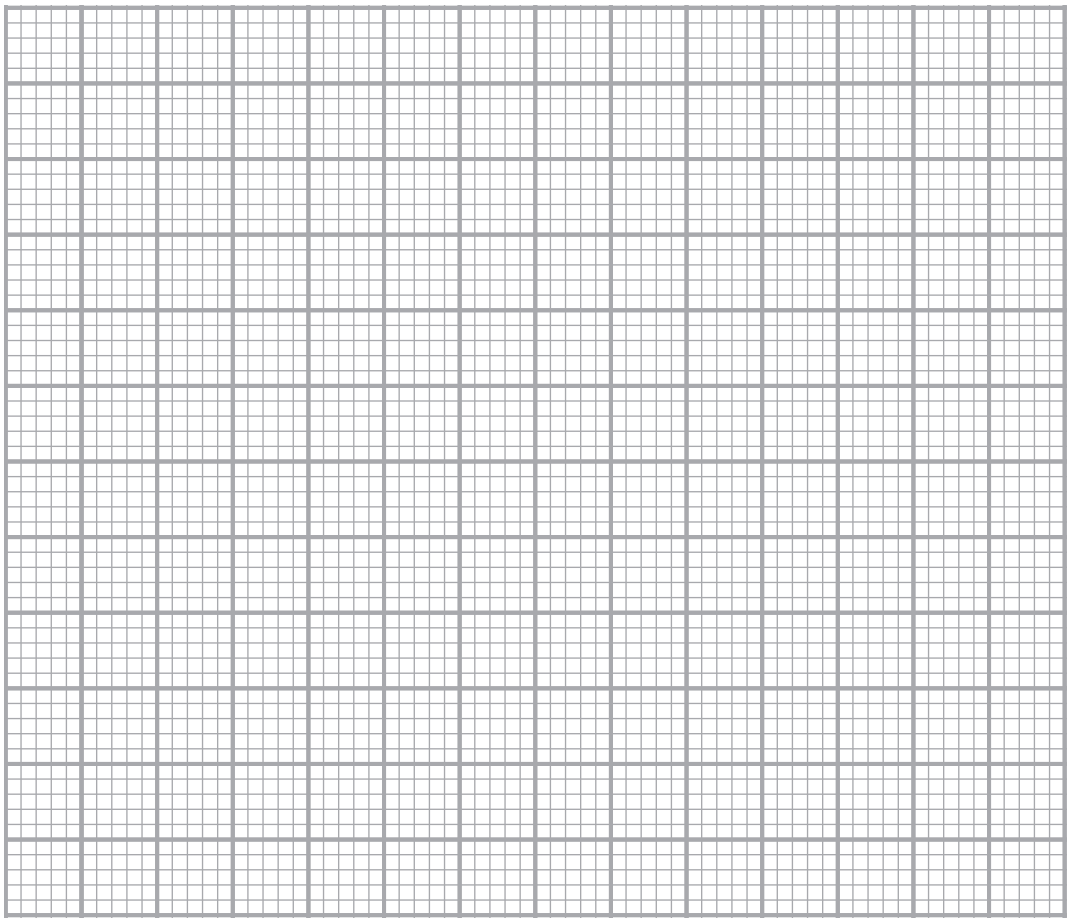
[Turn over

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14 The number of items that 80 students had in their sports bags was recorded. The numbers were grouped as shown in the table.

Number (n)	Frequency
$2 < n \leqslant 4$	8
$4 < n \leqslant 6$	24
$6 < n \leqslant 8$	18
$8 < n \leqslant 10$	17
$10 < n \leqslant 12$	9
$12 < n \leqslant 14$	4

(a) Show this information on a frequency polygon.



[3]

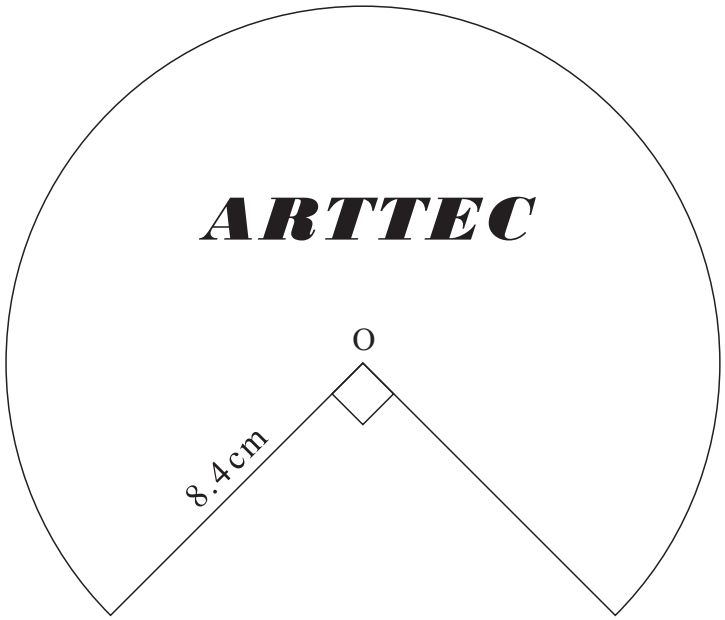
(b) Which class interval contains the median number?

Answer _____ [1]

Examiner Only	
Marks	Remark
Total Question 14	

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15 A company logo is shown below. It is $\frac{3}{4}$ of a circle centre O.



Calculate the perimeter of the logo.

Answer _____ cm [3]

Examiner Only	
Marks	Remark
Total Question 15	

[Turn over

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16 The times that 100 sportsmen spent playing golf one week were recorded. The times were grouped as shown in the table.

Time t (hours)	Frequency		
$0 < t \leqslant 4$	4		
$4 < t \leqslant 8$	19		
$8 < t \leqslant 12$	32		
$12 < t \leqslant 16$	18		
$16 < t \leqslant 20$	16		
$20 < t \leqslant 24$	11		

Calculate an estimate for the mean time.

Answer _____ hours [4]

Examiner Only

Marks	Remark

Total Question 16

Quality of written communication will be assessed in this question.

17 The dimensions of three triangles are given:

Triangle A: 5 cm 6 cm 8 cm
Triangle B: 5 cm 12 cm 13 cm
Triangle C: 5 cm 10 cm 12 cm

Only one of these triangles is right-angled. Which one?
Explain your answer clearly.

Triangle: _____ because _____

_____

_____ [3]

Total Question 17

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18 **(a)** Calculate the exact value of $4\frac{1}{6} - 2\frac{5}{8}$ without using a calculator.
Show your work.

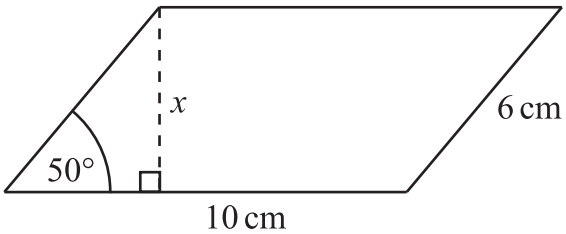
[3]

(b) Conor bought a new car for £23 000
Each year the value of the car depreciated by 15%.
Work out the value of the car at the end of 3 years, giving your answer to the nearest pound.

Answer £ _____ [4]

Total Question 18

19 A parallelogram has sides of 6 cm and 10 cm, with an angle of 50° between the sides.
Calculate the height x of the parallelogram.



Answer x _____ cm [3]

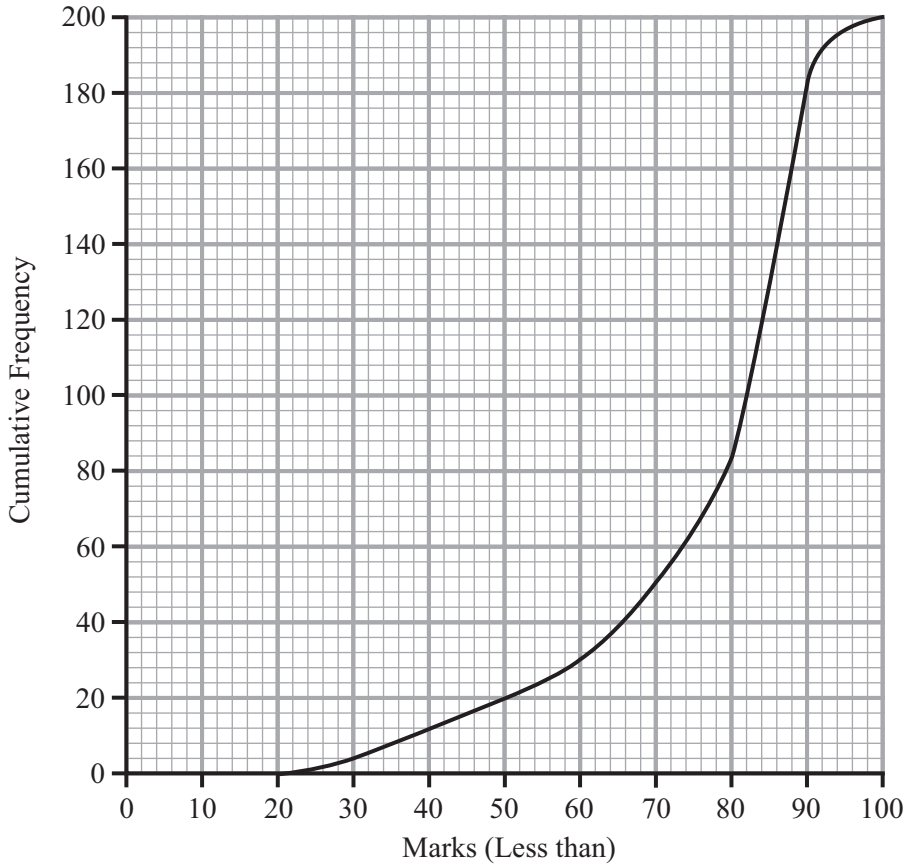
Total Question 19

[Turn over

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20 The graph below shows the cumulative frequency of marks obtained in a spelling test.

Examiner Only	
Marks	Remark



(a) Use the graph to estimate the median.

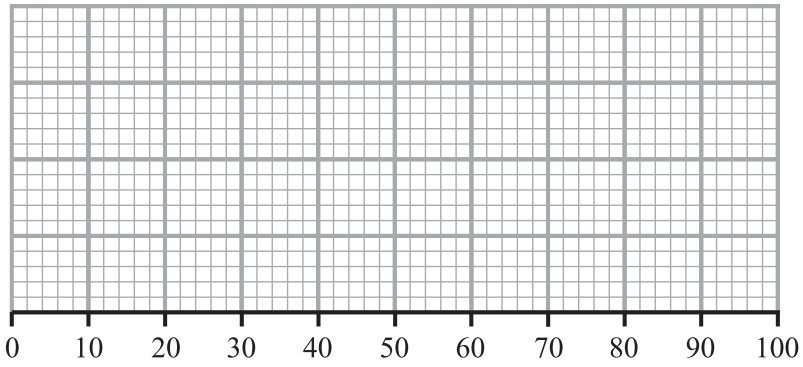
Answer _____ [1]

(b) The pass mark is 75
Estimate how many passed the spelling test.

Answer _____ [2]

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(c) From the graph opposite draw a box plot.



[3]

Examiner Only

Marks	Remark

Total Question 20

21 **(a)** Solve the simultaneous equations $5x - y = 9$
$-2x + y = 3$

Show your working clearly.

Answer $x =$ _____ $y =$ _____ [2]

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

Answer $x =$ _____ [4]

Total Question 21

[Turn over

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22 Factorise

Examiner Only	
Marks	Remark

(a) $15xy - 5y^2$

Answer _____ [2]

(b) $x^2 - 9x - 36$

Answer _____ [2]

Total Question 22

23 What is the Highest Common Factor (HCF) of 210 and 252?

Answer _____ [2]

Total Question 23

24 Tony opened a savings account with the Western Bank.
After one year, the bank paid 6% per annum interest into his account.
The total amount in his account was then £710.20
Work out the amount of money with which Tony opened the account.

Answer £ _____ [3]

Total Question 24

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25 The area of the sector is 20.11 cm^2
Calculate the angle x.

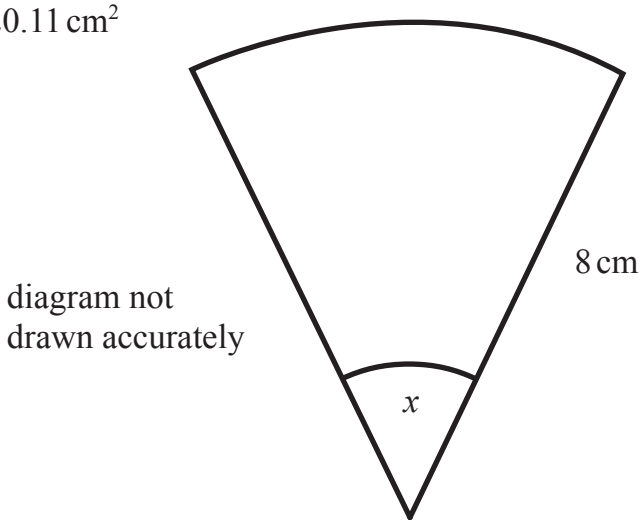


diagram not drawn accurately

Answer _____ ° [4]

Examiner Only	
Marks	Remark
Total Question 25	

Quality of written communication will be assessed in this question.

26 A football pitch is 105 metres long and 68 metres wide.
The length is measured to the nearest 5 metres.
The width is measured to the nearest metre.
Work out the maximum area of the pitch.
Show your working.

Answer _____ m^2 [3]

Total Question 26	

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For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2013

Mathematics

Unit T3
Higher Tier

[GMT31]

TUESDAY 11 JUNE

9.15 am–11.15 am

MARK SCHEME

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GCSE MATHEMATICS

Introduction

The mark scheme normally provides the most popular solution to each question. Other solutions given by candidates are evaluated and credit given as appropriate; these alternative methods are not usually illustrated in the published mark scheme.

The solution to a question gains marks for correct method and marks for accurate working based on this method. The marks awarded for each question are shown in the right hand column and they are prefixed by the letters **M**, **A** and **MA** as appropriate. The key to the mark scheme is given below:

M indicates marks for correct method.
A indicates marks for accurate working, whether in calculation, reading from tables, graphs or answers. Accuracy marks may depend on preceding **M** (method) marks, hence **M**0 **A**1 cannot be awarded i.e. where the method is not correct no marks can be given.
MA indicates marks for combined method and accurate working.
C indicates marks for quality of written communication.
oe indicates "or equivalent" i.e. where a solution can be expressed in an alternative correct form, e.g. $\frac{1}{4} = 0.25$
ft indicates "follow through". See explanation below.

A later part of a question may require a candidate to use an answer obtained from an earlier part of the same question. A candidate who gets the wrong answer to the earlier part and goes on to the later part is naturally unaware that the wrong data is being used and is actually undertaking the solution of a parallel problem from the point at which the error occurred. If such a candidate continues to apply correct method, then the candidate's individual working must be **followed through** from the error. If no further errors are made, then the candidate is penalised only for the initial error. Solutions containing two or more working or transcription errors are treated in the same way. This process is usually referred to as "follow-through marking" and allows a candidate to gain credit for that part of a solution which follows a working or transcription error.

It should be noted that where an error trivialises a question, or changes the nature of the skills being tested, then as a general rule, it would be the case that not more than half the marks for that question or part of that question would be awarded; in some cases the error may be such that no marks would be awarded.

Positive marking:

It is our intention to regard candidates for any demonstration of relevant knowledge, skills or understanding. For this reason we adopt a policy of **following through** their answers, that is, having penalised a candidate for an error, we mark the succeeding parts of the question using the candidate's value or answers and award marks accordingly.

Some common examples of this occur in the following cases:

(a) a numerical error in one entry in a table of values might lead to several answers being incorrect, but these might not be essentially separate errors;

(b) readings taken from candidates' inaccurate graphs may not agree with the answers expected but might be consistent with the graphs drawn.

When the candidate misreads a question in such a way as to make the question easier, only a proportion of the marks will be available (based on the professional judgement of the examiner).

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General Marking Advice

(i) If the correct answer is seen in the body of the script and the answer given in the answer line is clearly a transcription error, full marks should be awarded.

(ii) If the answer is missing, but the correct answer is seen in the body of the script, full marks should be awarded.

(iii) If the correct answer is seen in working but a completely different answer is seen in the answer space, then some marks will be awarded depending on the severity of the error.

(iv) Work crossed out but not replaced should be marked.

(v) In general, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered (with no solution offered on the answer line), mark the poorest answer.

(vi) For methods not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work.

(vii) Where a follow through mark is indicated on the mark scheme for a particular part question, the marker must ensure that you refer back to the answer of the previous part of the question.

(viii) Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen. E.g. the answer in the mark scheme is 4.65 and the candidate then correctly rounds to 4.7 or 5 on the answer line. Allow full marks for 4.65 seen in the working.

(ix) Anything in the mark scheme which is in brackets (...) is not required for the mark to be earned, but if present it must be correct.

(x) For any question, the range of answers given in the mark scheme is inclusive.

(xi) Incorrect money notation will generally lose one mark but will be penalised only once per paper.

(xii) In general, a tolerance of ±2° is allowed in drawing angles, and ± 2 mm in measuring length.

(xiii) In algebra, if further inaccurate work is done to a correct answer, some marks may be lost.

Quality of written communication

In GCSE Mathematics, particular questions are identified where candidates must demonstrate the quality of their written communication.

In particular, candidates must:

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear (i.e. comprehension and meaning is clear by using the correct notation and labelling conventions);

(ii) select and use a form and style of writing appropriate to their purpose and to complex subject matter (i.e. reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning); and

(iii) organise information clearly and coherently, using specialist vocabulary where appropriate (i.e. the mathematical methods and processes used are coherently and clearly organised and appropriate mathematical vocabulary used).

This assessment may be through, for example, an explanation of the geometrical properties of a given shape or, for example, through concise mathematical argument in a multi-step problem.

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				AVAILABLE MARKS
1	**(a)**	$m - 5$	A1	
	(b)	$2m + m - 5$	M1	
		$3m - 5$	A1	
	(c)	$3m - 5 = 22$	A1	
		$3m = 27$		
		$m = 9$	A1	
		Bag 2 $(9 - 5) = 4$ marbles	A1	6
2	**(a)**	$6x + 2x = 11 - 9$		
		$8x = 2$	MA2	
		$x = \frac{2}{8}$	A1	
	(b)	$\frac{5x}{15} - \frac{3x}{15}$ **oe**	M1	
		$\frac{2x}{15}$	A1	5
3		218 from Bude	MA1	
		310 from Plymouth	MA1	
		Boscastle marked B	A1	3
4	**(a)**	$\frac{3}{8} \times \frac{4}{3}$ or $\frac{3}{8} \div \frac{6}{8}$ **oe**	MA1	
		$\frac{12}{24} \left(= \frac{1}{2}\right)$ or $\frac{3}{6} \left(= \frac{1}{2}\right)$ **oe**	A1	
	(b)	$\frac{24}{320} \times 100$	MA1	
		7.5	A1	4
5	**(a)**	pos. cor.	A1	
	(b)	no. cor.	A1	
	(c)	pos. cor.	A1	
	(d)	neg. cor.	A1	4

6

15	1	4	7				
16	5	6	8	8	9	9	9
17	0	1	3	6	7		

M1, A1

Key 15|1 means 151 cm MA1 — 3

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			AVAILABLE MARKS
7	4108 – 1957 = 2151	A1	
	2151 × 4.433p = £95.35(383)	MA1	
	92 × 7.93p = £7.2956 (£7.30)	MA1	
	102.64943 × 0.05 = 5.13247	MA1	
	£107.78	A1	5
8	**(a)** Correct angle marked	A1	
	(b) 32°	A1	
	(c) (8 – 2) × 180	M1	
	= 1080	A1	
	Alternative solution		
	ext = 360/8 = 45 so int. = 135	MA1	
	135 × 8 = 1080	MA1	
	(d) int = 130 so ext = 50	MA1	
	360 ÷ 50 = 7.2 which is not a whole number of sides; therefore not possible	A1	6
9	$62\,000 \div (100)^2$ **oe**	M1	
	= 6.2	A1	2
10	**(a)** line	A1	
	(b) reading	A1	2
11	$\frac{2x}{5} = 10$ or $2x - 15 = 35$	A1	
	$2x = 50$		
	$x = 25$	MA1	2

12	9.3	89.5396	Too small		
	9.4	91.426	Too big	MA1	
	9.32	89.9153	Too small		
	9.33	90.1034	Too big	MA1	
	9.325	90.0093	Too large	MA1	
	Answer	9.32		A1	4

NB Correct answer with no working gets no marks.

13	$4y - 2y^2$	A1, A1	2

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				AVAILABLE MARKS
14	**(a)**	correct diagram with scales correct points above mid points points joined	MA1 A1 A1	
	(b)	$6 < n \leq 8$	A1	4
15		$2 \times \pi \times 8.4$	MA1	
		$\frac{3}{4} \times 52.7 = 39.584$	MA1	
		$39.584 + 2 \times 8.4 = 56.384$ NB Using an incorrect formula for the circumference will gain no marks.	MA1	3
16		mid pts fx 2 8 6 114 10 320 14 252 18 288 22 242	M1 for midpoint $\times f$ A1 for accuracy	
		$1224 \div 100$ $= 12.24$	MA1 A1	4
17		Recognition of Pythagoras as test Triangle B selected with supporting evidence $5^2 + 12^2 = 13^2$	C1 C1, C1	3
18	**(a)**	$2 + \frac{1}{6} - \frac{5}{8}$	MA1	
		$2 + \frac{4}{24} - \frac{15}{24}$	MA1	
		$1\frac{13}{24}$	A1	
	(b)	19550 16617.5 14124.875 £14125	MA1 MA1 MA1 A1	
		Alternative solution $23\,000 \times 0.85^3$ 14124.875 14125	MA2 MA1 A1	7

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			AVAILABLE MARKS
19	$\sin 50 = \frac{x}{6}$	MA1	
	$6 \sin 50 = x$	MA1	
	$x = 4.596$ or 4.6	A1	3
20	**(a)** 82	MA1	
	(b) Accept answers 62 to 66	MA1	
	200 – above = **134** to **138**	MA1	
	(c) median of 82	A1	
	quartiles of 70, 87	A1	
	range	A1	6
21	**(a)** $3x = 12$ **or** $3y = 33$	MA1	
	$x = 4$ and $y = 11$	MA1	
	(b) $8(1 - x) - 3(3x - 1) = 96$ or $\frac{2}{3} - \frac{2}{3}x - \frac{3}{4}x + \frac{1}{4} = 8$	MA1	
	$8 - 8x - 9x + 3 = 96$ $\quad \frac{2}{3} + \frac{1}{4} - 8 = \frac{2}{3}x + \frac{3}{4}x$	MA1	
	$11 - 17x = 96$ $\quad -\frac{85}{12} = \frac{17}{12}x$	MA1	
	$-17x = 85$		
	$x = -5$ $\quad x = -5$	A1	6
22	**(a)** $5y(3x - y)$	A1, A1	
	(b) $(x + 3)(x - 12)$	A2	4
	NB both factors must be correct. 1 mark cannot be gained		
23	$210 = 2 \times 3 \times 5 \times 7$		
	$252 = 2^2 \times 3^2 \times 7$	MA1	
	HCF = 42	A1	2
24	106% = £710.20	MA1	
	$\frac{710.20}{106} \times 100$	MA1	
	£670	A1	3

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			AVAILABLE MARKS
25	$\pi \times 8^2 = 201.1$	MA1	
	20.11 is $\frac{1}{10}$ or $\frac{20.11}{201.1} \times 360°$	MA2	
	$x = 36°$	A1	
	Alternative solution		
	$\frac{x}{360} \times \pi \times 8^2 = 20.11$	MA1	
	$x \times \pi \times 8^2 = 20.11 \times 360$	MA1	
	$x = \frac{20.11 \times 360}{\pi \times 8^2}$	MA1	
	$x = 36°$	A1	4
26	maximum length = 107.5	C1	
	maximum width = 68.5	C1	
	maximum area = 7363.75	A1	3
		Total	**100**

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Centre Number

Candidate Number

Rewarding Learning

General Certificate of Secondary Education
January 2013

Mathematics

Unit T3
(With calculator)
Higher Tier



[GMT31]

GMT31

FRIDAY 11 JANUARY, 9.15 am–11.15 am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided. Do not write outside the box, around each page, on blank pages or tracing paper.
Complete in blue or black ink only. **Do not write in pencil or with a gel pen**.
Answer **all twenty-five** questions.
Any working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

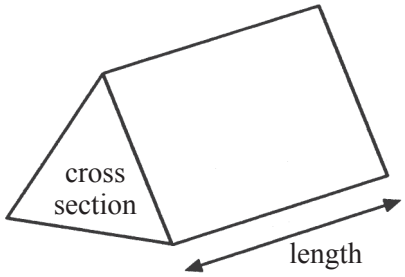
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **questions 1 and 25**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is overleaf.

8123

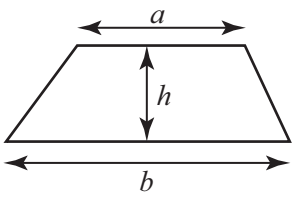
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Formula Sheet

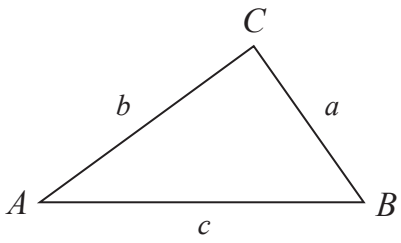
Volume of prism = area of cross section × length



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



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 = $\frac{1}{2}ab\sin C$

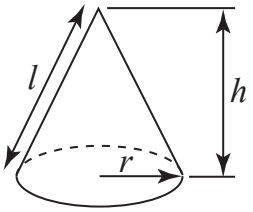
Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

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

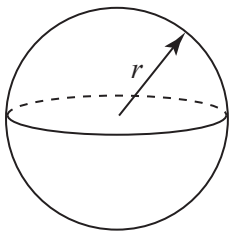
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = πrl



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

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



8123

1 **Quality of written communication will be assessed in this question.**
Show your working.

The signs below showed the price of the same table in two different stores.

Super Price £640 15% off marked price

Right Price £460 plus 20% VAT

Which store had the cheaper price for the table?

Explain your answer.

Answer _____ [6]

Examiner Only	
Marks	Remark
Total Question 1	

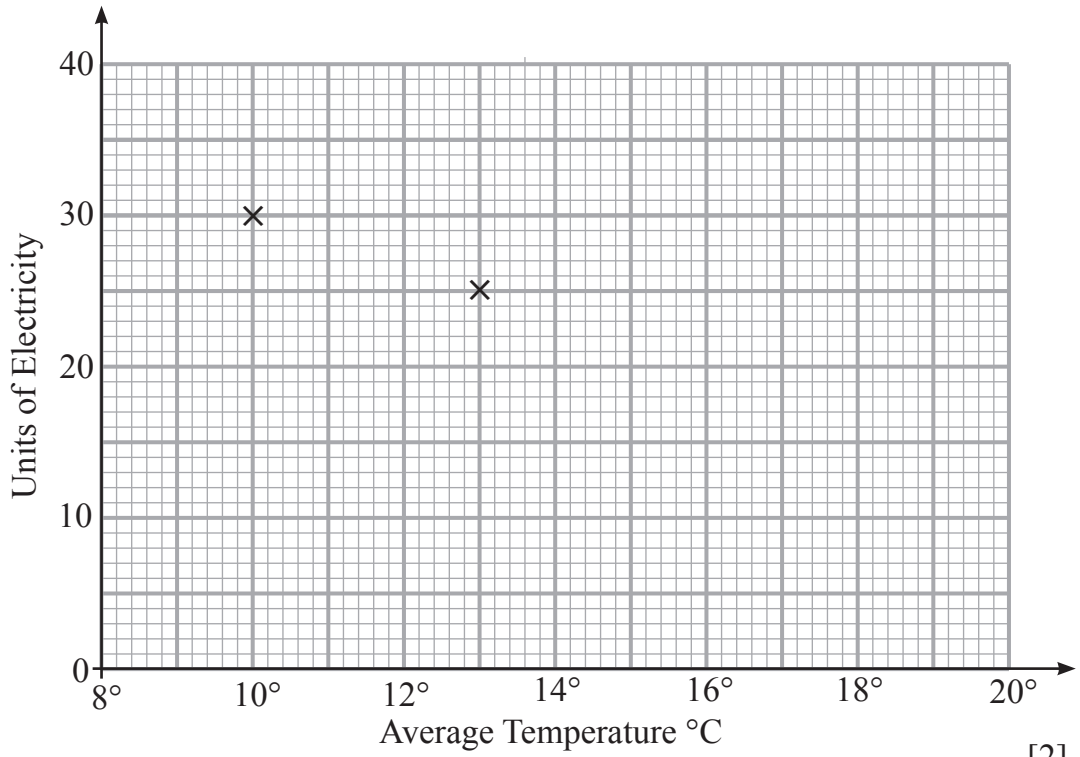
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2 The table shows the number of units of electricity used in heating a greenhouse on eight different days and the average temperature for each day.

Average Temperature (°C)	10	13	15	12	14	20	17	19
Units of Electricity	30	25	22	26	20	14	17	15

(a) Complete the scatter diagram shown (the first two points have been plotted for you).



[2]

(b) Describe the correlation between Average Temperature and Units of Electricity.

Answer _____ [1]

(c) Draw a line of best fit on the diagram.

[1]

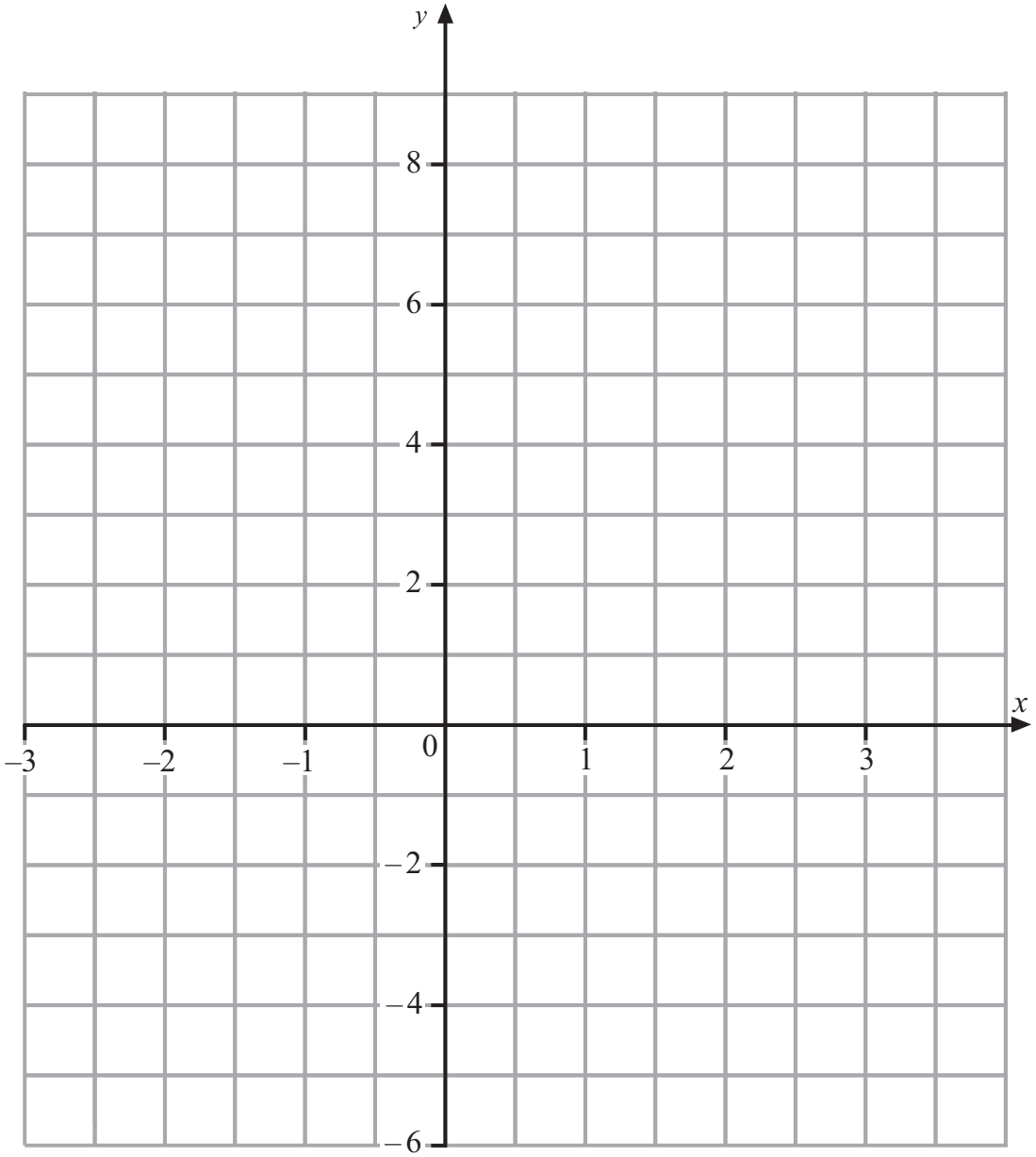
(d) Use your line of best fit to estimate how many of units of electricity were used when the temperature was 16 °C.

Answer _____ units [1]

Examiner Only	
Marks	Remark
Total Question 2	

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3 Draw the graph of $y = 3 - 2x$ on the grid below.



[3]

Examiner Only	
Marks	Remark
Total Question 3	

[Turn over

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4 A circle has a radius of 11.7 cm.

Work out the circumference of the circle.

Answer _____ [3]

Examiner Only	
Marks	Remark
Total Question 4	

5 **(a)** Which of the following fractions is nearest in value to $\frac{1}{4}$?

$\frac{3}{10}$ $\frac{7}{20}$ $\frac{4}{15}$ $\frac{17}{60}$

Show your working.

Answer _____ [2]

(b) Write down the meaning of $0.\dot{5}\dot{7}$

Answer _____ [1]

Total Question 5

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6 AB is a straight line. Three angles are shown.

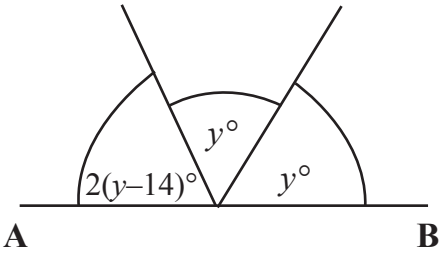


diagram not drawn accurately

(a) Write an **equation** in terms of y.

Answer _____ [1]

(b) Solve your equation to find y.

Answer y = _____ [3]

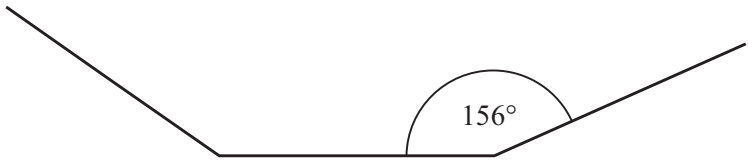
Examiner Only	
Marks	Remark
Total Question 6	

[Turn over

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7 The diagram below shows part of a regular polygon.

Each interior angle is 156°.



(a) Calculate the size of the exterior angle of the polygon.

Answer _____° [2]

(b) Calculate the number of sides of the polygon.

Answer _____ [2]

Examiner Only	
Marks	Remark
Total Question 7	

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8 Factorise fully

(a) 12p + 8 Answer _____ [1]

(b) $25 - a^2$ Answer _____ [1]

Examiner Only	
Marks	Remark
Total Question 8	

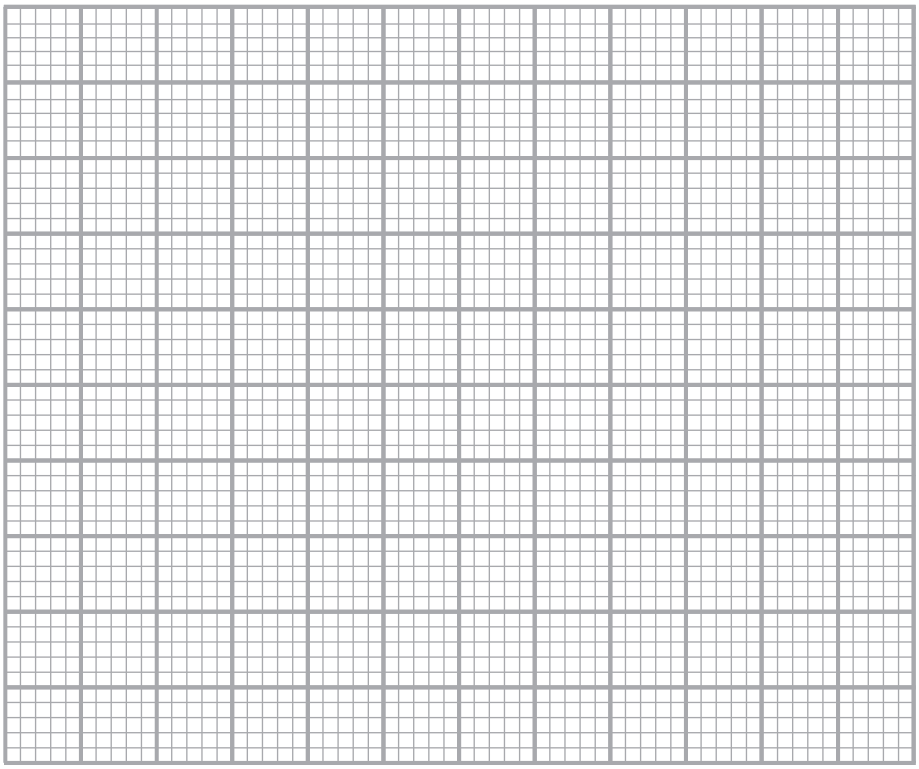
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9 The table shows the marks achieved by a class of girls in a test.

Marks	Number of girls
1–10	3
11–20	8
21–30	7
31–40	7
41–50	4
51–60	2

(a) Draw a grouped frequency diagram.



[3]

Examiner Only	
Marks	Remark

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(b) Write down the modal class.

Answer _____ [1]

(c) Calculate an estimate for the mean mark in the test.

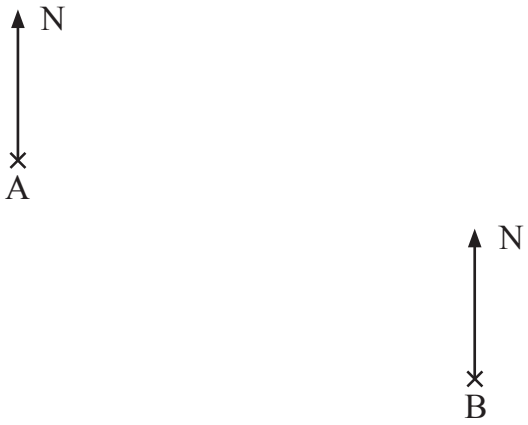
Answer _____ [4]

(d) Which group contains the median mark?

Answer _____ [1]

Examiner Only	
Marks	Remark
Total Question 9	

10



The diagram above represents the location of two boats, A and B, at sea.

A lighthouse, H, can be seen from both boats.

The bearing of the lighthouse from A is 216°.

The bearing of the lighthouse from B is 278°.

On the diagram above, locate and mark the position of the lighthouse, H.

[2]

Examiner Only	
Marks	Remark
Total Question 10	

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11

Examiner Only	
Marks	Remark

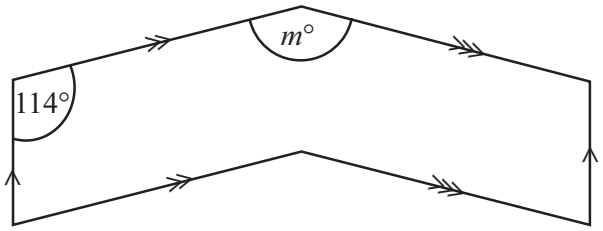


diagram
not drawn
accurately

The shape above has three pairs of parallel lines and one line of symmetry.

An angle of 114° is as shown on the diagram.

Find the size of the angle marked m.

Answer m = _____ [2]

Total Question 11

[Turn over

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12 Simplify $\frac{x}{4} - \frac{x}{6}$

Answer _____ [3]

Examiner Only	
Marks	Remark
Total Question 12	

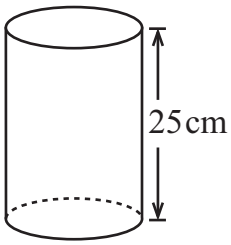
13 The volume of water in a tank increases by 5% every hour.
At 2pm there are 6000 litres of water in the tank.
What will the volume of water be at 5pm?

Answer _____ litres [3]

Examiner Only	
Marks	Remark
Total Question 13	

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14



The cylinder above has a capacity of 3 litres. It is 25 cm high.

Find the radius of the cylinder.

Answer _____ cm [4]

Examiner Only	
Marks	Remark
Total Question 14	

[Turn over

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15 **(a)** The two points A (6, 6) and B (−4, 6) are joined by a straight line.

Work out the *x* co-ordinate of the midpoint of the line AB.

Answer midpoint (_____, 6) [1]

(b) C has coordinates (6, −1). B has coordinates (−4, 6).
Calculate the length of the line CB.

Answer _____ [3]

Examiner Only	
Marks	Remark
Total Question 15	

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16 In a class there are 16 girls and 14 boys.
Thirteen of the girls are right-handed and eleven of the boys are right-handed.
What percentage of the class are right-handed?

Answer _____ % [3]

Examiner Only	
Marks	Remark

Total Question 16

17 A student is designing a questionnaire for her friends to complete. She wants to find the different activities that her friends attend after school.

Design a suitable question with appropriate response boxes which would allow **every** student to make a response.

[2]

Total Question 17

[Turn over

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18 Write 90 as a product of prime factors.

Answer _____ [2]

Examiner Only	
Marks	Remark
Total Question 18	

19 One solution of $x^3 - 2x = 30$ lies between 3 and 4

Use the method of **trial and improvement** to find this solution correct to one decimal place.

Show all your working.

Answer x = _____ [3]

Examiner Only	
Marks	Remark
Total Question 19	

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20 **(a)** Expand and simplify

(i) $6(y + 3) - 2(2y + 3)$

Answer _____ [2]

(ii) $(x - 3)^2$

Answer _____ [2]

(b) Write down the nth term for the sequence

2, 8, 14, 20, ...

Answer _____ [2]

Examiner Only	
Marks	Remark
Total Question 20	

[Turn over

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21



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A chair has a sale price of £52.48 which is a saving of 18% on the original price.

What was the original price of the chair?

Answer £ _____ [3]

Examiner Only	
Marks	Remark

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22 **(a)** Evaluate $\frac{3}{4} + 2\frac{1}{2} \times 1\frac{1}{3}$ giving your answer as a mixed number.

Show all your working.

Answer _____ [2]

(b) Find the lowest common multiple (LCM) of 48 and 80

Answer _____ [2]

Examiner Only	
Marks	Remark
Total Question 22	

[Turn over

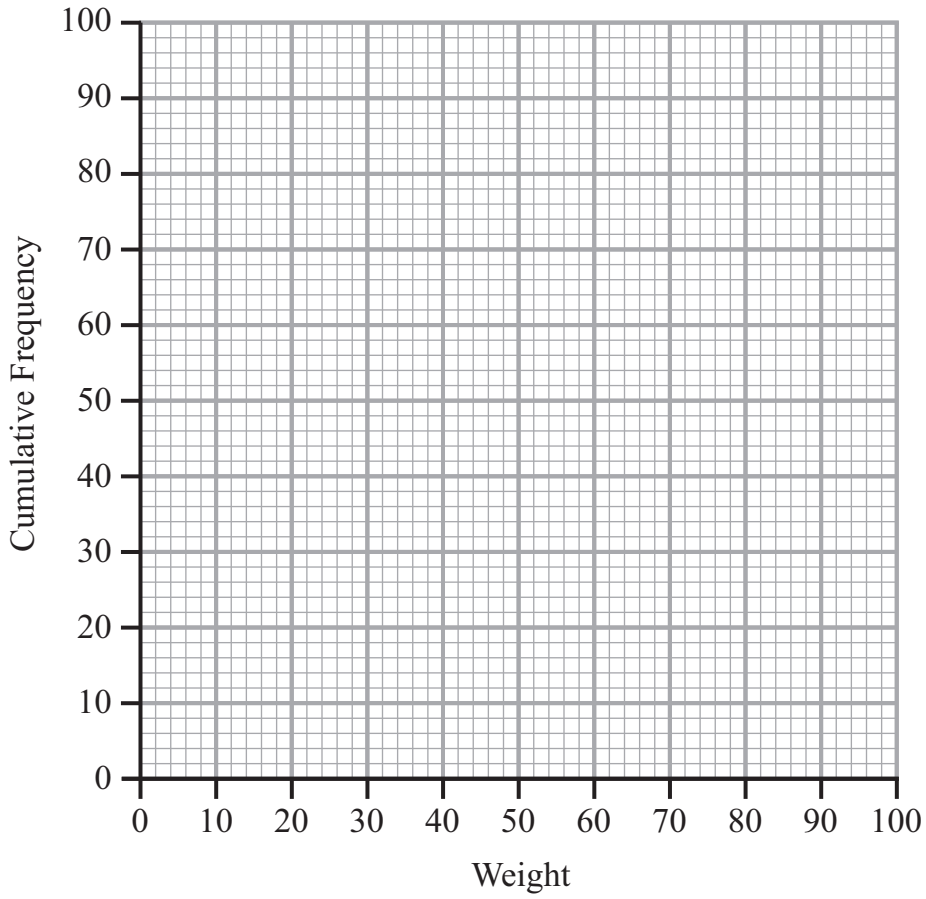
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23 The weights of potatoes collected from 100 garden plots are shown in the table.

Weights (w kg)	Frequency	Cumulative Frequency
$0 < w \leq 10$	4	4
$10 < w \leq 20$	8	
$20 < w \leq 30$	11	
$30 < w \leq 40$	13	
$40 < w \leq 50$	10	
$50 < w \leq 60$	32	
$60 < w \leq 70$	10	
$70 < w \leq 80$	8	
$80 < w \leq 90$	4	

(a) Complete the Cumulative Frequency column in the table. [1]

(b) Hence draw the Cumulative Frequency graph on the axes provided.



[3]

Examiner Only

Marks	Remark

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(c) From your completed graph,

Examiner Only	
Marks	Remark

(i) find the median weight,

Answer _____ kg [1]

(ii) find the inter-quartile range,

Answer _____ kg [2]

(iii) estimate the number of garden plots which produced weights of at least 45 kg.

Answer _____ [2]

Total Question 23	

[Turn over

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24 (a) Solve the simultaneous equations

$$2x - 4y = 10$$
$$3x + 2y = 7$$

Show your working.
A solution by trial and improvement will not be accepted.

Answer $x =$ _____, $y =$ _____ [3]

(b) Solve the equation $\frac{x-1}{3} + \frac{3x-2}{4} = \frac{4}{3}$

Show your working.
A solution by trial and improvement will not be accepted.

Answer $x =$ _____ [4]

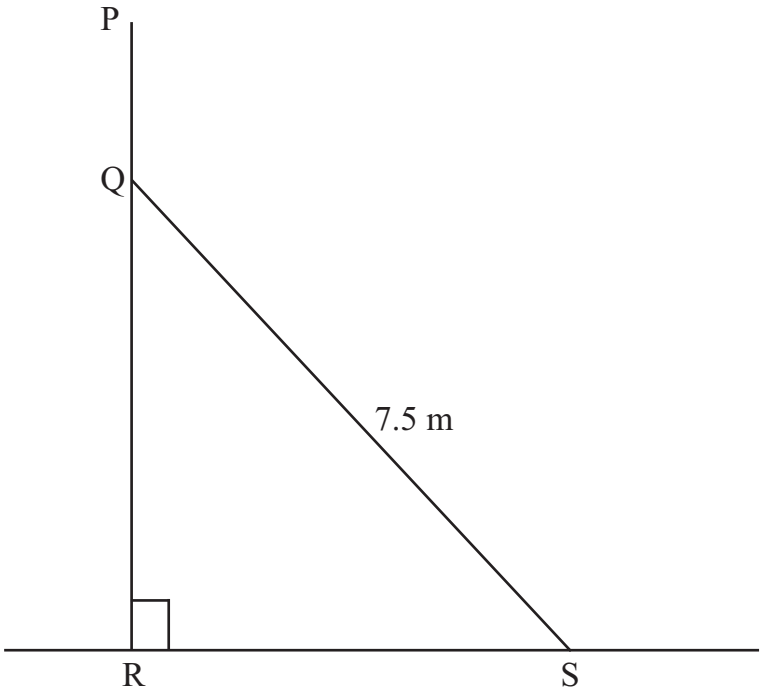
Examiner Only	
Marks	Remark
Total Question 24	

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Quality of written communication will be assessed in this question.
Show your working.

Examiner Only	
Marks	Remark

25



The diagram represents a vertical wall PQR.
RS is horizontal ground.
SQ is a metal support of length 7.5 metres.
The height of the wall is 10 metres.
For the support to be effective, the length PQ must be at least 3 metres.
Show that when the angle RSQ = 67° the support will be effective.

[4]

Total Question 25

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THIS IS THE END OF THE QUESTION PAPER

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For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
January 2013

Mathematics

Unit T3

Higher Tier

[GMT31]

FRIDAY 11 JANUARY
9.15 am–11.15 am

MARK SCHEME

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Introduction

The mark scheme normally provides the most popular solution to each question. Other solutions given by candidates are evaluated and credit given as appropriate; these alternative methods are not usually illustrated in the published mark scheme.

The solution to a question gains marks for correct method and marks for accurate working based on this method. The marks awarded for each question are shown in the right hand column and they are prefixed by the letters **M**, **A** and **MA** as appropriate. The key to the mark scheme is given below:

M indicates marks for correct method.
A indicates marks for accurate working, whether in calculation, reading from tables, graphs or answers. Accuracy marks may depend on preceding **M** (method) marks, hence **M**0 **A**1 cannot be awarded i.e. where the method is not correct no marks can be given.
MA indicates marks for combined method and accurate working.

C indicates marks for quality of written communication.

A later part of a question may require a candidate to use an answer obtained from an earlier part of the same question. A candidate who gets the wrong answer to the earlier part and goes on to the later part is naturally unaware that the wrong data is being used and is actually undertaking the solution of a parallel problem from the point at which the error occurred. If such a candidate continues to apply correct method, then the candidate's individual working must be **followed through** from the error. If no further errors are made, then the candidate is penalised only for the initial error. Solutions containing two or more working or transcription errors are treated in the same way. This process is usually referred to as "follow-through marking" and allows a candidate to gain credit for that part of a solution which follows a working or transcription error.

It should be noted that where an error trivialises a question, or changes the nature of the skills being tested, then as a general rule, it would be the case that not more than half the marks for that question or part of that question would be awarded; in some cases the error may be such that no marks would be awarded.

Positive marking:

It is our intention to reward candidates for any demonstration of relevant knowledge, skills or understanding. For this reason we adopt a policy of **following through** their answers, that is, having penalised a candidate for an error, we mark the succeeding parts of the question using the candidate's value or answers and award marks accordingly.

Some common examples of this occur in the following cases:

(a) a numerical error in one entry in a table of values might lead to several answers being incorrect, but these might not be essentially separate errors;

(b) readings taken from candidates' inaccurate graphs may not agree with the answers expected but might be consistent with the graphs drawn.

When the candidate misreads a question in such a way as to make the question easier, only a proportion of the marks will be available (based on the professional judgement of the examiner).

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General Marking Advice:

(i) If the correct answer is seen in the body of the script and the answer given in the answer line is clearly a transcription error, full marks should be awarded.

(ii) If the answer is missing, but the correct answer is seen in the body of the script, full marks should be awarded.

(iii) If the correct answer is seen in working but a completely different answer is seen in the answer space, then some marks will be awarded depending on the severity of the error.

(iv) Work crossed out but not replaced should be marked.

(v) In general, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered (with no solution offered on the answer line), mark the poorest answer.

(vi) For methods not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work.

(vii) Where a follow through mark is indicated on the mark scheme for a particular part question, the marker must ensure that you refer back to the answer of the previous part of the question.

(viii) Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen. E.g. the answer in the mark scheme is 4.65 and the candidate then correctly rounds to 4.7 or 5 on the answer line. Allow full marks for 4.65 seen in the working.

(ix) Anything in the mark scheme which is in brackets (...) is not required for the mark to be earned, but if present it must be correct.

(x) For any question, the range of answers given in the mark scheme is inclusive.

Quality of written communication

In GCSE Mathematics, particular questions are identified where candidates must demonstrate the quality of their written communication.

In particular, candidates must:

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear (i.e. comprehension and meaning is clear by using the correct notation and labelling conventions);

(ii) select and use a form and style of writing appropriate to their purpose and to complex subject matter (i.e. reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning); and

(iii) organise information clearly and coherently, using specialist vocabulary where appropriate (i.e. mathematical methods and processes used are coherently and clearly organised and appropriate mathematical vocabulary used).

This assessment may be through, for example, an explanation of the geometrical properties of a given shape or, for example, through concise mathematical argument in a multi-step problem.

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				AVAILABLE MARKS
1	$\frac{15}{100} \times 640 = 96$	or $\frac{20}{100} \times 460 = 92$	C1, C1	
	$(640 - 96) = 544$	$(460 + 92) = 552$	C1	
	$\frac{20}{100} \times 460 = 92$	$\frac{15}{100} \times 640 = 96$	C1	
	$(460 + 92) = 552$	$(640 - 96) = 544$	C1	
	Super Price		C1	6
2	**(a)** Points plotted		6 correct A2 (4 correct A1)	
	(b) Negative		A1	
	(c) Accurate line drawn		A1	
	(d) Their reading correct		A1	5
3	1st correct point		A1	
	2nd correct point		A1	
	Straight line		MA1	3
4	$2 \times \pi \times 11.7 = 73.5(1326\ldots)$ cm		MA1, A1, A1 (units)	3
5	**(a)** $\frac{18}{60}$ $\frac{21}{60}$ $\frac{16}{60}$ **or** 0.3 0.35 0.26(66...) 0.28(33...)		MA1	
	or 30% 35% 26(27)% 28%		A1	
	$\frac{4}{15}$ (Work must be shown for any mark)			
	(b) 0.575757...		A1	3
6	**(a)** $2(y - 14) + y + y = 180$ (or equivalent)		MA1	
	(b) $4y - 28 = 180$ $4y = 208$		MA1, MA1	
	$y = 52$		A1	4
7	**(a)** $180 - 156$		MA1	
	24		A1	
	(b) $360 \div 24$		MA1	
	15		A1	4

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			AVAILABLE MARKS
8	**(a)** $4(3p + 2)$	A1	
	(b) $(5 - a)(5 + a)$	A1	2
9	**(a)** Suitable diagram with scales	M1	
	6 bars correct ($\geqslant 4$ A1)	A2	
	(b) Modal class = 11–20	A1	

(c)

x	f	fx
5.5	3	16.5
15.5	8	124
25.5	7	178.5
35.5	7	248.5
45.5	4	182
55.5	2	111
	31	860.5

x A1

fx M1

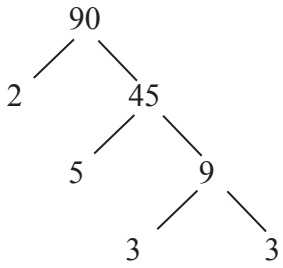
mean MA1

mean $= \frac{860.5}{31} = 27.75(806)$ A1

(d) Median = 16th 21–30 A1 — 9

10	Angles A1, A1	A2	2
11	$(180 - 114) = 66$	MA1	
	132	A1	2
12	$\frac{3x}{12} - \frac{2x}{12} = \frac{x}{12}$	MA1, MA1, A1	3
13	6300	MA1	
	6615	MA1	
	6945.75	MA1	3
14	3 litres = 3000 cm^3	A1	
	$\pi \times r^2 \times 25 = 3000$	MA1	
	$r^2 = 38.197$	MA1	
	$r = 6.18$	A1	4
15	**(a)** x co-ordinate = 1	A1	
	(b) $\sqrt{10^2 + 7^2} = \sqrt{149} = 12.2(065556)$	MA1, A1, A1	4

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			AVAILABLE MARKS
16	$\frac{24}{30}$	MA1	
	$\frac{24}{30} \times 100 = 80\%$	M1, A1	3
17	Must contain relevant opening question/title regarding activities		
	With OTHER	A1	
	With DON'T HAVE ACTIVITY	A1	2
18	$2\overline{)90}$ $3\overline{)45}$ $3\overline{)15}$ $5\overline{)5}$ 1 **or** $2\overline{)90}$ $5\overline{)45}$ $3\overline{)9}$ 3 **or** 	M1	
	$2 \times 3 \times 3 \times 5$ **or** $2 \times 3^2 \times 5$	MA1	2
19	$x = 3.4$ 32.504 $x = 3.3$ 29.337 $x = 3.35$ tested 30.895375 $x = 3.3$	MA1 for these two values identified MA1 A1	3
20	**(a)** **(i)** $6y + 18 - 4y - 6$ $= 2y + 12$	MA1 A1	
	(ii) $x^2 - 3x - 3x + 9$ $= x^2 - 6x + 9$	MA1 A1	
	(b) $6n - 4$	A1, A1	6
21	$82\% = 52.48$	MA1	
	$52.48 \div 0.82 = 64$	M1, A1	3

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				AVAILABLE MARKS
22	**(a)**	$\frac{3}{4} + \frac{10}{3}$ **or** $\frac{3}{4} + \frac{20}{6}$	MA1	
		$4\frac{1}{12}$	A1	
	(b)	$48 = 2 \times 2 \times 2 \times 2 \times 3$ $80 = 2 \times 2 \times 2 \times 2 \times 5$	MA1	
		LCM $= 2 \times 2 \times 2 \times 2 \times 3 \times 5$ $= 240$	A1	4
23	**(a)**	4, 12, 23, 36, 46, 78, 88, 96, 100	A1	
	(b)	9 points correct (7 points correct allow A1)	A2	
		Lines or curve	A1	
	(c)	**(i)** Their median – follow graph	A1	
		(ii) Quartiles at 25 and 75 correctly read	MA1	
		Difference correct	A1	
		(iii) their reading at 45	A1	
		100 – their reading	MA1	9
24	**(a)**	$2x - 4y = 10$ $6x + 4y = 14$ (or equivalent equating of coefficients)	MA1	
		$8x = 24$ $x = 3$	A1	
		$y = -1$	A1	
	(b)	$\frac{4(x-1) + 3(3x-2)}{12} = \left(\frac{16}{12}\right)$ LHS	MA1	
		$4(x - 1) + 3(3x - 2) = 16$ fractions RHS	MA1	
		$4x - 4 + 9x - 6 = 16$		
		$13x = 26$	MA1	
		$x = 2$	MA1	7
25		Sin $67° = \frac{QR}{7.5}$	C1	
		QR = 6.903786	C1	
		PQ = 10 – 6.903786 = 3.096214	C1	
		PQ > 3 metres	C1	4
			Total	**100**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2012

Mathematics

Unit T3
(With calculator)
Higher Tier



[GMT31]

GMT31

WEDNESDAY 6 JUNE 9.15 am–11.15 am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Complete in blue or black ink only. **Do not write in pencil or with a gel pen.**
Answer **all nineteen** questions.
Any working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

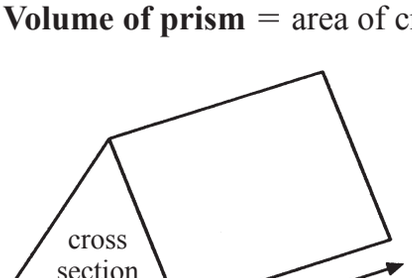
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **questions 4 and 16**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is overleaf.

7416

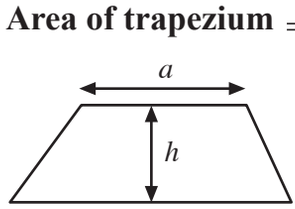
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Formula Sheet

Volume of prism = area of cross section × length

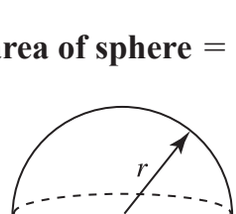


Area of trapezium = $\frac{1}{2}(a+b)h$



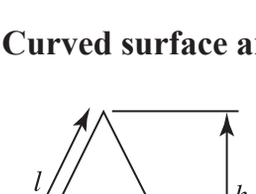
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

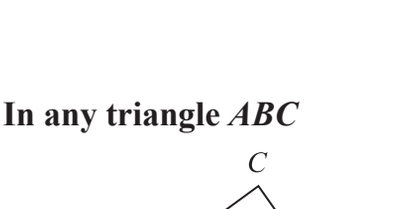


Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

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

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 = $\frac{1}{2}ab\sin C$

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1 One week a money exchange bureau discovered that 15% of the £20 notes they changed were fake. If they changed £5,600 worth of £20 notes, how many of these £20 notes were fake?

Answer _____ [3]

Examiner Only	
Marks	Remark
Total Question 1	

[Turn over

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2 **(a)** Write the ratio 12 : 27 in its simplest form.

Answer _____ [1]

(b) The heights of three flower pots are 45 cm, 30 cm and 10 cm.

Write the ratio of their heights in simplest form.

Answer _____ [1]

(c) Complete the following:

The recurring decimal 0.280280280… can be written using dot notation as _____ [1]

(d) Fill in the box to make the statement correct.

$$\frac{1}{\square} + \frac{1}{4} = \frac{9}{20}$$ [2]

Examiner Only	
Marks	Remark
Total Question 2	

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3 **(a)** Solve the equations:

(i) $3(2x - 5) = 4$

Answer $x =$ _____ [3]

(ii) $\frac{12-5x}{4} = 1$

Answer $x =$ _____ [3]

(b) Liz buys x markers at 90p each and 3 books at £1.20 each. The total cost is £13.50

Write down an equation and solve it to find x.

Equation _____

Answer $x =$ _____ [4]

Examiner Only	
Marks	Remark
Total Question 3	

Quality of written communication will be assessed in this question.

Examiner Only	
Marks	Remark

4 **(a)** Jacob wants to investigate the hypothesis

"Children watch more television than adults."

He surveys 8 boys in his class and 8 teachers in his school.

Give **two** reasons why his sample is unsuitable.

Reason 1 _____

_____ [1]

Reason 2 _____

_____ [1]

(b) Twenty pupils were asked to estimate the length of a line in cm.

Their responses are listed below.

12.6	13.0	9.8	8.5	10.3
12.1	11.3	10.0	9.5	12.6
8.7	9.1	10.6	12.1	12.2
9.7	11.1	9.0	8.9	8.0

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Construct a stem and leaf diagram to illustrate this data.

[3]

Examiner Only	
Marks	Remark
Total Question 4	

[Turn over

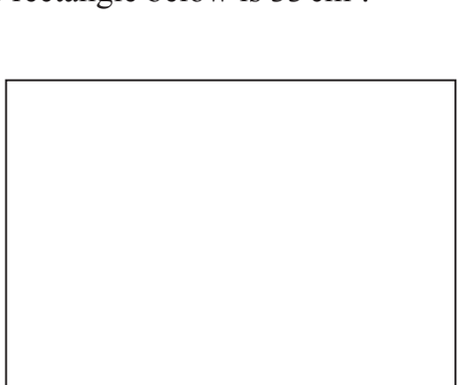
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5 **(a)** Calculate the circumference of a circular garden with radius 5.4 m.

Examiner Only	
Marks	Remark

Answer _____ m [2]

(b) The area of the rectangle below is 33 cm^2.



Change 33 cm^2 into mm^2.

Answer _____ mm^2 [2]

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(c) Find the area of a triangle with base 9 cm and perpendicular height 6 cm.

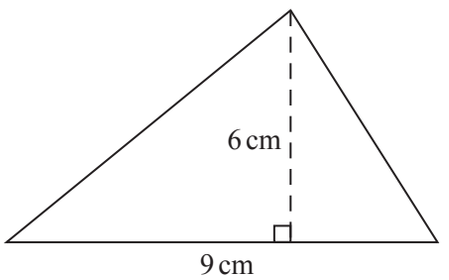


Diagram not drawn accurately

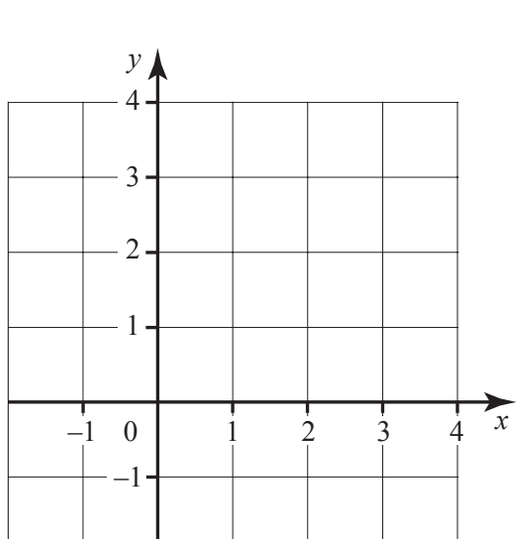
Answer _____ [3]

Examiner Only	
Marks	Remark
Total Question 5	

[Turn over

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6 Draw the graph of $3x + 4y = 12$ [3]

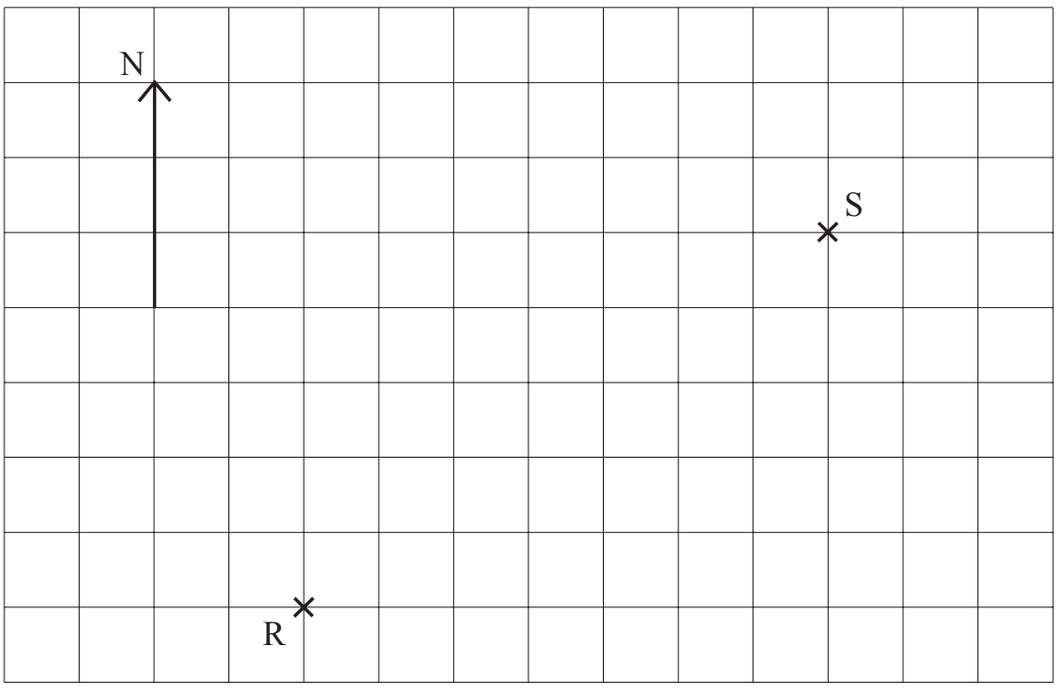


Examiner Only	
Marks	Remark
Total Question 6	

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Examiner Only	
Marks	Remark

7 **(a)** Two lighthouses are at the points R and S on the diagram.



What is the bearing of R from S?

Answer _____° [1]

[Turn over

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(b) The lines EF and GH are parallel.

Calculate the size of angles a and b.

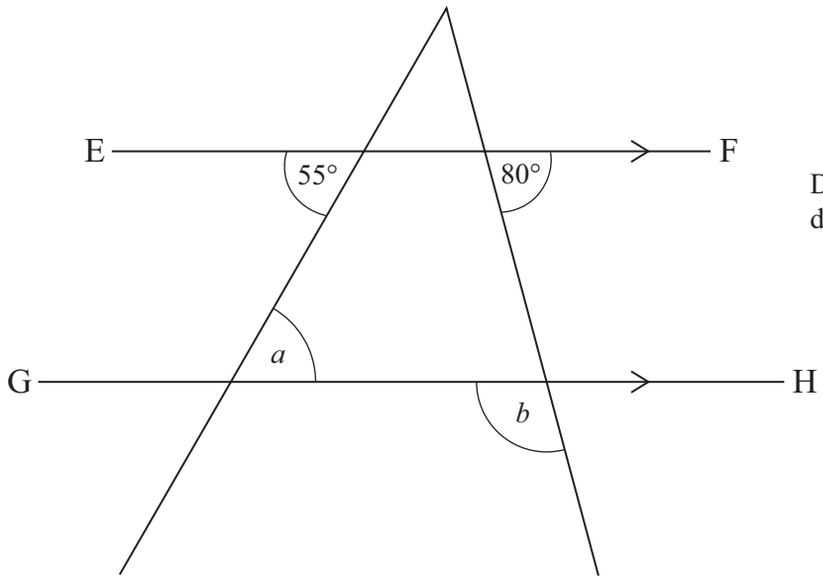


Diagram not drawn accurately

Answer a = _____°

b = _____° [2]

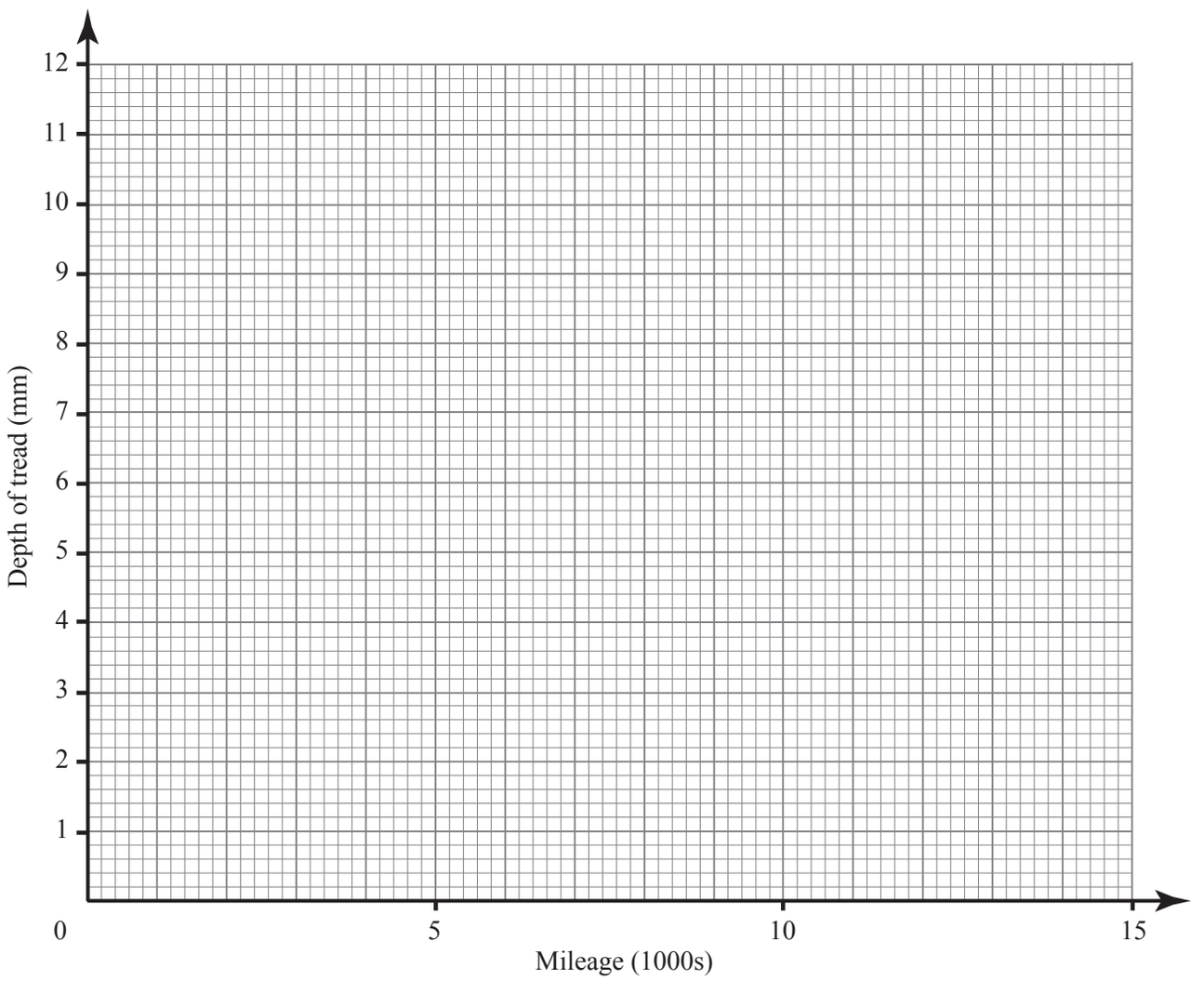
Examiner Only	
Marks	Remark
Total Question 7	

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8 The mileage on seven cars (in 1000s of miles) and the depth of tread on the tyres (in mm) were recorded. The table shows the results.

Mileage (1000s)	3	8	12.5	9	6	15	4.5
Depth of tread (mm)	9.4	7.7	10.6	7.4	8.4	4.9	8.7

(a) Draw a scatter graph for this data.



[2]

Examiner Only	
Marks	Remark

[Turn over

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(b) One of the points seems unusual. Circle this point and suggest a possible reason for it.

Answer _____

_____ [1]

(c) Describe the type of correlation of the other points and explain what this means.

Answer _____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 8	

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9 **(a)** Complete the following to write 252 as a product of prime factors.

$252 = 2 \times 2 \times 3 \times _____ \times _____$ [1]

(b) Write 297 as a product of prime factors.

Answer _____ [1]

(c) A floor measuring 252 cm by 297 cm is to be covered **completely** by identical square tiles.

What is the **length** of side of the largest square tile that can be used?

Answer _____ cm [2]

Examiner Only	
Marks	Remark
Total Question 9	

10 (a) Paul's car insurance is due and the company quote him a price of £228.

Another company make him an offer which is 35% cheaper and he decides to take up their offer. How much does he pay?

Answer £ _____ [2]

(b) Steve invests £8,400 at 1.8% per annum compound interest for 3 years.

Calculate the amount at the end of 3 years.

Answer £ _____ [3]

Examiner Only	
Marks	Remark
Total Question 10	

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11 Two sides of a triangle are 6 cm and 8 cm.

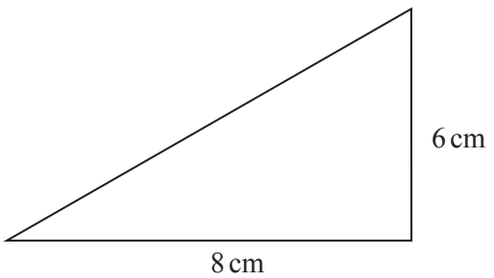


Diagram not drawn accurately

(a) **If** the third side is 10 cm, show why the triangle **must** be right-angled.

[1]

(b) **If** the triangle is **not** right-angled write down a possible length that the third side could have.

Answer _____ cm [1]

Examiner Only	
Marks	Remark
Total Question 11	

[Turn over

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12 The table shows the ages of people visiting the town library one Saturday morning.

Age	Frequency		
$0 < A \leqslant 10$	7		
$10 < A \leqslant 20$	4		
$20 < A \leqslant 30$	5		
$30 < A \leqslant 40$	4		
$40 < A \leqslant 50$	18		
$50 < A \leqslant 60$	20		
$60 < A \leqslant 70$	22		

(a) Calculate an estimate for the mean age of the library users.

Answer _____ [4]

(b) Write down the class interval which contains the median age.

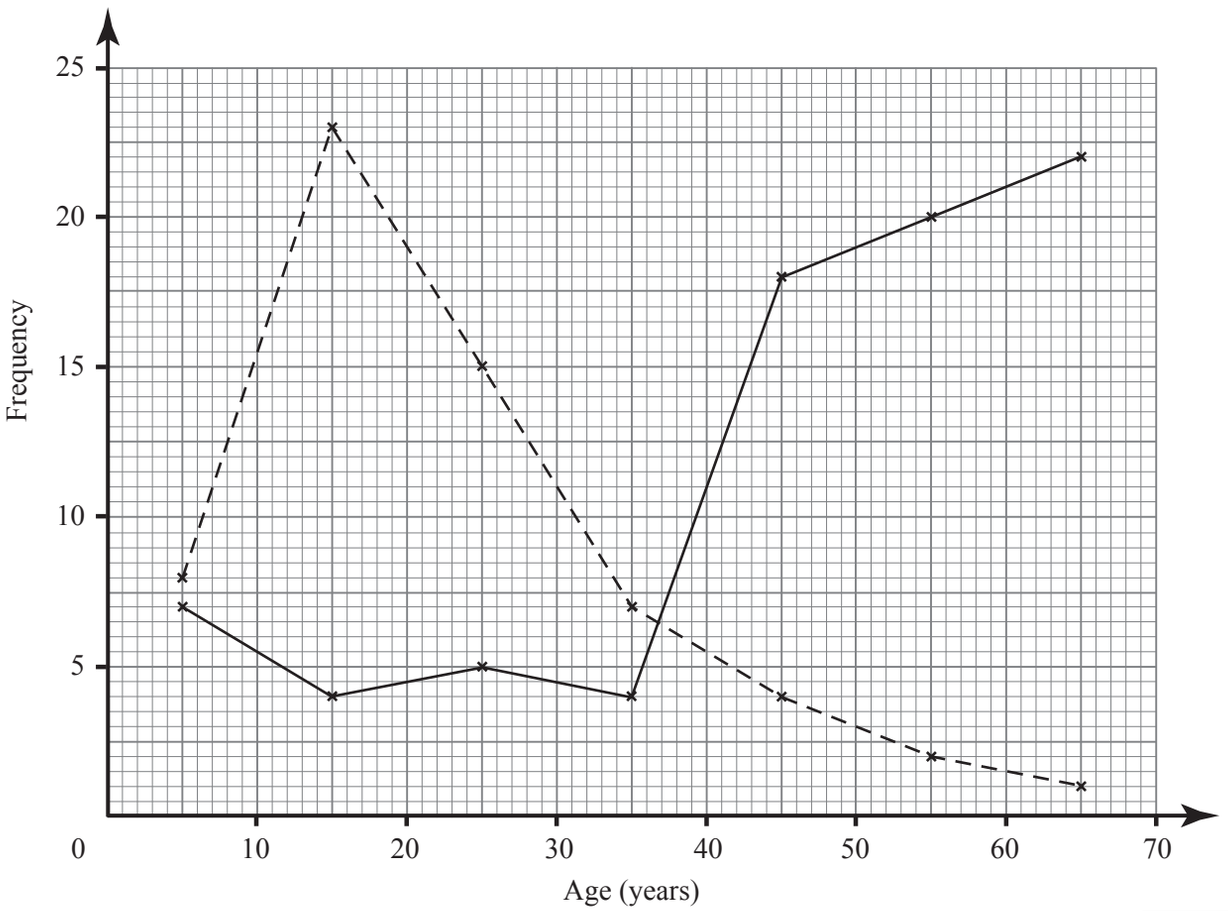
Answer _____ [1]

Examiner Only	
Marks	Remark

(c) The frequency polygon below (solid line) illustrates the data recorded at the library.

A second frequency polygon (broken line) illustrates the ages of people visiting a different place in the same town on the Saturday morning.

By considering the polygons suggest what the second place might be. Give a reason for your answer.



Answer _____ because _____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 12	

[Turn over

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13 **(a)** P is the point (1, 4). Q is the point (7, −2). Find the co-ordinates of the midpoint of PQ.

Answer (_____ , _____) [2]

(b) Calculate the size of the interior angle of a regular nonagon (nine-sided polygon).

Answer _____ ° [2]

(c) Calculate the area of a semi-circle with diameter 6 cm.

Answer _____ cm^2 [2]

Examiner Only	
Marks	Remark
Total Question 13	

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14 Use the method of trial and improvement to solve the equation

$$x^3 + 2x = 60$$

giving the answer correct to one decimal place.

Show all your working.

Answer $x =$ _____ [4]

Examiner Only	
Marks	Remark
Total Question 14	

[Turn over

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15 **(a)** Expand and simplify $(2a + 3)(3a - 2)$

Answer _____ [2]

(b) Factorise fully

(i) $9xy - 12y^2$

Answer _____ [2]

(ii) $y^2 - 9$

Answer _____ [1]

Examiner Only	
Marks	Remark
Total Question 15	

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Quality of written communication will be assessed in this question.

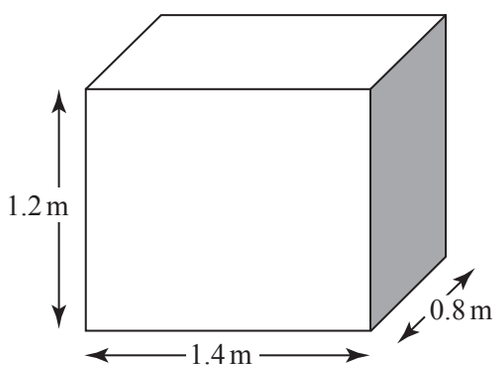
Show your working.

Examiner Only	
Marks	Remark

16 (a) In a housing estate $\frac{5}{6}$ of the houses have a garage.
In three out of every four garages there is a car parked.
There are 15 cars in total parked in a garage. Find the number of houses that have no garage.

Answer _____ [3]

(b) An empty tank is in the shape of a cuboid as shown with measurements 1.4 m, 1.2 m and 0.8 m all to the nearest 0.1 m.
What is the smallest possible volume of the tank?



Answer _____ m^3 [3]

Total Question 16

[Turn over

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17 120 employees in a warehouse were asked how far they travelled to work each day. The table shows their responses.

Distance (km)	Frequency (number of people)	Distance ($\leqslant$)	Cumulative frequency
$0 < d \leqslant 5$	5	5	5
$5 < d \leqslant 10$	12	10	17
$10 < d \leqslant 15$	16		
$15 < d \leqslant 20$	21		
$20 < d \leqslant 25$	27		
$25 < d \leqslant 30$	14		
$30 < d \leqslant 35$	12		
$35 < d \leqslant 40$	8		
$40 < d \leqslant 45$	5		

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

(b) Draw the cumulative frequency graph on the grid opposite. [3]

(c) Use your graph to find

(i) the median,

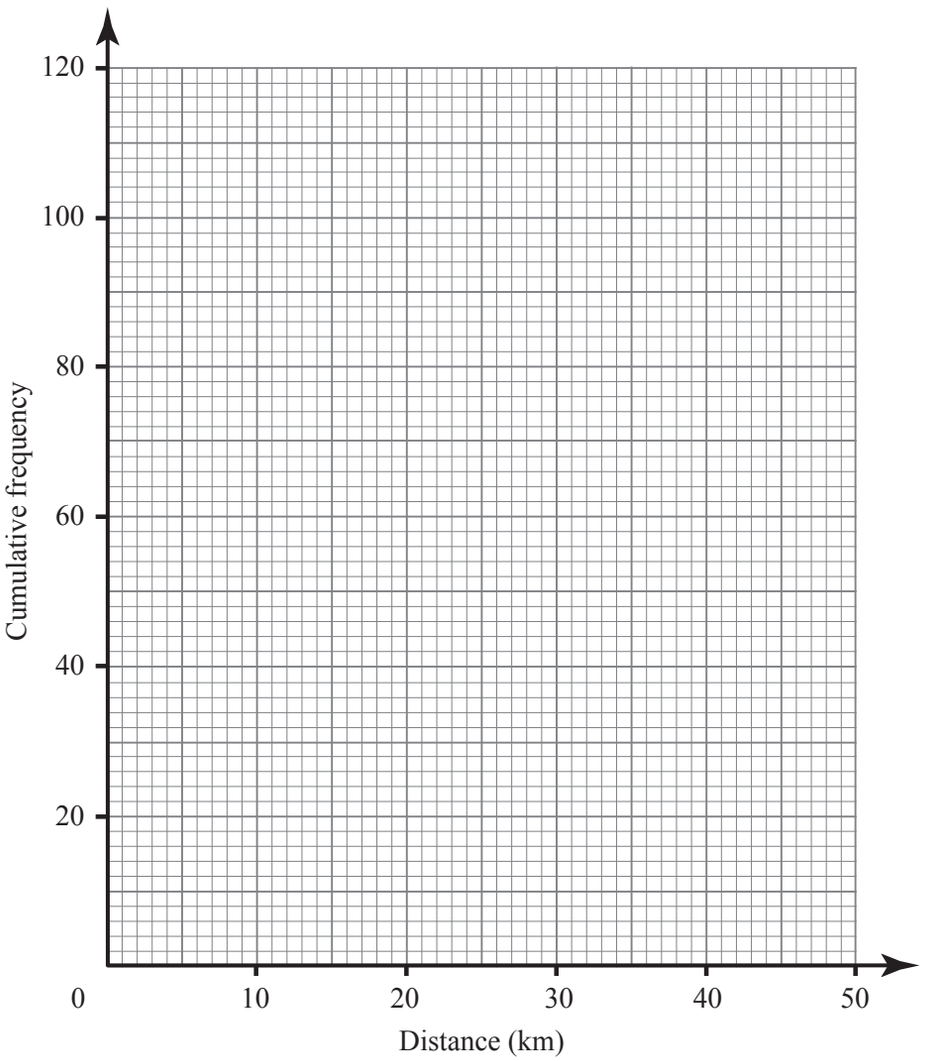
Answer _____ km [1]

Examiner Only	
Marks	Remark

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(ii) the **percentage** of employees who travel more than 18 km to work each day.

Answer _____ % [2]



Examiner Only	
Marks	Remark
Total Question 17	

18 **(a)** M is the point $(-1, 4)$. N is the point $(5, 8)$.

Find the length of MN correct to 2 decimal places.

Answer _____ [3]

(b) Calculate the angle DCE in the triangle below.

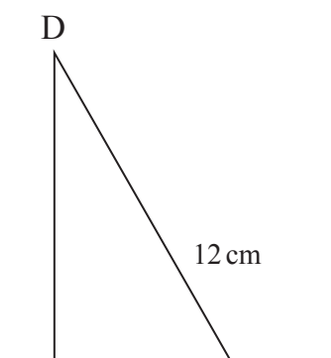


Diagram not drawn accurately

Answer _____ ° [3]

Examiner Only	
Marks	Remark
Total Question 18	

19 **(a)** Solve the simultaneous equations

$$5x + 2y = 13$$
$$2x - 3y = 9$$

A solution by trial and improvement will not be accepted.

Answer $x =$ _____

$y =$ _____ [4]

(b) Find the equation of the line through the points (0, 1) and (3, 13)

Answer _____ [3]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark
Total Question 19	

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For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
QWC	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2012

Mathematics

Unit T3
Higher Tier

[GMT31]

WEDNESDAY 6 JUNE, MORNING

MARK SCHEME

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Introduction

The mark scheme normally provides the most popular solution to each question. Other solutions given by candidates are evaluated and credit given as appropriate; these alternative methods are not usually illustrated in the published mark scheme.

The marks awarded for each question are shown in the right-hand column and they are prefixed by the letters **M**, **A** and **MA** as appropriate. The key to the mark scheme is given below:

M indicates marks for correct method.
A indicates marks for accurate working, whether in calculation, readings from tables, graphs or answers.
MA indicates marks for combined method and accurate working.

The solution to a question gains marks for correct method and marks for an accurate working based on this method. Where the method is not correct no marks can be given.
A later part of a question may require a candidate to use an answer obtained from an earlier part of the same question. A candidate who gets the wrong answer to the earlier part and goes on to the later part is naturally unaware that the wrong data is being used and is actually undertaking the solution of a parallel problem from the point at which the error occurred. If such a candidate continues to apply correct method, then the candidate's individual working must be **followed through** from the error. If no further errors are made, then the candidate is penalised only for the initial error. Solutions containing two or more working or transcription errors are treated in the same way. This process is usually referred to as "follow-through marking" and allows a candidate to gain credit for that part of a solution which follows a working or transcription error.

It should be noted that where an error trivialises a question, or changes the nature of the skills being tested, then as a general rule, it would be the case that not more than half the marks for that question or part of that question would be awarded; in some cases the error may be such that no marks would be awarded.

Positive marking

It is our intention to reward candidates for any demonstration of relevant knowledge, skills or understanding. For this reason we adopt a policy of **following through** their answers, that is, having penalised a candidate for an error, we mark the succeeding parts of the question using the candidate's value or answers and award marks accordingly.

Some common examples of this occur in the following cases:

(a) a numerical error in one entry in a table of values might lead to several answers being incorrect, but these might not be essentially separate errors;

(b) readings taken from candidates' inaccurate graphs may not agree with the answers expected but might be consistent with the graphs drawn.

When the candidate misreads a question in such a way as to make the question easier only a proportion of the marks will be available (based on the professional judgement of the examiner).

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General Marking Advice

(i) If the correct answer is seen in the body of the script and the answer given in the answer line is clearly a transcription error, full marks should be awarded.

(ii) If the answer is missing, but the correct answer is seen in the body of the script, full marks should be awarded.

(iii) If the correct answer is seen in working but a completely different answer is seen in the answer space, then some marks will be awarded depending on the severity of the error.

(iv) Work crossed out but not replaced should be marked.

(v) In general, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered (with no solution offered on the answer line), mark the poorest answer.

(vi) For methods not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work.

(vii) Where a follow through mark is indicated on the mark scheme for a particular part question, the marker must ensure that you refer back to the answer of the previous part of the question.

(viii) Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen. E.g. the answer in the mark scheme is 4.65 and the candidate then correctly rounds to 4.7 or 5 on the answer line. Allow full marks for 4.65 seen in the working.

(ix) Anything in the mark scheme which is in brackets (...) is not required for the mark to be earned, but if present it must be correct.

(x) For any question, the range of answers given in the mark scheme is inclusive.

Quality of written communication

In GCSE Mathematics, particular questions are identified where candidates must demonstrate the quality of their written communication.

In particular, candidates must:

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear (i.e. comprehension and meaning is clear by using the correct notation and labelling conventions);

(ii) select and use a form and style of writing appropriate to their purpose and to complex subject matter (i.e. reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning); and

(iii) organise information clearly and coherently, using specialist vocabulary where appropriate (i.e. the mathematical methods and processes used are coherently and clearly organised and appropriate mathematical vocabulary used).

This assessment may be through, for example, an explanation of the geometrical properties of a given shape or, for example, through concise mathematical argument in a multi-step problem.

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				AVAILABLE MARKS
1	$5600 \div 20 = 280$ notes	MA1		
	$\frac{280}{100} \times 15 = 42$ notes	M1, A1		3
2	**(a)** $4 : 9$	A1		
	(b) $9 : 6 : 2$ (in any order)	A1		
	(c) $0.\dot{2}\dot{8}0$	A1		
	(d) 5	M1, A1		5
3	**(a)** **(i)** $6x - 15 = 4$ $6x = 4 + 15$	MA1		
	$6x = 19$	MA1		
	$x = \frac{19}{6}$ **or** $\left(3\frac{1}{6}\right)$	A1		
	No penalty for calculating answer			
	(ii) $12 - 5x = 4$	MA1		
	$12 - 4 = 5x$			
	$8 = 5x$	MA1		
	$\frac{8}{5} = x$	A1		
	(b) $90x + 360 = 1350$	M1, A1		
	$90x = 990$	MA1		
	$x = 11$	A1		10
4	**(a)** Boys are not representative of all children. Teachers are not representative of all adults. Sample too small (Other suitable explanations)	A1, A1		
	Author to supply QWC			
	(b)	M1, A1		
	Key: $8 \mid 9 = 8.9$	A1		5

8	0	5	7	9	
9	0	1	5	7	8
10	0	3	6		
11	1	3			
12	1	1	2	6	6
13	0				

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				AVAILABLE MARKS
5	**(a)**	$2\pi \times 5.4$	MA1	
		33.92920066	A1	
	(b)	33×100	MA1	
		3300	A1	
	(c)	$\frac{9 \times 6}{2}$	MA1	
		27 cm^2	A1, A1 (units)	7
6		(0, 3)	MA1	
		(4, 0)	MA1	
		line	A1	3
7	**(a)**	234 ± 2	A1	
	(b)	55	A1	
		100	A1	3
8	**(a)**	7 points correct (4 correct – A1)	A2	
	(b)	(12.5, 10.6) circled – perhaps the car has been recently fitted with new tyres.	A1	
	(c)	negative correlation	A1	
		meaning that as the number of miles travelled increases the depth of tread decreases.	A1	5
9	**(a)**	3×7	A1	
	(b)	$3 \times 3 \times 3 \times 11$	MA1	
	(c)	9	A2	4
10	**(a)**	$\frac{228}{100} \times 35 = 79.8$ **or** 228×0.65	MA1	
		$228 - 79.8 = 148.20$	MA1	
	(b)	$8400 \times 1.8\% = 151.20 \rightarrow 8551.20$	MA1	
		$8551.20 \times 1.8\% = 153.92 \rightarrow 8705.12$	MA1	
		$8705.12 \times 1.8\% = 156.70 \rightarrow 8861.82$ $156.69 \rightarrow 8861.81$	MA1	
		Or		
		$8400 \times (1.018)^3$	MA2	
		$= 8861.81$	A1	5

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				AVAILABLE MARKS
11	**(a)**	$6^2 + 8^2 = 10^2$	MA1	
	(b)	2 < any length < 14 (length ≠ 10)	A1	2
12	**(a)**	5 35 15 60 25 125 35 140 45 810 55 1100 65 1430	(f*x* nos) M1, A1	
		$\frac{3700}{80} = 46.25$	M1, A1	
	(b)	50 < A ⩽ 60	A1	
	(c)	Cinema/leisure centre/bowling alley because there are many more younger people and fewer older people attending.	A2	7
13	**(a)**	(4, 1)	A1, A1	
	(b)	exterior = 40 **or** total interior = 1260	MA1	
		140	MA1	
	(c)	$\pi \times 3^2$	MA1	
		28.274		
		14.137	A1	6
14		$x = 3$ $27 + 6 = 33$ $x = 4$ $64 + 8 = 72$	MA1	
		$x = 3.7$ 58.053 $x = 3.8$ 62.472	MA1	
		$x = 3.75$ 60.234 375	MA1	
		$x = 3.7$	A1	4
15	**(a)**	$6a^2 + 9a - 4a - 6$	MA1	
		$6a^2 + 5a - 6$	MA1	
	(b)	**(i)** $3y(3x - 4y)$	A1, A1	
		(ii) $(y + 3)(y - 3)$	A1	5

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				AVAILABLE MARKS
16	**(a)**	$\frac{3}{4}$ of the garages = 15 Number of garages = 20	MA1	
		$\frac{5}{6}$ of the houses = 20		
		Number of houses = 24	MA1	
		$\frac{1}{6}$ of 24 = 4	MA1	
	(b)	Smallest volume 1.35 × 1.15 × 0.75	M1, A1	
		1.164375	A1	6
		Author to supply QWC		
17	**(a)**	33 54 81 95 107 115 120	A1	
	(b)	points	A2	
		curves	A1	
	(c)	**(i)** reading from graph (approx. 21)	MA1	
		(ii) more than 18 km – approx. 76	MA1	
		$\frac{76}{120} \times 100 = 63\frac{1}{3}\%$	MA1	7
18	**(a)**	$6^2 + 4^2 = 52$	MA1	
		$\sqrt{52}$	MA1	
		= 7.21	A1	
	(b)	$\cos DCE = \frac{5}{12}$	M1, A1	
		$x = 65.375...$	A1	6
19	**(a)**	$15x + 6y = 39$ **or** $10x + 4y = 26$	MA1	
		$4x - 6y = 18$ $10x - 15y = 45$	MA1	
		$19x = 57$ $19y = -19$		
		$x = 3$ $y = -1$	MA1	
		$15 + 2y = 13$ $5x - 2 = 13$		
		$2y = 13 - 15$ $5x = 15$		
		$y = -1$ $x = 3$	A1	
	(b)	gradient = $\frac{13-1}{3-0} = 4$	MA2	
		$y = 4x + 1$	A1	7
			Total	**100**

New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
January 2012

Mathematics



Unit T3
(With calculator)
Higher Tier

[GMT31]

WEDNESDAY 11 JANUARY

9.15 am–11.15 am

GMT31

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
Total Marks	

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all twenty-one** questions.
Any working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

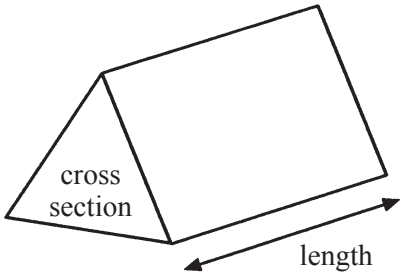
INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **question 2**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is overleaf.

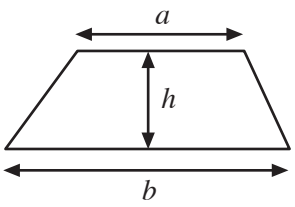
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Formula Sheet

Volume of prism = area of cross section × length

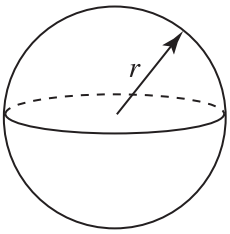


Area of trapezium $= \frac{1}{2}(a+b)h$



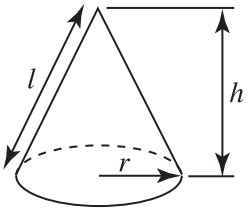
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

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

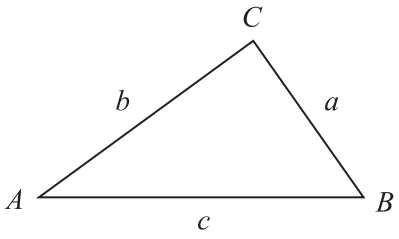


Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

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

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 $= \frac{1}{2}ab\sin C$

Answer **all** questions.

Examiner Only	
Marks	Remark

1 **(a)** Calculate $\dfrac{6.5 \times 5.8}{5.3 + 2.1}$

Give your answer correct to 2 decimal places.

Answer _____ [2]

(b) A girl uses $\frac{2}{5}$ of a bag of flour to make a dozen scones.

How many bags of flour does she need to buy to make 80 scones?

Answer _____ [3]

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Quality of written communication will be assessed in this question.

Examiner Only	
Marks	Remark

2 Aaron wants to find out how often people go to the cinema.
He designs the following questionnaire to use to gather data for his survey.

> How often do you go to the cinema?
>
> Tick one box below.
>
> Not very often ☐ Sometimes ☐ A lot ☐

(a) Write down two things that are wrong with this questionnaire.

1. _____

_____

2. _____

_____ [2]

(b) Design a better questionnaire for him to use to find out how often people go to the cinema.
You should include some response boxes.

[2]

(c) Aaron intends to give out his questionnaire to all the men leaving the cinema.
Give two reasons why the data he will collect from his survey will be biased.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

3 **(a)** In April last year, it rained on 24 days.

What percentage of days in April were dry?

Answer _____% [2]

(b) A wealthy American has $300 000 to spend on a holiday villa in Spain.

The exchange rates are shown below:

£1 = 1.1752 euro	£1 = $1.5669

She sees a villa priced at 240 000 euro.

Has she enough money to buy the villa?

Show working to explain your answer.

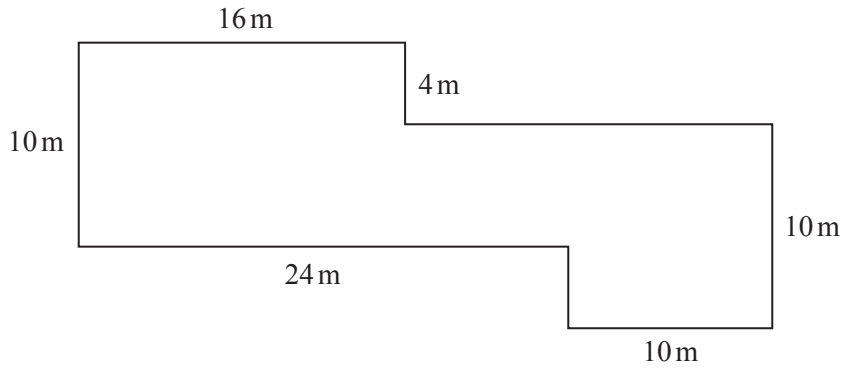
Answer _____

_____ [3]

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Examiner Only	
Marks	Remark

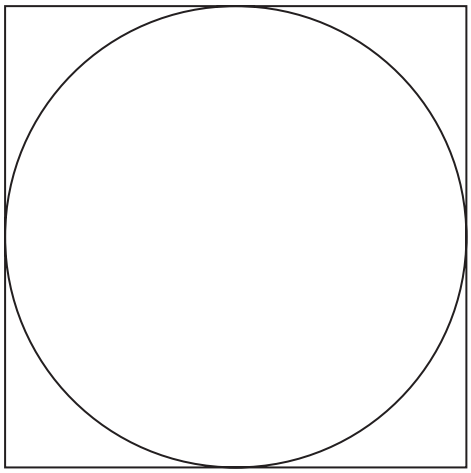
4 **(a)** Calculate the surface area of the water in a hotel swimming pool with dimensions as shown.



Answer _____ [3]

(b) A square of side 8 cm has a circle drawn inside it which just touches its four sides.

Calculate the area of the circle.



Not drawn to scale

Answer _____ cm^2 [2]

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5 **(a)** Factorise $20d + 35$

Answer _____ [1]

(b) Work out the value of x in the quadrilateral below.

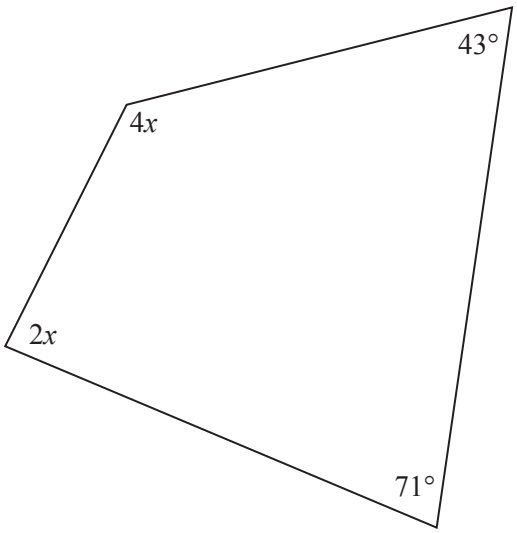


Diagram not drawn accurately

Answer x = _____° [4]

Examiner Only

Marks	Remark

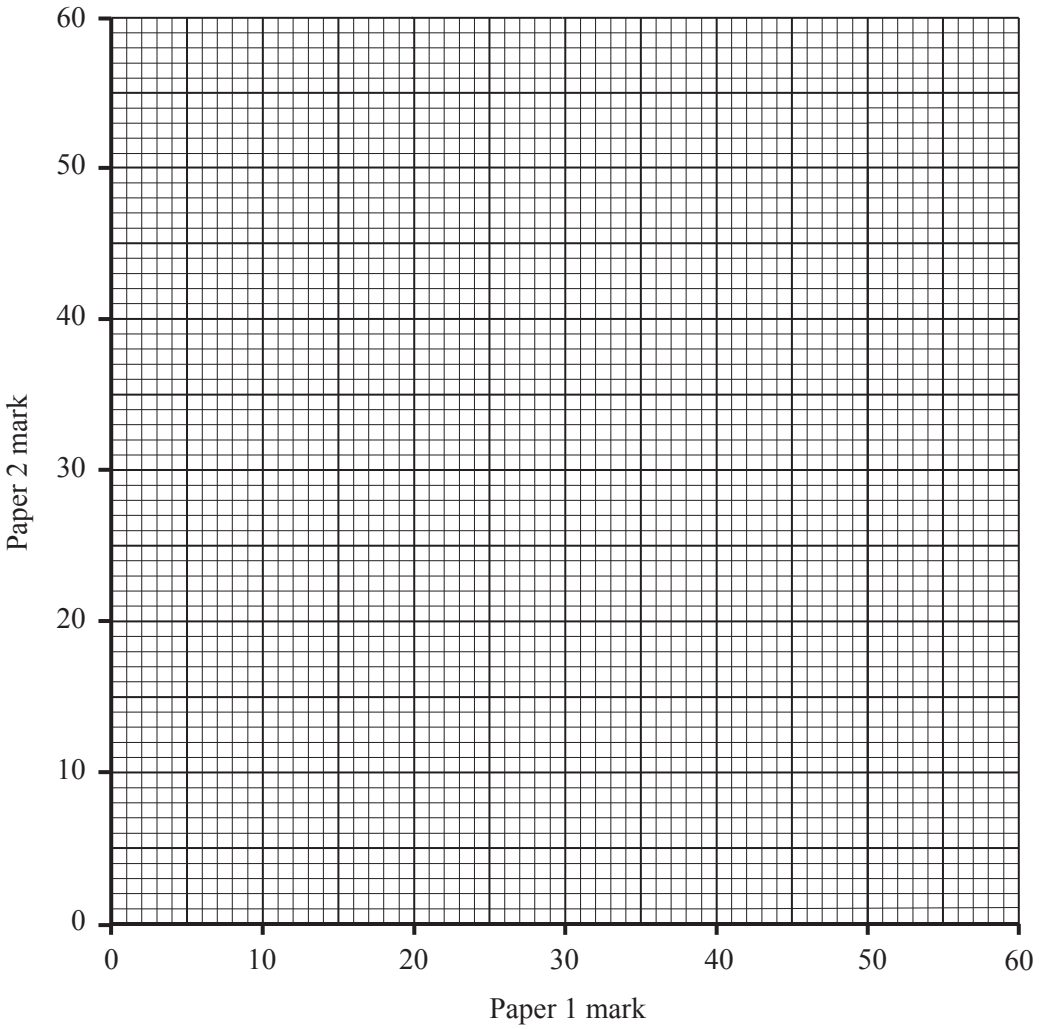
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Examiner Only	
Marks	Remark

6 The table below shows the marks scored by 8 students in two papers in a Mathematics examination.

Paper 1 mark	20	7	14	23	31	35	41	35
Paper 2 mark	20	2	9	28	41	46	58	50

(a) Draw a scatter graph below.



[2]

(b) Describe the correlation between the marks on Paper 1 and Paper 2.

Answer _____ [1]

(c) Draw a line of best fit on the grid. [1]

Another student was absent for Paper 1 but scored 35 marks on Paper 2.

(d) Use your line of best fit to estimate a mark for Paper 1 for this student.

Answer _____ [1]

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(Questions continue overleaf)

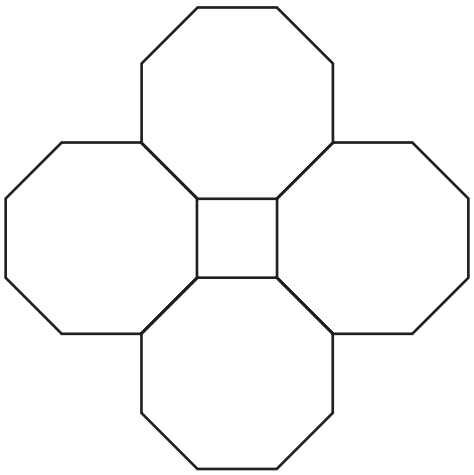
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Examiner Only	
Marks	Remark

7 **(a)** Calculate the size of the interior angle in a regular octagon.

Answer _____° [2]

(b) Four floor tiles, each in the shape of a regular octagon are placed together as shown. Explain why the shape between them must be a square.



Answer _____

_____ [2]

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(c) AB is parallel to CD. EF is a straight line. BC = BD. Angle ABC = 42°

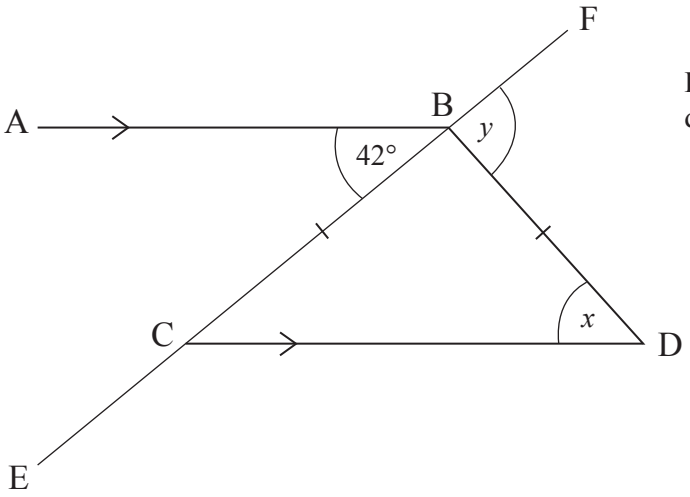


Diagram not drawn accurately

(i) Calculate the size of angle x.

Answer x = _____° [1]

(ii) Calculate the size of angle y.

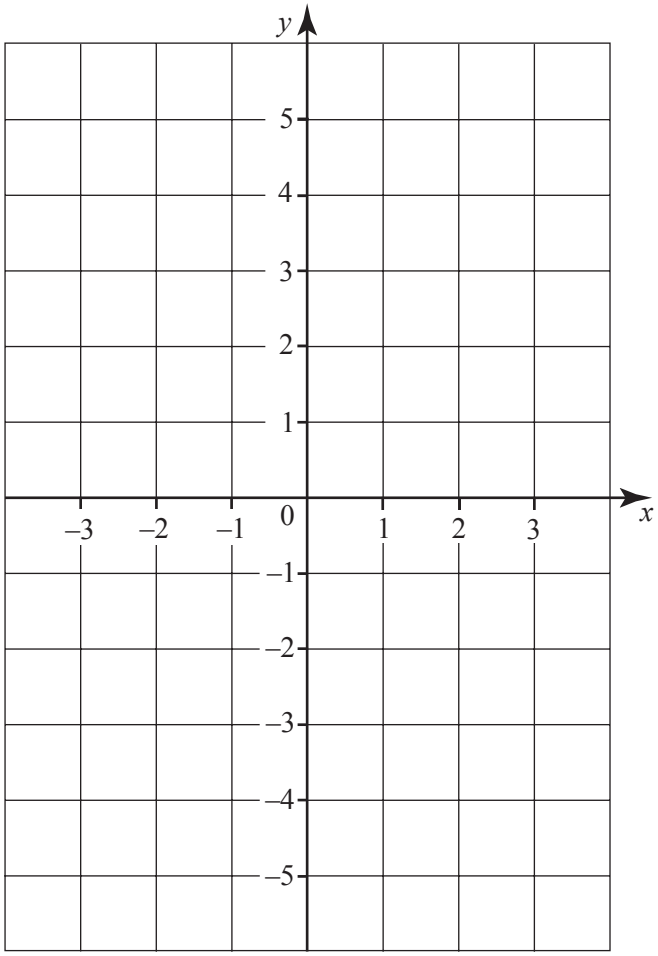
Answer y = _____° [2]

Examiner Only

Marks	Remark

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8 Draw the graph of $y = 1 - 2x$



[3]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

9 **(a)** **(i)** Write 24 as a product of prime factors.

Answer _____ [2]

(ii) What is the smallest whole number 24 could be multiplied by to make it a square number?

Answer _____ [2]

(b) From a large bottle containing $2\frac{1}{2}$ litres of lemonade, a girl pours four full glasses each holding $\frac{2}{5}$ litre.

How many **more** full glasses can she pour before running short of lemonade?

Answer _____ [3]

---

10 **(a)** Expand and simplify $7(2a + 3) + 3(4a - 2)$.

Answer _____ [2]

(b) Kyle bought 6 pears at x pence each and 3 tins of meat at $4x$ pence each. He got £4.24 change from £10.

Write down an equation in terms of x and solve it to find the value of x.

Answer x = _____ [4]

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11 The table shows information about the number of hours that 100 children used a computer for last week.

Number of hours (H)	Frequency
$0 < H \leq 3$	8
$3 < H \leq 6$	16
$6 < H \leq 9$	21
$9 < H \leq 12$	36
$12 < H \leq 15$	12
$15 < H \leq 18$	7

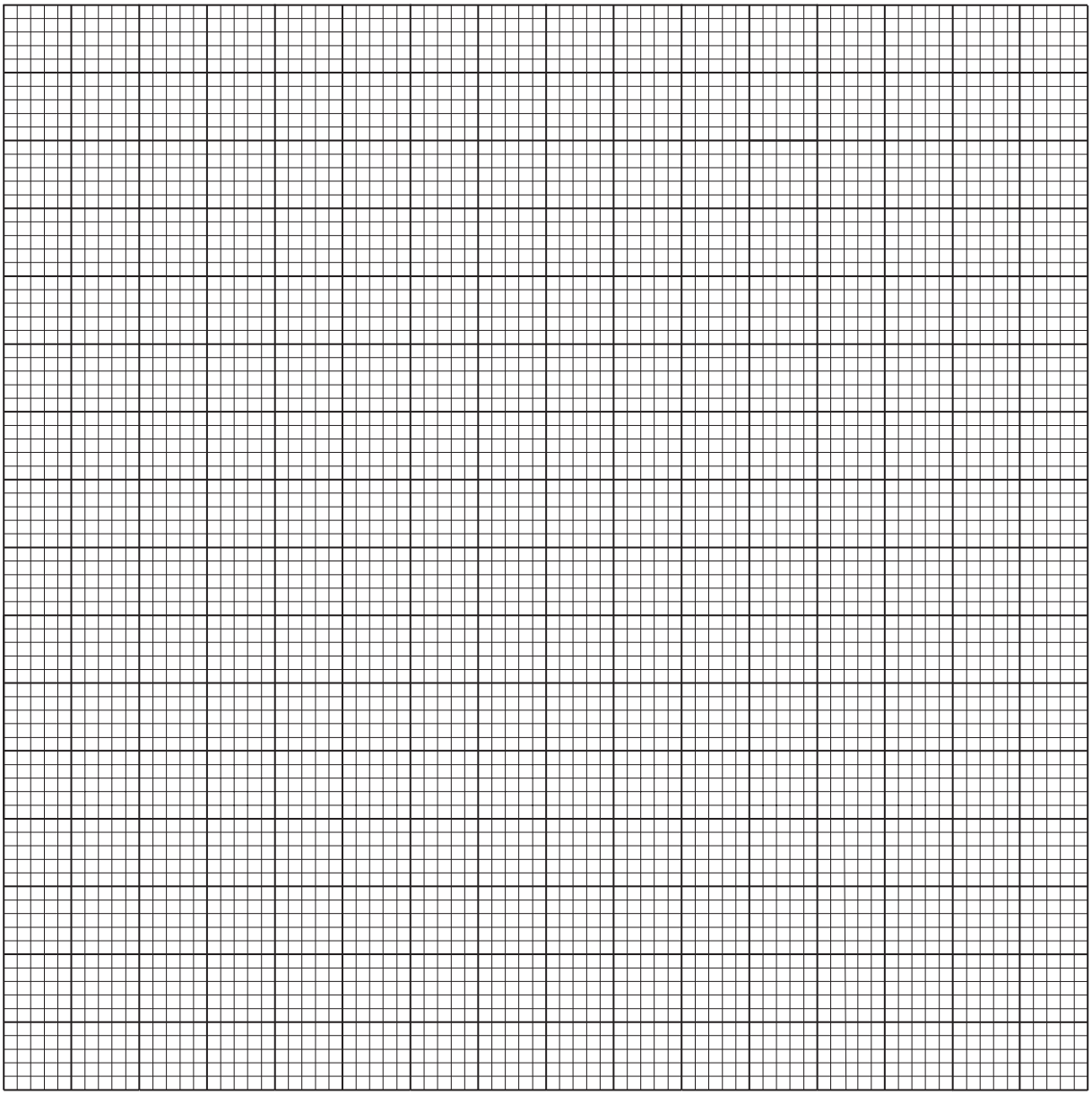
(a) Work out an estimate for the mean number of hours that the children used a computer for last week.

Answer _____ hours [4]

Examiner Only	
Marks	Remark

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(b) On the grid below draw a frequency polygon to illustrate the data opposite.



[2]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

12 A solution to the equation $x^3 - 5x = 27$ lies between 3 and 4.
Use trial and improvement to find this solution.
Give your answer correct to 1 decimal place.
Show each stage of your working.

Answer $x =$ _____ [3]

---

13 A man measures the length of his house as 13 metres using a stick which he thinks is **1 metre** long. Later he finds out that the stick is actually 99.3 centimetres long.

Calculate by how much the length of the house is shorter than 13 metres.

Answer _____ cm [3]

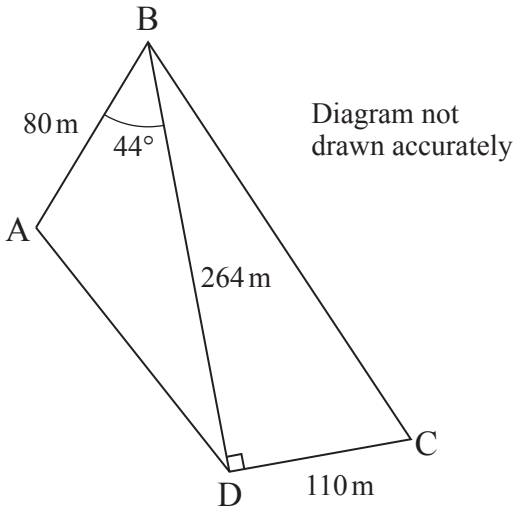
---

14 Jane attends both piano and flute lessons on August 31st.
She attends flute lessons every 8 days and piano lessons every 10 days.
On what date will she next attend both lessons?

Answer _____ [2]

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15 A field ABCD has straight sides. AB = 80 m, DC = 110 m and BD = 264 m. Angle BDC = 90° and angle ABD = 44°.



(a) Calculate the length of BC.

Answer _____ m [3]

(b) Calculate angle ABC.

Answer _____° [3]

Examiner Only

Marks	Remark

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16 Fifty-five pupils in Year 11 do an end of year French test.

Their data is recorded in the table below.

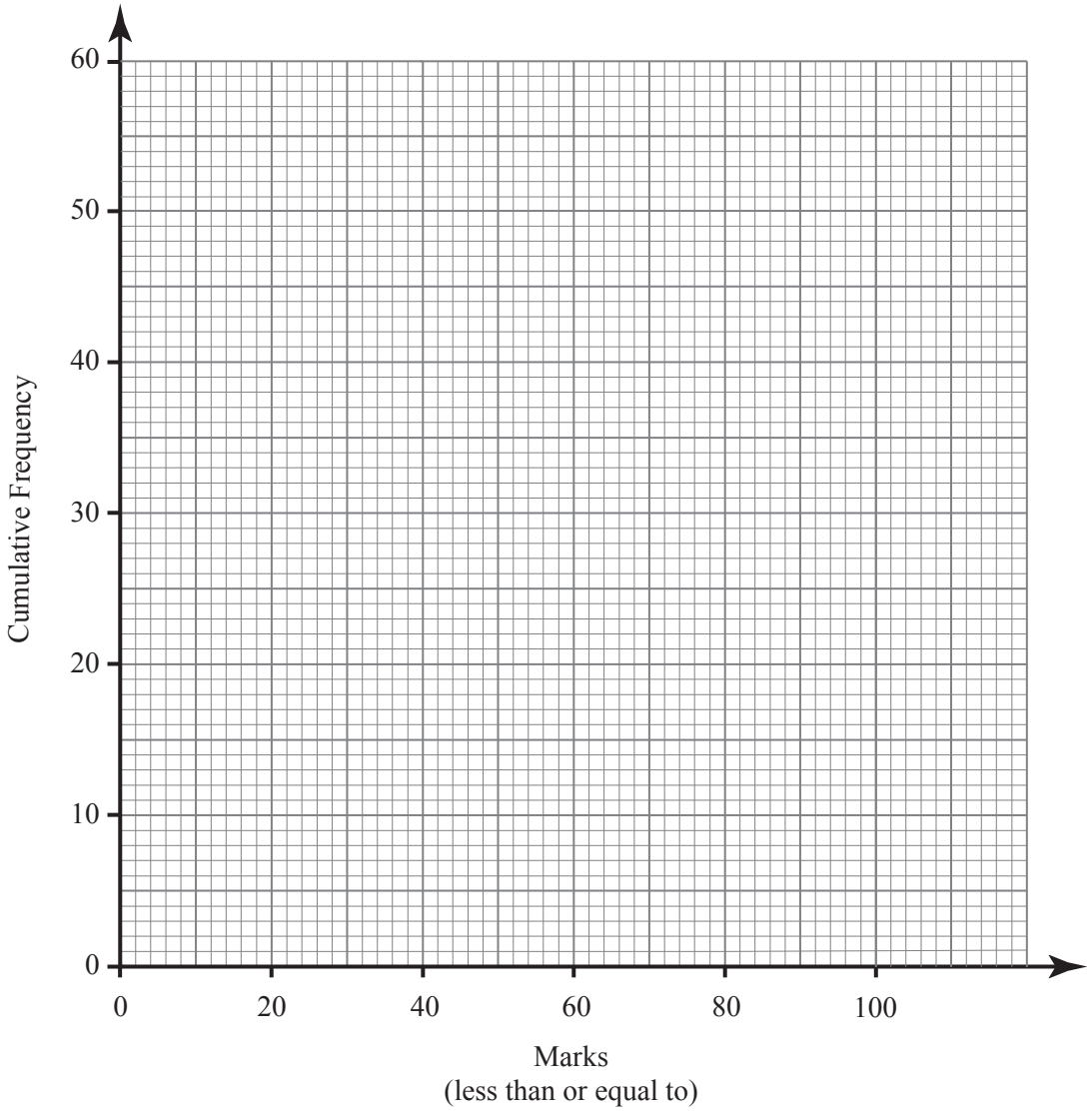
Mark	0–20	21–40	41–60	61–80	81–100
Frequency	6	17	20	9	3

(a) Complete the cumulative frequency table below.

Mark (less than or equal to)	20	40	60	80	100
Cumulative Frequency	6				

[1]

(b) Draw a cumulative frequency graph to illustrate this information.



[3]

Examiner Only

Marks	Remark

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(c) Use your graph to estimate the median mark.

Answer _____ [1]

The pass mark for the examination was 52.

(d) Use your graph to estimate the number of students who passed the examination.

Answer _____ [2]

Examiner Only

Marks	Remark

---

17 An electric fire cost £135.66 including VAT at 20%.
How much VAT was payable on the bill?

Answer £ _____ [3]

---

18 **(a)** Solve the simultaneous equations $7x + 3y = 15$
$4x + 3y = 6$

Answer $x =$ _____, $y =$ _____ [2]

(b) Solve the equation $\frac{4x+1}{12} + \frac{2x-3}{6} = \frac{7}{4}$

Answer $x =$ _____ [4]

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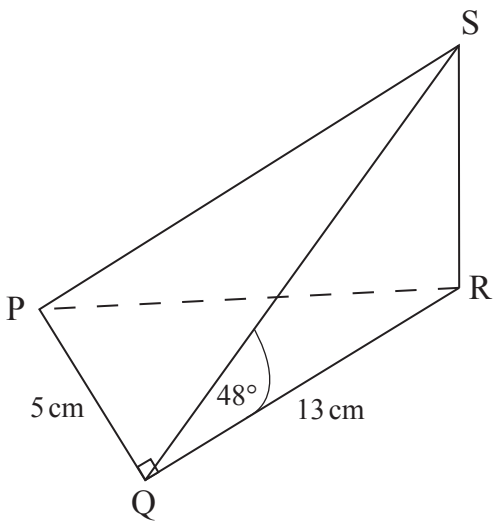
Examiner Only	
Marks	Remark

19 The temperature in a cooling furnace falls by 5% every hour.
The temperature is measured every hour.
At 10 am the temperature is 1200°C.
At what hour will it first be found to measure below 1000 °C?
Show your working.

Answer _____ [2]

---

20 The diagram shows a pyramid PQRS in which RS is at right angles to the horizontal base PQR. PQ = 5 cm, QR = 13 cm, angle PQR = 90° and angle RQS = 48°.



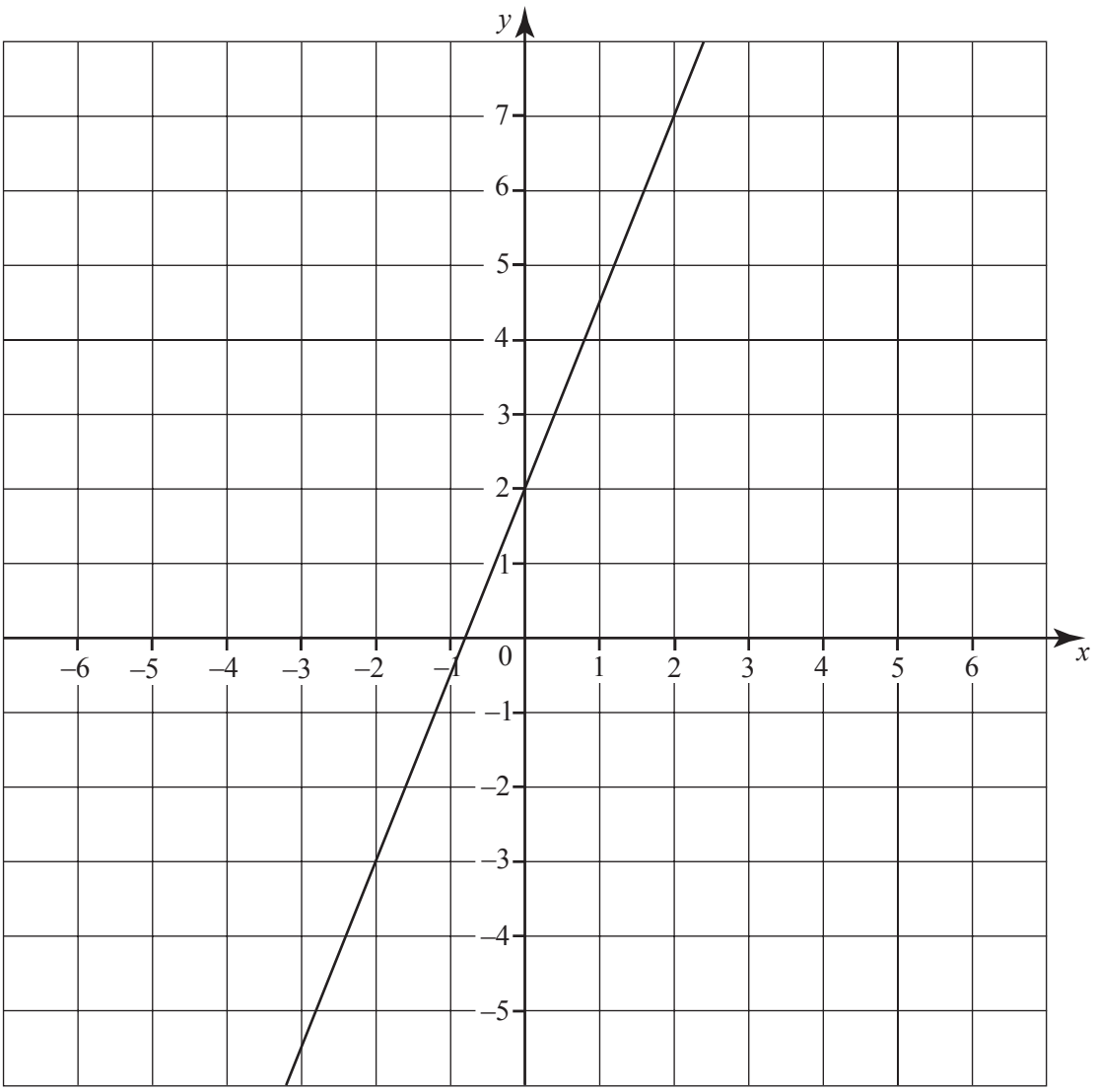
Calculate the length SR.

Answer _____ cm [3]

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21 (a)

Examiner Only	
Marks	Remark



(i) Write down the gradient of the line drawn above.

Answer _____ [1]

(ii) Hence write down the equation of this line.

Answer _____ [2]

(b) Factorise fully $9x^2y + 15x$

Answer _____ [2]

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THIS IS THE END OF THE QUESTION PAPER

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112507

New Specification

Rewarding Learning

General Certificate of Secondary Education
January 2012

Mathematics

Unit T3
Higher Tier

[GMT31]

WEDNESDAY 11 JANUARY

9.15 a.m.–11.15 a.m.

MARK SCHEME

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Introduction

The mark scheme normally provides the most popular solution to each question. Other solutions given by candidates are evaluated and credit given as appropriate; these alternative methods are not usually illustrated in the published mark scheme.

The solution to a question gains marks for correct method and marks for accurate working based on this method. The marks awarded for each question are shown in the right hand column and they are prefixed by the letters **M**, **A** and **MA** as appropriate. The key to the mark scheme is given below:

M indicates marks for correct method.

A indicates marks for accurate working, whether in calculation, reading from tables, graphs or answers. Accuracy marks may depend on preceding **M** (method) marks, hence **M**0 **A**1 cannot be awarded, i.e. where the method is not correct no marks can be given.

MA indicates marks for combined method and accurate working.

A later part of a question may require a candidate to use an answer obtained from an earlier part of the same question. A candidate who gets the wrong answer to the earlier part and goes on to the later part is naturally unaware that the wrong data is being used and is actually undertaking the solution of a parallel problem from the point at which the error occurred. If such a candidate continues to apply correct method, then the candidate's individual working must be **followed through** from the error. If no further errors are made, then the candidate is penalised only for the initial error. Solutions containing two or more working or transcription errors are treated in the same way. This process is usually referred to as "follow-through marking" and allows a candidate to gain credit for that part of a solution which follows a working or transcription error.

It should be noted that where an error trivialises a question, or changes the nature of the skills being tested, then as a general rule, it would be the case that not more than half the marks for that question or part of that question would be awarded; in some cases the error may be such that no marks would be awarded.

Positive marking:

It is our intention to reward candidates for any demonstration of relevant knowledge, skills or understanding. For this reason we adopt a policy of following through their answers, that is, having penalised a candidate for an error, we mark the succeeding parts of the question using the candidate's value or answers and award marks accordingly.

Some common examples of this occur in the following cases:

(a) a numerical error in one entry in a table of values might lead to several answers being incorrect, but these might not be essentially separate errors;

(b) readings taken from candidates' inaccurate graphs may not agree with the answers expected but might be consistent with the graphs drawn.

When the candidate misreads a question in such a way as to make the question easier, only a proportion of the marks will be available (based on the professional judgement of the examiner).

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General Marking Advice

(i) If the correct answer is seen in the body of the script and the answer given in the answer line is clearly a transcription error, full marks should be awarded.

(ii) If the answer is missing, but the correct answer is seen in the body of the script, full marks should be awarded.

(iii) If the correct answer is seen in working but a completely different answer is seen in the answer space, then some marks will be awarded depending on the severity of the error.

(iv) Work crossed out but not replaced should be marked.

(v) In general, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered (with no solution offered on the answer line), mark the poorest answer.

(vi) For methods not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work.

(vii) Where a follow through mark is indicated on the mark scheme for a particular part question, the marker must ensure that you refer back to the answer of the previous part of the question.

(viii) Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen. E.g. the answer in the mark scheme is 4.65 and the candidate then correctly rounds to 4.7 or 5 on the answer line. Allow full marks for 4.65 seen in the working.

(ix) Anything in the mark scheme which is in brackets (...) is not required for the mark to be earned, but if present it must be correct.

(x) For any question, the range of answers given in the mark scheme is inclusive.

Quality of written communication

In GCSE Mathematics, particular questions are identified where candidates must demonstrate the quality of their written communication.

In particular, candidates must:

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear (i.e. comprehension and meaning is clear by using the correct notation and labelling conventions);

(ii) select and use a form and style of writing appropriate to their purpose and to complex subject matter (i.e. reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning); and

(iii) organise information clearly and coherently, using specialist vocabulary where appropriate (i.e. the mathematical methods and processes used are coherently and clearly organised and appropriate mathematical vocabulary used).

This assessment may be through, for example, an explanation of the geometrical properties of a given shape or, for example, through concise mathematical argument in a multi-step problem.

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				AVAILABLE MARKS
1	**(a)**	5.09459	MA1	
		= 5.09	A1	
	(b)	$80 \div 12 \times \frac{2}{5}$ or equivalent	MA1	
		= 2.67	A1	
		= 3 bags	A1	5
2	**(a)**	1. No time period 2. Labels on boxes too vague 3. No box for 'never' } any 2 of these	A2	
	(b)	Use of time period	A1	
		Good response boxes (at least three) – which are exhaustive and non-overlapping	A1	
	(c)	1. Only males questioned	A1	
		2. Questionnaire to cinema-goers only	A1	6
3	**(a)**	$\frac{6}{30}$ **or** 80%	MA1	
		20%	A1	
	(b)	\$300 000 = £191 460.85	MA1	
		= 225 005 euro	MA1	
		No; she has not enough to cover 240 000 euro	A1	
		Alternatively		
		240 000 euro = £204 220	MA1	
		240 000 euro = \$319 993	MA1	
		No; she has not enough to cover 240 000 euro	A1	5
4	**(a)**	$16 \times 10 + 6 \times 8 + 10 \times 10 = 308$ m^2	M1, A1, A1 units	
	(b)	Area = $\pi \times 4^2 = 50.3$ (50.26548)	M1, A1	5

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				AVAILABLE MARKS
5	**(a)**	$5(4d + 7)$	A1	
	(b)	$4x + 2x + 71 + 43 = 360$ or equivalent	MA1	
		$6x + 114 = 360$	MA1	
		$6x = 246$	MA1	
		$x = 41$	A1	5
6	**(a)**	All points plotted correctly (5 of 8 gets [1])	A2	
	(b)	Positive	A1	
	(c)	Correct line drawn	A1	
	(d)	Answer from pupil's line	A1	5
7	**(a)**	$360/8 = 45$ $180 - 45 = 135$ **or** $(8 - 2) \times 180 = 1080$ $1080 \div 8 = 135$	MA1 MA1	
	(b)	Angles are $360 - 270 = 90$	MA1	
		Sides are equal sides of regular octagon (explanation necessary)	MA1	
	(c)	**(i)** $x = 42$	A1	
		(ii) $180 - (42 + 42) = 96$	MA1	
		$y = 180 - 96$ $= 84$	MA1	7
8		One correct point plotted	MA1	
		Second correct point plotted	MA1	
		Line drawn	A1	3
9	**(a)**	**(i)** $2 \times 2 \times 2 \times 3$	M1, A1	
		(ii) $2 \times 3 = 6$	M1, A1	
	(b)	$2.5 - 4 \times 0.4 = 0.9$	MA1	
		$0.9 \div 0.4 = 2.25$	MA1	
		2	A1	7

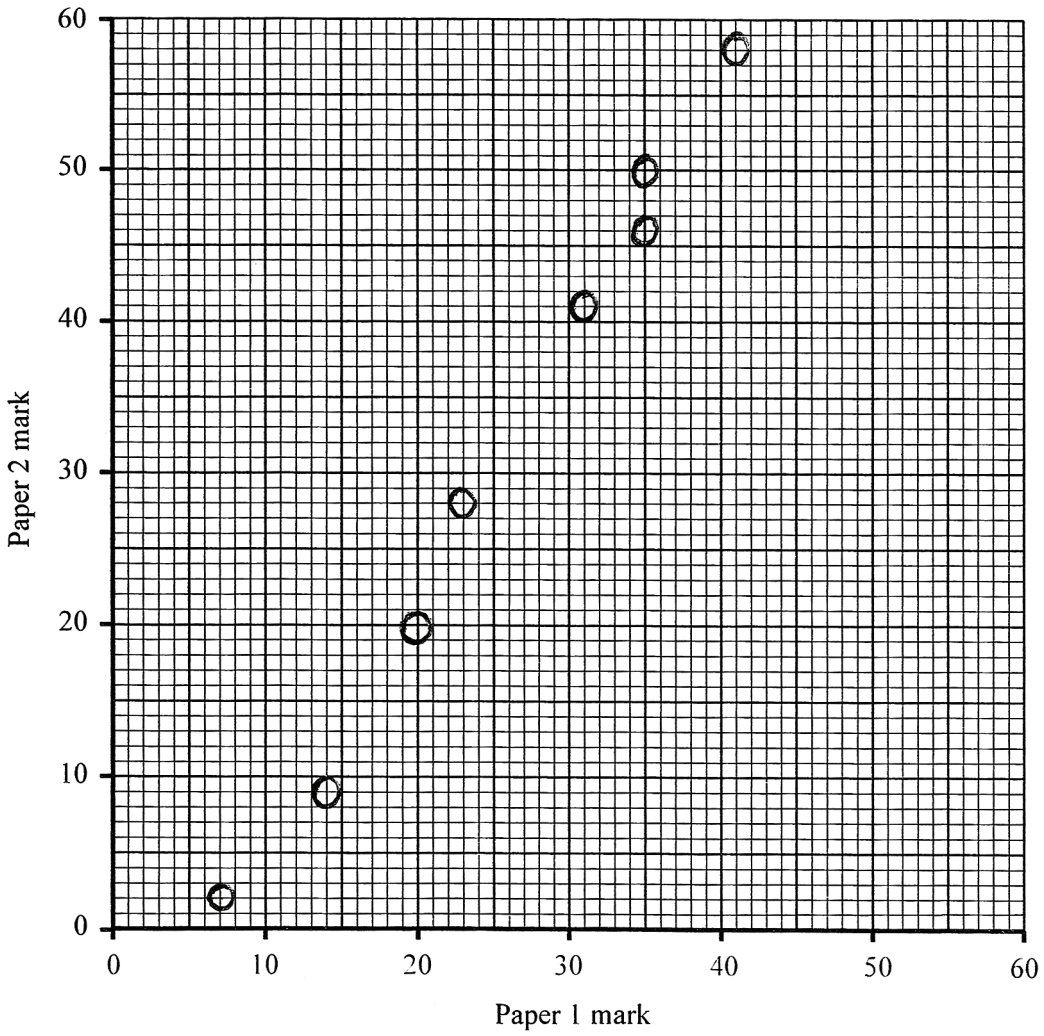
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				AVAILABLE MARKS
10	**(a)**	$14a + 21 + 12a - 6$	MA1	
		$26a + 15$	MA1	
	(b)	$6x + 12x + 424 = 1000$ (or equivalent)	M1, A1	
		$18x = 576$	MA1	
		$x = 32$	MA1	6
11	**(a)**	$1.5 \times 8 + 4.5 \times 16 + 7.5 \times 21 + 10.5 \times 36 + 13.5 \times 12 + 16.5 \times 7$	MA1	
		$12 + 72 + 157.5 + 378 + 162 + 115.5 = 897$	MA1	
		$897 \div 100$	MA1	
		8.97	A1	
	(b)	Accurate frequency polygon	M1, A1	6
12		$x = 3.5 \rightarrow 25.375$ and $x = 3.6 \rightarrow 28.656$	MA1	
		$x = 3.55 \rightarrow 26.988875$	MA1	
		$x = 3.6$	MA1	3
13		$13 \times 99.3 = 1290.9$ **or** 13×0.7	MA1	
		$1300 - 1290.9 = 9.1$	MA1, A1	3
14		LCM of 8 and 10 = 40	MA1	
		10th October	A1	2
15	**(a)**	$BC^2 = 110^2 + 264^2$	MA1	
		$BC = \sqrt{81796}$	MA1	
		$BC = 286$	A1	
	(b)	$\tan DBC = \frac{110}{264}$	MA1	
		$DBC = 22.6$	A1	
		$ABC = 22.6 + 44 = 66.6$	MA1	6

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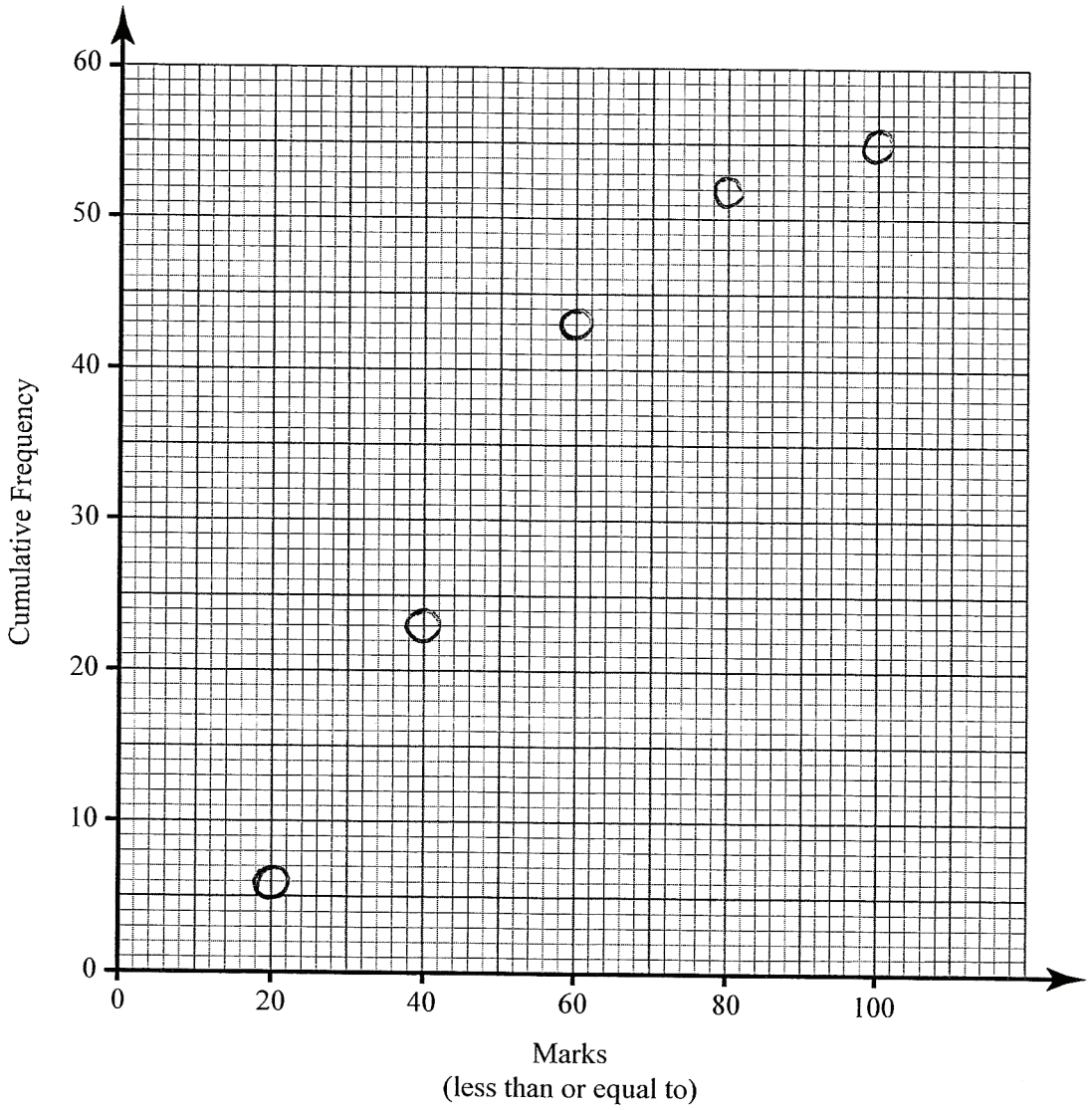
			AVAILABLE MARKS
16	**(a)** 23, 43, 52, 55	A1	
	(b) Correctly drawn graph	A3	
	(c) Correct reading	A1	
	(d) Identifying 37	A1	
	$55 - 37 = 18$	A1	7
17	$135.66 = 120\%$	MA1	
	$\frac{135.66}{120} \times 20$ **or** 113.05	MA1	
	$= £22.61$	A1	3
18	**(a)** $3x = 9$	MA1	
	$x = 3$	MA1	
	$y = -2$		
	(b) $\frac{4x + 1 + 4x - 6}{12} = \frac{21}{12}$	MA1	
	$4x + 1 + 4x - 6 = 21$	MA1	
	$8x = 26$	MA1	
	$x = \frac{26}{8}$ **or** $\frac{13}{4}$ **or** 3.25	MA1	6
19	$0.95 (\times 0.95 \times 0.95 \times 0.95) \times 1200$	MA1	
	$\Rightarrow$ 4 hours $\Rightarrow$ 2pm	A1	2
20	$\tan 48° = RS/13$	MA1	
	$RS = 13 \tan 48°$	MA1	
	$RS = 14.4$ (14.438)	A1	3
21	**(a)** **(i)** $\frac{5}{2}$	MA1	
	(ii) $y = \frac{5}{2}x + 2$	MA2	
	(b) $3x(3xy + 5)$	A1, A1	5
		Total	**100**

GCSE NEW SPEC MATHEMATICS JANUARY 2012
UNIT T3
OVERLAYS QUESTION 6



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GCSE NEW SPEC MATHEMATICS JANUARY 2012
UNIT T3
OVERLAYS QUESTION 16 B



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New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011

Mathematics



Unit T3
(With calculator)
Higher Tier

[GMT31]

TUESDAY 31 MAY
9.15 am–11.15 am

GMT31

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
Total Marks	

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all twenty-four** questions.
Any working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

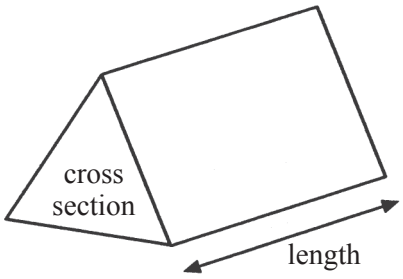
INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **question 3**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is overleaf.

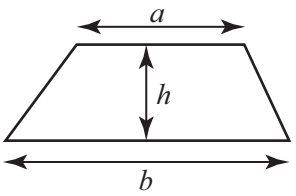
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Formula Sheet

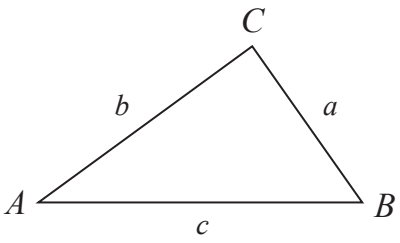
Volume of prism = area of cross section × length



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



In any triangle *ABC*



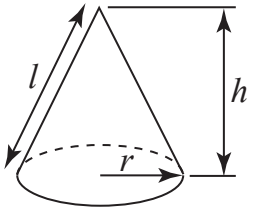
Sine Rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

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

Curved surface area of cone = πrl



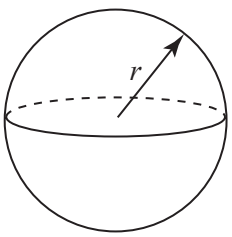
Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

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

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

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



Answer **all** questions.

Examiner Only	
Marks	Remark

1 **(a)** The Ross family eat $\frac{3}{5}$ of a loaf of bread each day.

What is the least number of loaves they will need to buy for 9 days?

Answer _____ [3]

(b) The family spend £150 per week on food.

They spend £36 of this on meat.

What percentage of the food bill is spent on meat?

Answer _____% [2]

---

2 A new bicycle is priced at £240

In a sale it is reduced by 35%.

Calculate the sale price.

Answer £ _____ [3]

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Quality of written communication will be assessed in this question.

Examiner Only	
Marks	Remark

3 (a) 

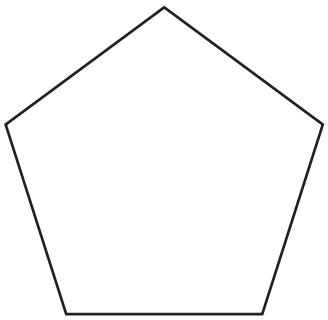
© The Royal Mint

A ten pence piece has a radius of 1.4 cm.

Calculate the circumference of this coin.

Show your work clearly.

Answer _____ cm [2]

(b) 

Explain why the sum of the interior angles in a regular pentagon is 540°.

_____

_____

_____

_____

[2]

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Examiner Only	
Marks	Remark

4 **(a)** Lines AB, CD and EF are parallel

Angles of 96° and 60° are marked in the diagram as shown.

Calculate the size of the angles marked x, y and z.

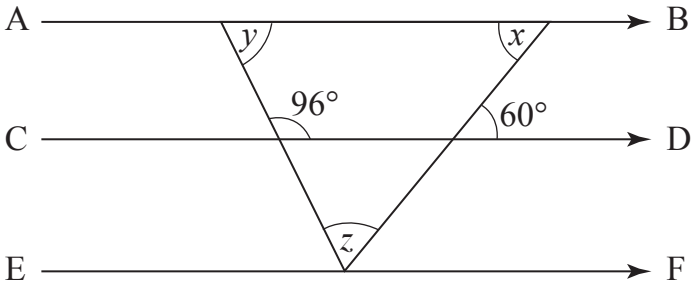


Diagram not drawn accurately

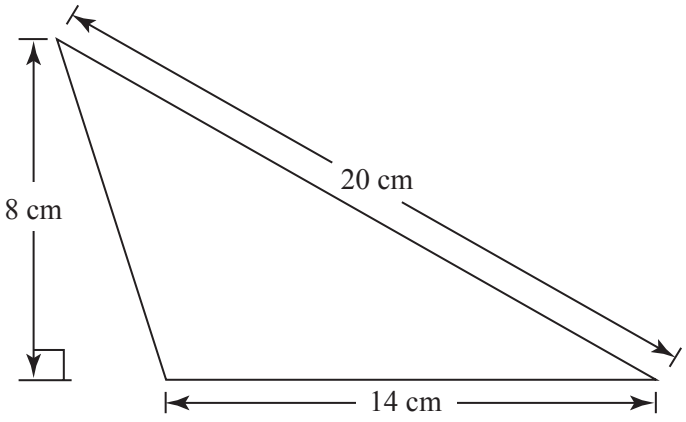
Answer Angle x = _____° [1]

Angle y = _____° [1]

Angle z = _____° [1]

(b) This triangle has some lengths marked on it.

Calculate the area of the triangle.



Answer _____ cm^2 [2]

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5 An adult ticket for a show costs £a.

A child ticket costs £4 less than an adult ticket.

Daisy buys two adult tickets and three child tickets. The total cost is £23

(a) Use this information to write down an **equation** in terms of a.

Answer _____ [3]

(b) Solve your equation to find the cost of an adult ticket.

Answer £ _____ [2]

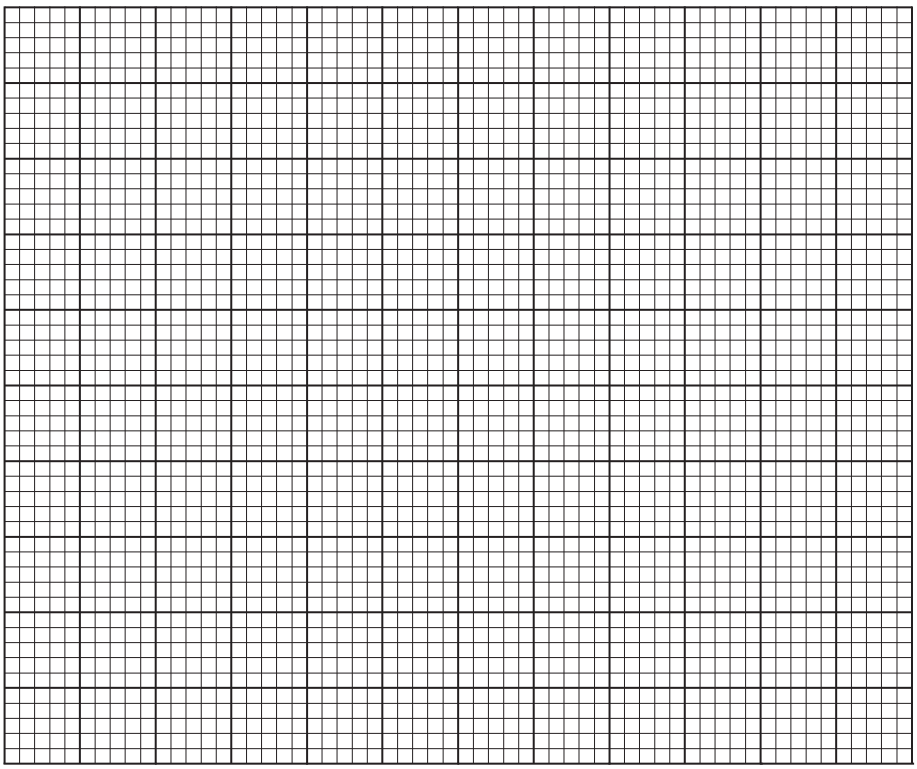
Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

6 The increase in test scores of 100 children over a period of time was recorded.

Increase in test scores (w)	$0 < w \leq 5$	$5 < w \leq 10$	$10 < w \leq 15$	$15 < w \leq 20$	$20 < w \leq 25$
Frequency	16	36	22	14	12

(a) Show this information on a grouped frequency diagram. [3]



(b) Write down the modal class interval.

Answer _____ [1]

---

7 Sam wants to buy travel insurance.

One company quotes £54.80

A second quotes £62.00 with a discount of 15% for buying online.

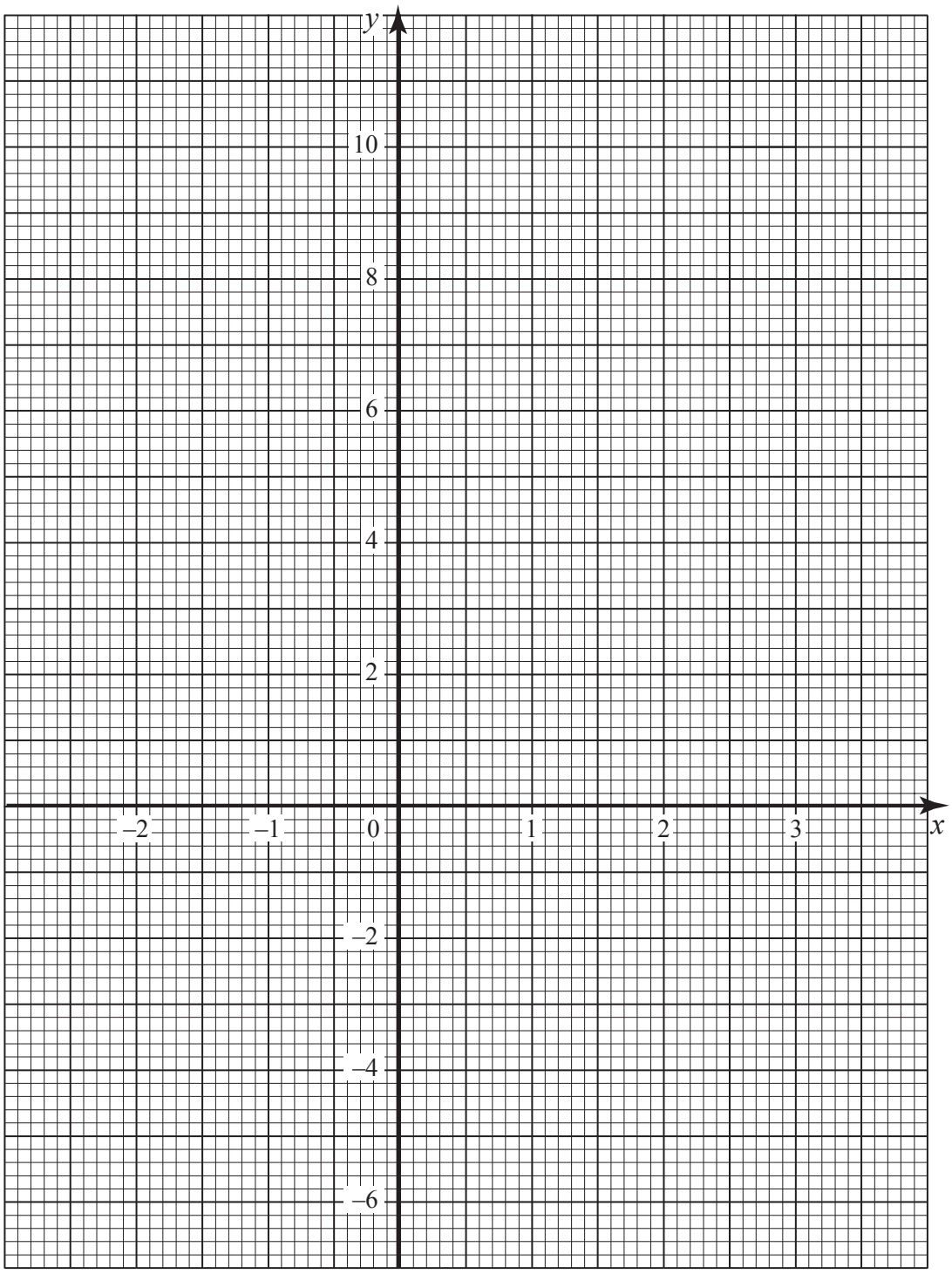
How much cheaper is the second quote?

Answer £ _____ [4]

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8 Draw the graph of $y = 4 - 3x$ on the graph paper below.

Examiner Only	
Marks	Remark

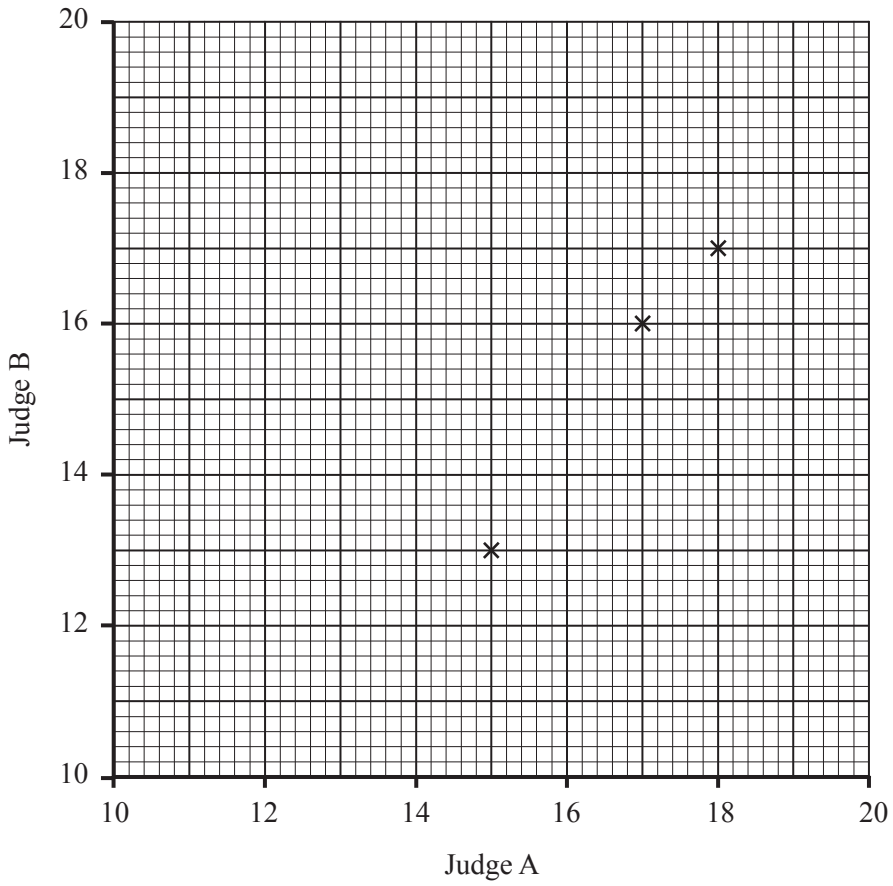


[3]

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9 The table shows the marks awarded by two judges to the first eight competitors in a gymnastics competition.

Judge A	**18**	**15**	**17**	13	19	15	12	18
Judge B	**17**	**13**	**16**	13	18	16	14	16



(a) The first three points have already been plotted.

Use the data to complete the scatter graph [2]

(b) Draw the line of best fit. [1]

(c) Another competitor was awarded 14 marks by Judge A.

Estimate the marks awarded to this competitor by Judge B.

Answer _____ [1]

(d) What type of correlation does your graph show?

Answer _____ [1]

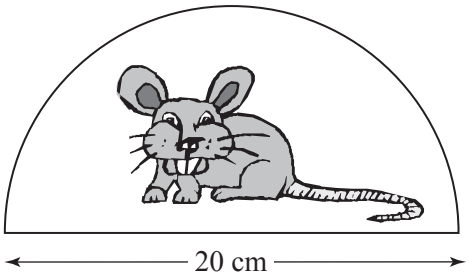
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

10 **(a)** A computer mouse mat is semicircular in shape. It has a diameter of 20 cm. Calculate the area of the mat.



Answer _____ cm^2 [2]

(b) **(i)** Find the midpoint of the line joining the points A (–1, 6) and B (3, –2)

Answer (_____, _____) [2]

(ii) The point M (4, 1) is the midpoint of the line joining the points C and D. C is the point (1, –1). Find the co-ordinates of the point D.

Answer (_____, _____) [2]

---

11 Write 84 as a product of prime factors. Express your answer in index notation.

Answer _____ [3]

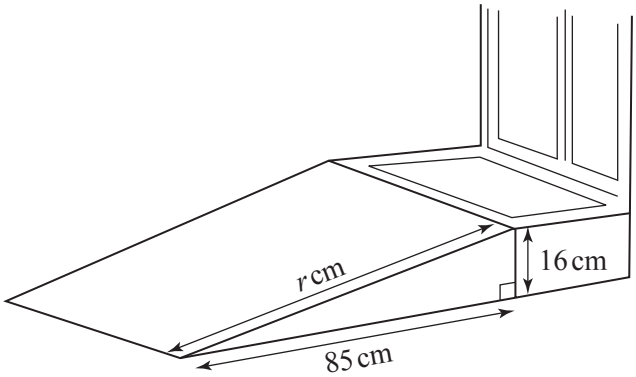
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Examiner Only	
Marks	Remark

12 A ramp is placed next to a step to allow wheelchair access.

The ramp is 16 cm high and reaches 85 cm from the step.

Calculate the sloping length, r cm, of the surface of the ramp to the edge of the step.



Answer _____ cm [3]

---

13 **(a)** At birth a baby boy weighed 4 kg. Six weeks later he weighed 7 kg.

What was the percentage increase in his weight?

Answer _____% [2]

(b) Colin leaves £4,800 in the bank for two years.

It earns compound interest of 3% per year.

Calculate the total amount Colin has in the bank at the end of the two years.

Answer £_____ [2]

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Examiner Only	
Marks	Remark

14 **(a)** Expand and simplify $(x - 6)(x + 4)$

Answer _____ [2]

(b) Write down the nth term for the sequence

6, 12, 18, 24, ...

Answer _____ [1]

(c) Write down the nth term for the sequence

4, 9, 14, 19, ...

Answer _____ [2]

---

15 The times that 100 students spent watching TV during one weekend were recorded. The times were grouped as shown in the table.

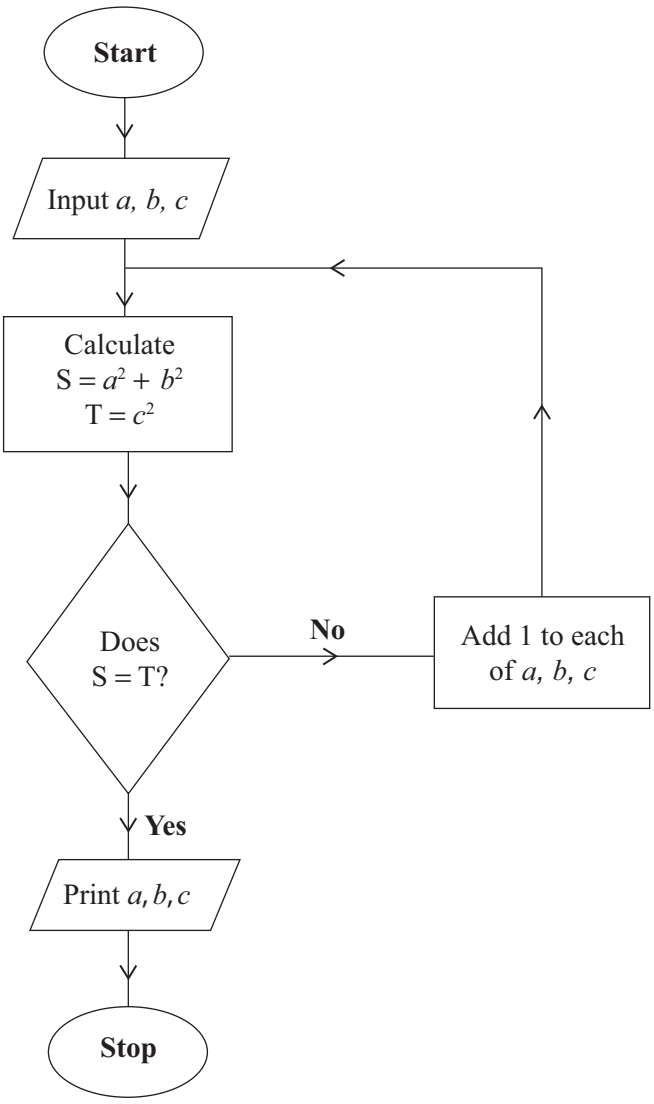
Time t (hours)	**Frequency**		
$0 < t \leq 2$	4		
$2 < t \leq 4$	18		
$4 < t \leq 6$	32		
$6 < t \leq 8$	20		
$8 < t \leq 10$	16		
$10 < t \leq 12$	10		

Calculate an estimate for the mean time.

Answer _____ hours [4]

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16



Starting with $a = 2$, $b = 9$, $c = 10$ use the flow chart to find the values printed.

a	b	c	S	T
2	9	10		

Answer $a =$ _____, $b =$ _____, $c =$ _____ [3]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

17 One solution of $x^2 + 4x = 50$ lies between 5 and 6

Use the method of **trial and improvement** to find this solution correct to one decimal place.

Show all your working.

Answer $x =$ _____ [3]

18 **(a)** Find the highest common factor (HCF) of 64 and 96

Answer _____ [2]

(b) Find the lowest common multiple (LCM) of 21 and 70

Answer _____ [2]

19 Bags of coal weigh 12 kg, to the nearest kg.

Find the least and greatest total weight of 9 of these bags.

Answer least _____ kg

greatest _____ kg [2]

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Examiner Only	
Marks	Remark

20 (a) Solve the equation $\frac{2x-4}{5}+\frac{x+11}{2}=2$

Show your working.

A solution by trial and improvement will not be accepted.

Answer $x =$ _____ [4]

(b) Solve the simultaneous equations $4x + 3y = 1$
$2x - y = -2$

Show your working.

A solution by trial and improvement will not be accepted.

Answer _____ [3]

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21 The graph opposite shows the cumulative frequency of scores obtained in a darts tournament.

Examiner Only	
Marks	Remark

(a) Use the graph to estimate

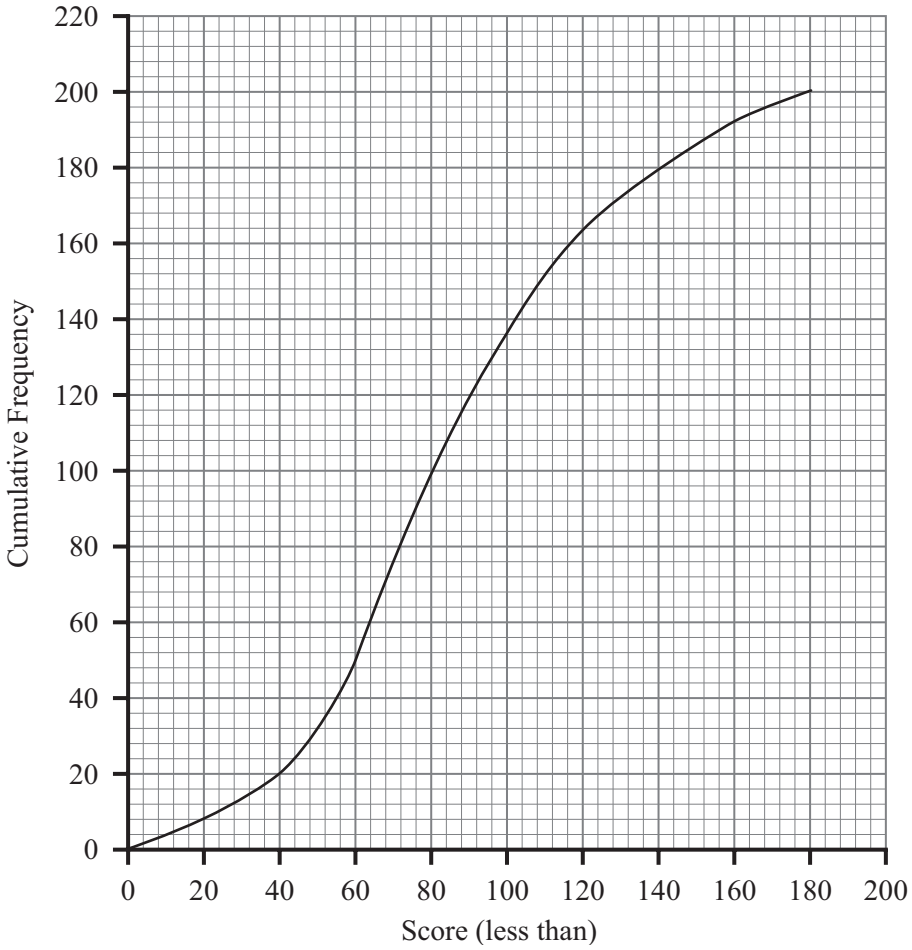
(i) the median,

Answer _____ [1]

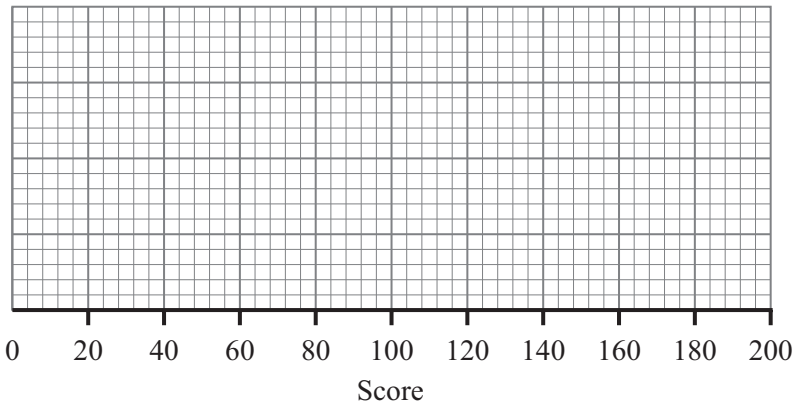
(ii) how many scores were more than 150

Answer _____ [2]

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(b) From the graph draw a box plot.



[3]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

22 The angle of elevation of the top of a telephone mast is 23° from a point 60 metres from the base of the mast on horizontal ground. Calculate the height of the mast.

Answer _____ m [4]

---

23 A tea set has a sale price of £63.36 which is a saving of 12% on the original price.

What was the original price of the tea set?

Answer £ _____ [3]

---

24 **(a)** Factorise $9a^2 - 3ay$

Answer _____ [2]

(b) **(i)** Factorise $x^2 + x - 6$

Answer _____ [2]

(ii) Hence solve the equation $x^2 + x - 6 = 0$

Answer _____ [1]

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2011

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Unit T3
Higher Tier

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MARK SCHEME

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GCSE MATHEMATICS

Introduction

The mark scheme normally provides the most popular solution to each question. Other solutions given by candidates are evaluated and credit given as appropriate; these alternative methods are not usually illustrated in the published mark scheme.

The solution to a question gains marks for correct method and marks for accurate working based on this method. The marks awarded for each question are shown in the right hand column and they are prefixed by the letters **M**, **A** and **MA** as appropriate. The key to the mark scheme is given below:

M indicates marks for correct method.
A indicates marks for accurate working, whether in calculation, reading from tables, graphs or answers. Accuracy marks may depend on preceding **M** (method) marks, hence **M**0 **A**1 cannot be awarded i.e. where the method is not correct no marks can be given.
MA indicates marks for combined method and accurate working.

A later part of a question may require a candidate to use an answer obtained from an earlier part of the same question. A candidate who gets the wrong answer to the earlier part and goes on to the later part is naturally unaware that the wrong data is being used and is actually undertaking the solution of a parallel problem from the point at which the error occurred. If such a candidate continues to apply correct method, then the candidate's individual working must be **followed through** from the error. If no further errors are made, then the candidate is penalised only for the initial error. Solutions containing two or more working or transcription errors are treated in the same way. This process is usually referred to as "follow-through marking" and allows a candidate to gain credit for that part of a solution which follows a working or transcription error.

It should be noted that where an error trivialises a question, or changes the nature of the skills being tested, then as a general rule, it would be the case that not more than half the marks for that question or part of that question would be awarded; in some cases the error may be such that no marks would be awarded.

Positive marking:

It is our intention to reward candidates for any demonstration of relevant knowledge, skills or understanding. For this reason we adopt a policy of **following through** their answers, that is, having penalised a candidate for an error, we mark the succeeding parts of the question using the candidate's value or answers and award marks accordingly.

Some common examples of this occur in the following cases:

(a) a numerical error in one entry in a table of values might lead to several answers being incorrect, but these might not be essentially separate errors;

(b) readings taken from candidates' inaccurate graphs may not agree with the answers expected but might be consistent with the graphs drawn.

When the candidate misreads a question in such a way as to make the question easier, only a proportion of the marks will be available (based on the professional judgement of the examiner).

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General Marking Advice:

(i) If the correct answer is seen in the body of the script and the answer given in the answer line is clearly a transcription error, full marks should be awarded.

(ii) If the answer is missing, but the correct answer is seen in the body of the script, full marks should be awarded.

(iii) If the correct answer is seen in working but a completely different answer is seen in the answer space, then some marks will be awarded depending on the severity of the error.

(iv) Work crossed out but not replaced should be marked.

(v) In general, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered (with no solution offered on the answer line), mark the poorest answer.

(vi) For methods not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work.

(vii) Where a follow through mark is indicated on the mark scheme for a particular part question, the marker must ensure that you refer back to the answer of the previous part of the question.

(viii) Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen. E.g. the answer in the mark scheme is 4.65 and the candidate then correctly rounds to 4.7 or 5 on the answer line. Allow full marks for 4.65 seen in the working.

(ix) Anything in the mark scheme which is in brackets (...) is not required for the mark to be earned, but if present it must be correct.

(x) For any question, the range of answers given in the mark scheme is inclusive.

Quality of written communication

In GCSE Mathematics, particular questions are identified where candidates must demonstrate the quality of their written communication.

In particular, candidates must:

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear (i.e. comprehension and meaning is clear by using the correct notation and labelling conventions);

(ii) select and use a form and style of writing appropriate to their purpose and to complex subject matter (i.e. reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning); and

(iii) organise information clearly and coherently, using specialist vocabulary where appropriate (i.e. mathematical methods and processes used are coherently and clearly organised and appropriate mathematical vocabulary used).

This assessment may be through, for example, an explanation of the geometrical properties of a given shape or, for example, through concise mathematical argument in a multi-step problem.

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				AVAILABLE MARKS
1	**(a)**	$9\times\frac{3}{5}$ or $\frac{3}{5}+\frac{3}{5}+\frac{3}{5}+\frac{3}{5}+\frac{3}{5}+\frac{3}{5}+\frac{3}{5}+\frac{3}{5}+\frac{3}{5}$	M1	
		$\frac{27}{5}$ or $5\frac{2}{5}$ or 5.4	A1	
		6	MA1	
	(b)	$\frac{36}{150}\times 100 = 24$	M1, A1	5
2		$0.35 \times 240 = 84$ or 0.65×240	M1, A1	
		$(240 - 84 =)$ £156	MA1	3
3	**(a)**	$C = \pi \times 2.8$	MA1 QWC	
		$= 8.796$	A1 QWC	
	(b)	EITHER 3 Triangles $= 3 \times 180 = 540°$, triangles drawn		
		OR explain Interior $= 108°$ Total $= 108 \times 5 = 540°$ (from ext $= 72$)	A2 QWC	4
4	**(a)**	60	A1	
		84	A1	
		36	A1	
	(b)	$\frac{1}{2}\times 14\times 8 = 56$	M1, A1	5
5	**(a)**	$2a + 3(a - 4) = 23$	A1 for $(a - 4)$ A1 for correct expression set up/A1 for equation	
	(b)	$2a + 3a - 12 = 23$		
		$5a - 12 = 23$	MA1	
		$5a = 35$		
		$a = 7$	MA1	5
6	**(a)**	correct scales	A1	
		correct heights (award A1 for 3 correct)	A2	
	(b)	$5 < w \leq 10$	A1	4

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			AVAILABLE MARKS
7	15% of £62 = £9.30 or $\frac{85}{100} \times 62$	M1, A1	
	Cost = £52.70	MA1	
	Ans £2.10	MA1	4
8	2 points correctly identified	MA1	
	2 points accurately plotted	A1	
	Straight line	A1	3
9	**(a)** correct points (allow A1 for 3 correct)	A2	
	(b) oblique line with roughly half the points on either side	A1	
	(c) follow pupil's line	A1	
	(d) positive	A1	5
10	**(a)** $\frac{1}{2} \times \pi \times 10^2$	M1	
	157.1	A1	
	(b) **(i)** (1, 2)	A1, A1	
	(ii) (7, 3)	A1, A1	6
11	$2\overline{)84}$ $2\overline{)42}$ $3\overline{)21}$ 7	M1, A1	
	$2^2 \times 3 \times 7$	A1	3
12	$r^2 = 85^2 + 16^2$	MA1	
	$r^2 = 7481$	A1	
	$r = 86.5$	A1	3
13	**(a)** $\frac{3}{4} \times 100$	MA1	
	75	A1	
	(b) 4944	MA1	
	5092.32	MA1	4

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			AVAILABLE MARKS
14	**(a)** $x^2 - 6x + 4x - 24$	MA1	
	$x^2 - 2x - 24$	A1	
	(b) $6n$	A1	
	(c) $5n - 1$	A1, A1	5

15

Mid-Points	fx
1	4
3	54
5	160
7	140
9	144
11	110

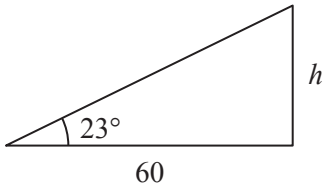
fx products	M1	
612	A1	
$612 \div 100 = 6.12$	M1, A1	4

16 $S_1 = 85, T_1 = 100$	MA1	
$S_2 = 109, T_2 = 121$		
$S_3 = 137, T_3 = 144$	MA1	
$S_4 = 169, T_4 = 169$		
5, 12, 13	MA1	3

17 $5.3 \rightarrow 49.29$		
$5.4 \rightarrow 50.76$	MA1	
5.35 tested $\rightarrow 50.0225$	MA1	
5.3	A1	3
5.35 must be tested for full marks		

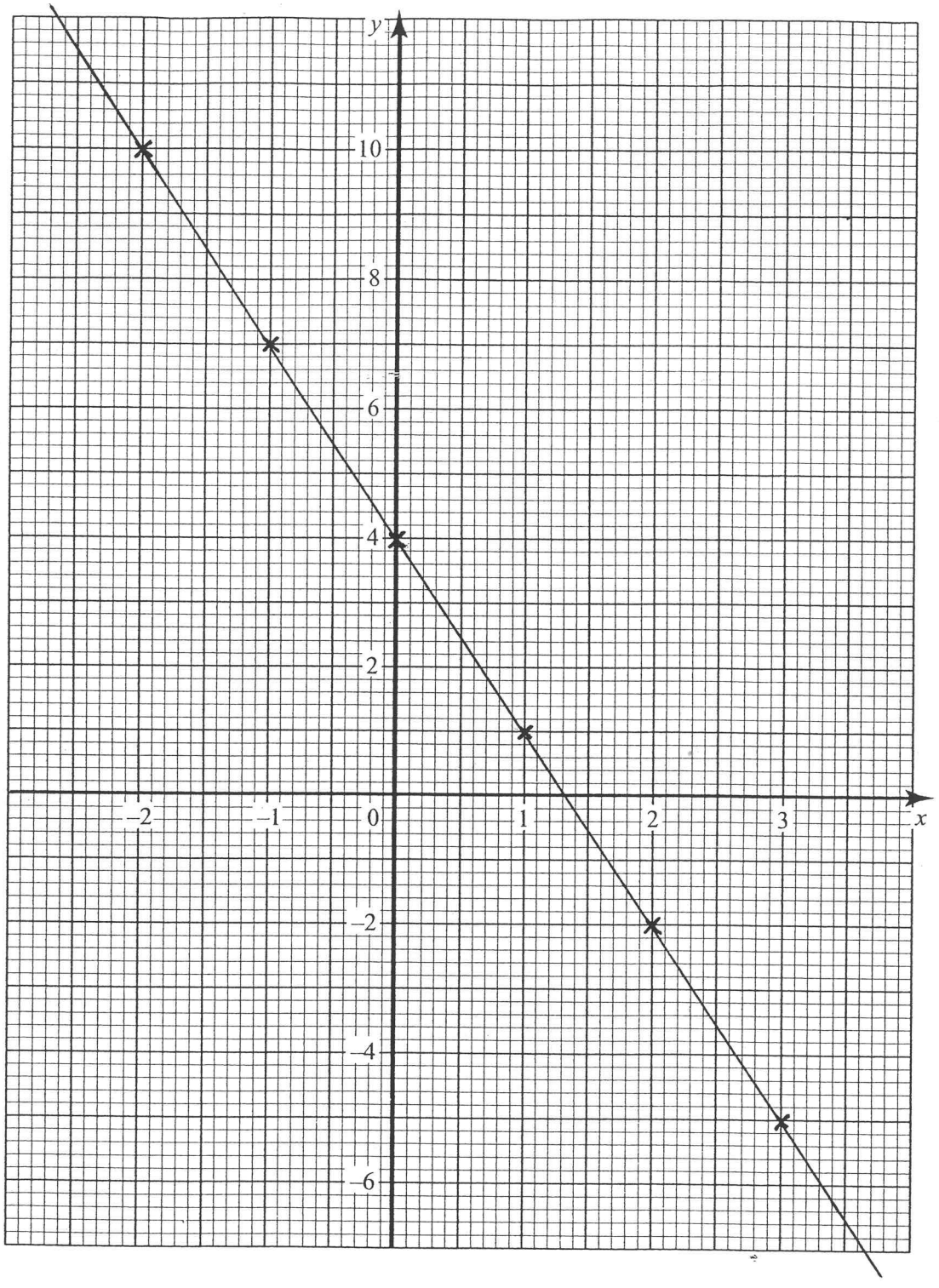
18 **(a)** $64 = 2^6$		
$96 = 2^5 \times 3$	A1	
HCF = 32	A1	
(b) $21 = 3 \times 7 \quad 70 = 7 \times 2 \times 5$	A1	
LCM = 210	A1	4

19 103.5	A1	
112.5	A1	2

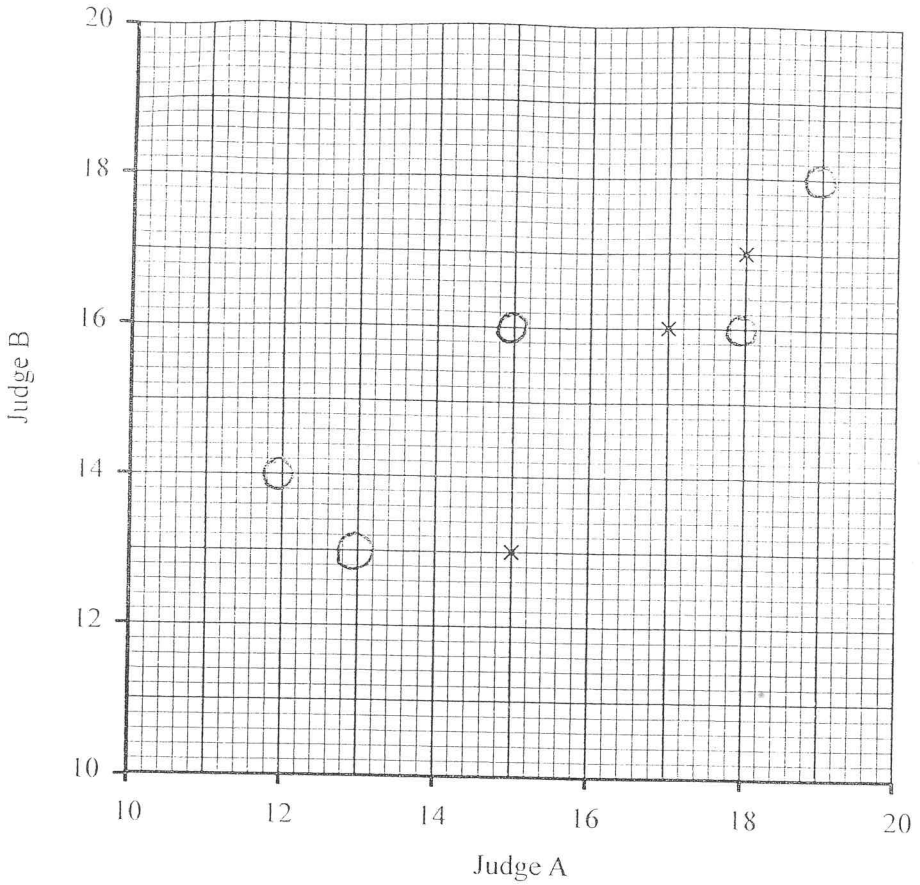
			AVAILABLE MARKS
20	**(a)** $2(2x - 4) + 5(x + 11) = 20$	MA1	
	$4x - 8 + 5x + 55 = 20$	MA1	
	$9x + 47 = 20$	MA1	
	$9x = -27$		
	$x = -3$	MA1	4
	(b) $4x + 3y = 1$ *OR* $4x + 3y = 1$		
	$4x - 2y = -4$ $\quad$ $6x - 3y = -6$	MA1	
	$y = 1$ *OR* $x = -\frac{1}{2}$	MA1	
	$x = -\frac{1}{2}$ *OR* $y = 1$	MA1	3
21	**(a)** **(i)** 80	MA1	
	(ii) $200 - 186$	MA1	
	14	A1	
	(b) median at 80	A1	
	quartiles at 60 and 110	A1	
	range	A1	6
22		diagram A1	
	$\tan 23° = \frac{h}{60}$	MA1	
	$h = 60 \tan 23°$	MA1	
	$= 25\ (.468)$	A1	4
23	$88\% = £63.36$	MA1	
	$63.36 \div 0.88$ or $\frac{63.36}{88} \times 100$	MA1	
	$= 72$	A1	3
24	**(a)** $3a(3a - y)$	A2	
	$3(3a^2 - ay)$ or $a(9a - 3y)$ allow A1		
	(b) **(i)** $(x + 3)(x - 2)$	MA1, MA1	
	(ii) $x = -3$ and $x = 2$	A1	5
		Total	**100**

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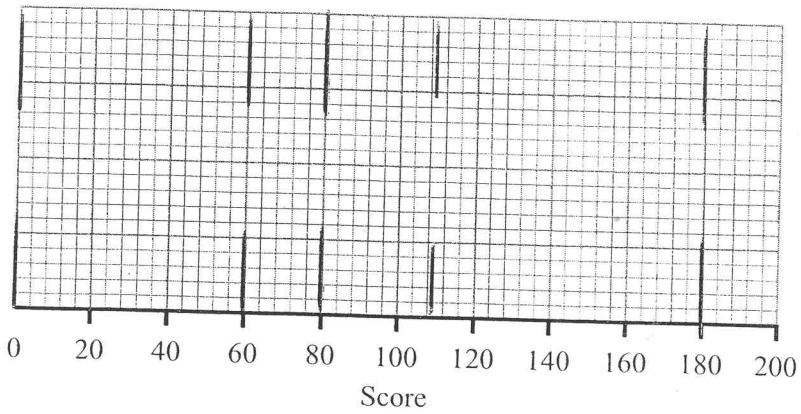
GCSE MATHEMATICS SUMMER 2011
UNIT T3
OVERLAY QUESTION 8



GCSE NEW SPEC MATHEMATICS SUMMER 2011
UNIT T3
OVERLAYS QUESTION 9



GCSE NEW SPEC MATHEMATICS SUMMER 2011
UNIT T3
OVERLAYS QUESTION 21B



GCSE NEW SPEC MATHEMATICS SUMMER 2011
UNIT T3
OVERLAYS QUESTION 21B

