CCEA GCSE MATHEMATICS

MATHS



EXAM QUESTION PACK

UNIT T4 HIGHER TIER GMT41 PAPERS

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
January 2016

Mathematics

Unit T4 **(With calculator)**
Higher Tier



[GMT41]

GMT41

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-one** 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.

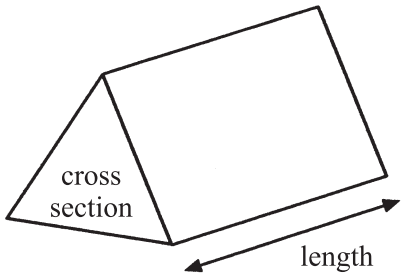
INFORMATION FOR CANDIDATES

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 **10** and **16**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

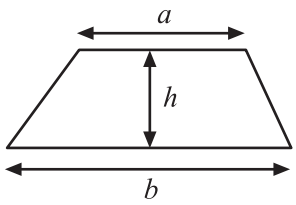
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Formula Sheet

Volume of prism = area of cross section × length

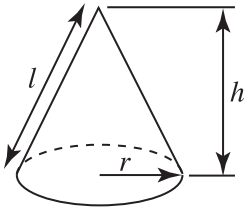


Area of trapezium = $\frac{1}{2}(a+b)h$



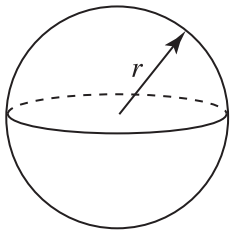
Volume of cone = $\frac{1}{3}\pi r^2 h$

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

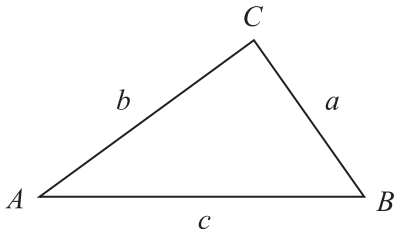


Volume of sphere = $\frac{4}{3}\pi r^3$

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

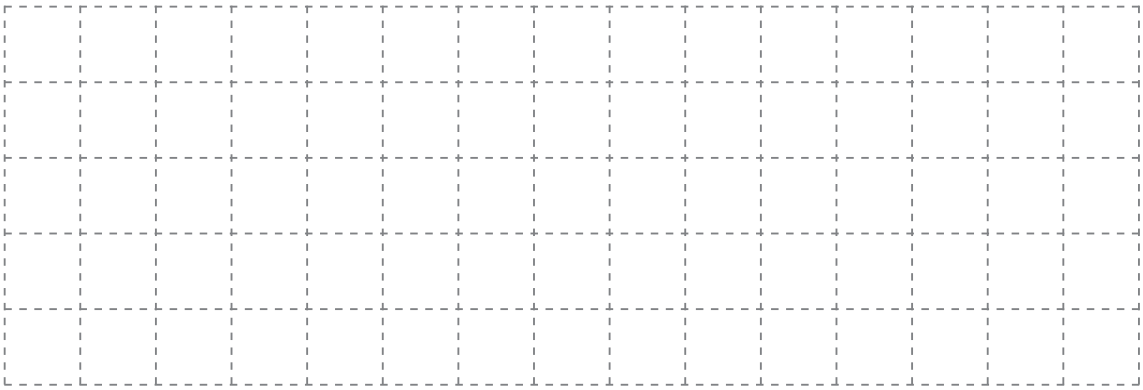
Area of triangle = $\frac{1}{2}ab\sin C$

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1 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.

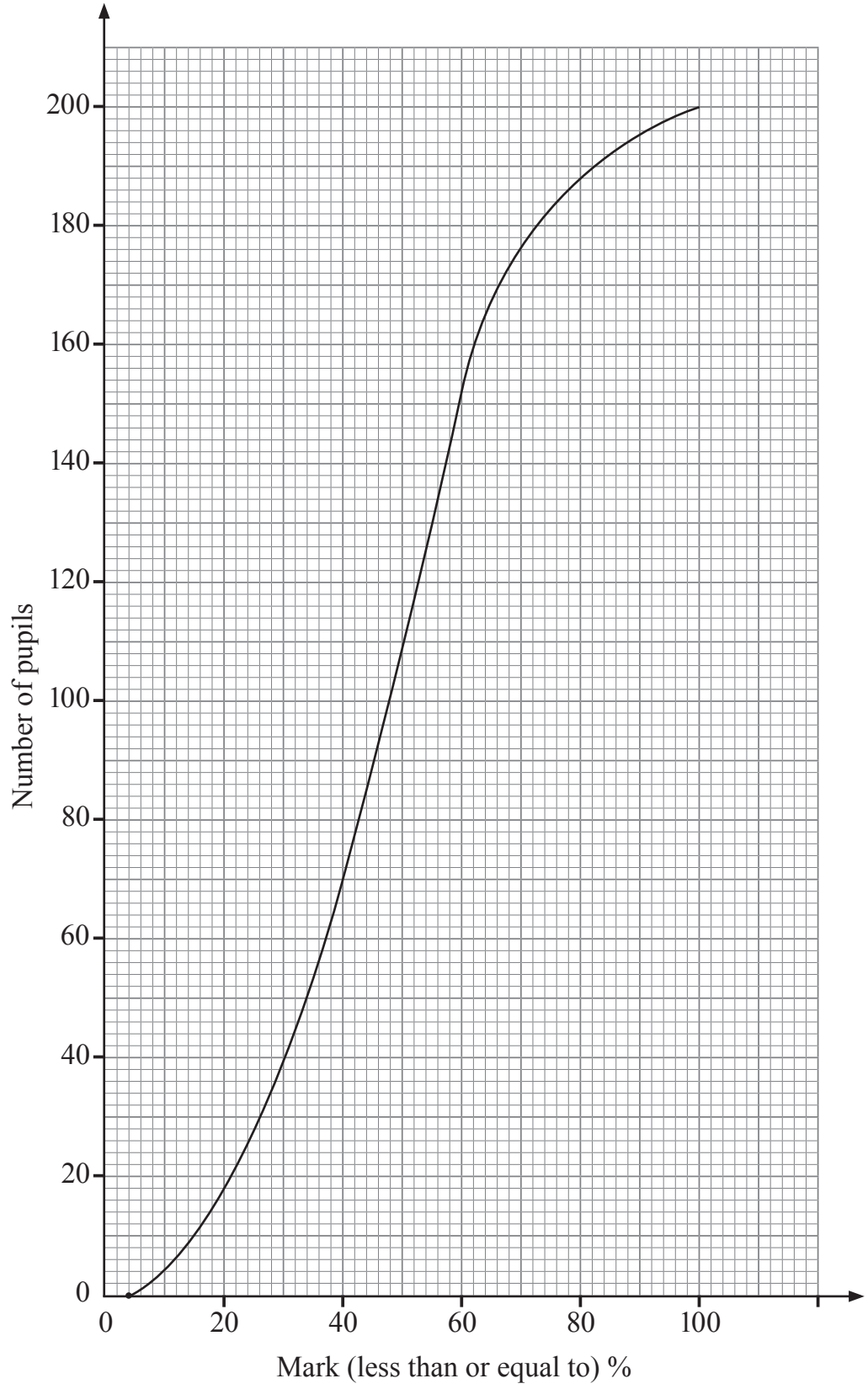


[4]

[Turn over

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2 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]

(c) Use the graph to estimate the range of marks for the top 30 pupils.

Answer _____ % [2]

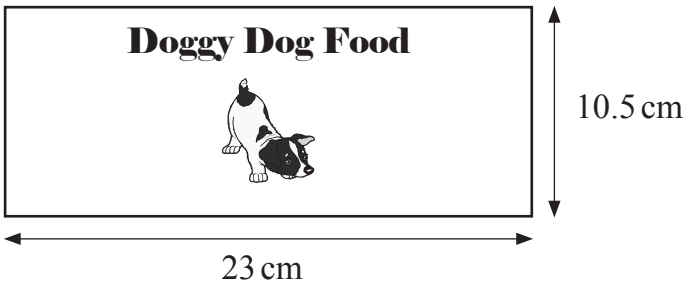
[Turn over

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3 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.

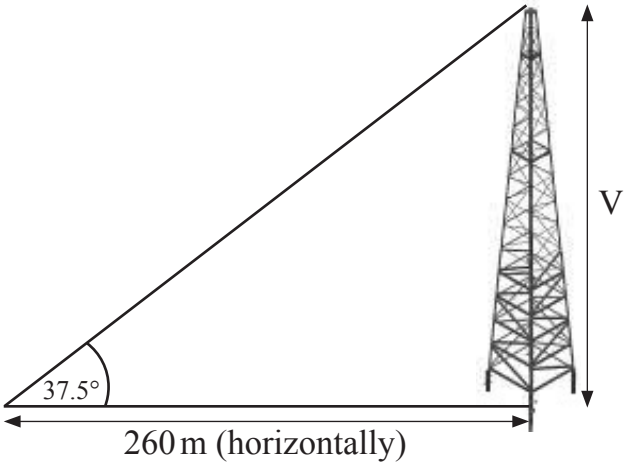


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Answer _____ cm^3 [4]

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4 Calculate the height V of this vertical radio mast.



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Answer _____ m [3]

5 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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6 **(a)** Find the equation of the line joining the points A (0, –1) and B (6, –4).

Answer _____ [3]

(b) Find the equation of the line perpendicular to AB which passes through B.

Answer _____ [3]

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7 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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8 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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9 The time (T) of swing of a pendulum varies as the square root of the length (L) of the pendulum.

When T = 1.8 seconds the length of the pendulum is 0.81 m.

(a) Find the formula for T in terms of L.

Answer T = _____ [3]

(b) Use your formula to find T when L = 1.21 m.

Answer _____ seconds [1]

(c) Find the value of L for which the time of swing is 0.5 seconds.

Answer _____ m [1]

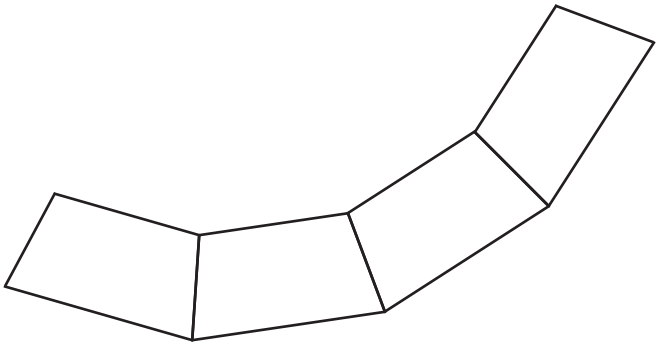
[Turn over

Quality of written communication will be assessed in this question.

10 The diagram shows a tile in the shape of an isosceles trapezium.



Some of these tiles are put together as a path all the way around a garden as shown.



How many exterior sides will the path have?

Show all your working clearly.

Answer _____ [3]

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11 The angle of elevation of the top of a vertical tower is 27°

From a point 30 metres closer, the angle of elevation is 36°

Calculate the height of the tower.

Answer _____ m [5]

[Turn over

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12 **(a)** Factorise fully

$3x^2 - 27y^2$

Answer _____ [3]

(b) Simplify fully

$$\frac{3x^2 - 27y^2}{x^2 - 6xy + 9y^2}$$

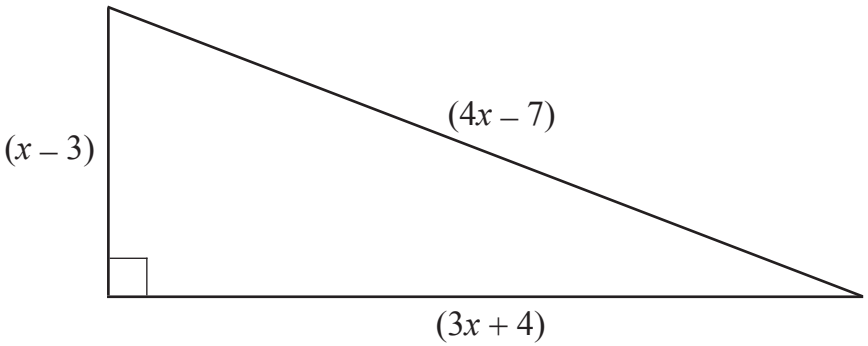
Answer _____ [3]

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13 In the triangle shown find x and hence the length of the longest side.

A solution by trial and improvement will not be accepted.

Show all your working.



Answer x = _____ longest side = _____ [7]

[Turn over

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14 A car dealer sells petrol cars and diesel cars.

In 2015 there were 876 petrol cars sold. This was 36.5% of the total number sold.

Janice questions a sample of all the people who had bought a car from this dealer in 2015.

Her sample was stratified by fuel type.

Estimate the number of diesel cars in her sample of 160.

Answer _____ [4]

15 Paula recorded the time, in seconds, of each of the songs stored on her phone.

She plans to draw a histogram for the data. Some of the data is shown in the table.

time (in seconds)	**frequency**	**height of bar (cm)**
$90 < t \leqslant 140$	30	6
$140 < t \leqslant 160$	8	
$160 < t \leqslant 200$		1.5

Complete the table. [4]

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Quality of written communication will be assessed in this question.

16 Without using a calculator evaluate

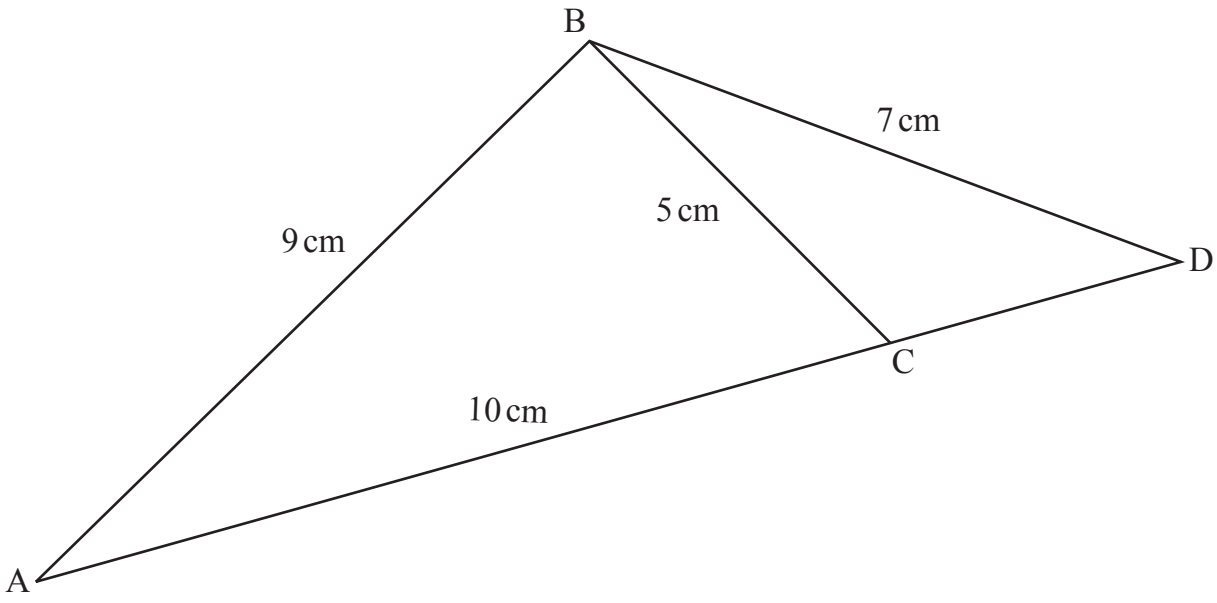
$$32^{\frac{6}{5}} \div 0.25^{-0.5}$$

Show all your working.

Answer _____ [3]

17 The triangle ABC in the diagram shown has sides of 5, 9, 10 cm.

BD has length 7 cm. ACD is a straight line.

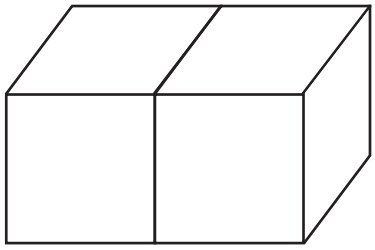


Calculate the size of the angle BDC.

Answer _____° [5]

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18



Two cubes, each of side 1 cm, are set side by side.

Calculate the angle between the base and the space diagonal from the bottom left hand corner to the top right hand corner.

Answer _____° [3]

[Turn over

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19 Solve the simultaneous equations

$x + 2y = -3$ and $x^2 - 2xy = 20$

Answer _____ [7]

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20 An events manager orders 600 sandwiches for a finger buffet. This will give all the guests the same number of sandwiches each.

At the last minute 10 extra guests arrive. This will still give all the guests the same number of sandwiches each, but two less each than previously calculated.

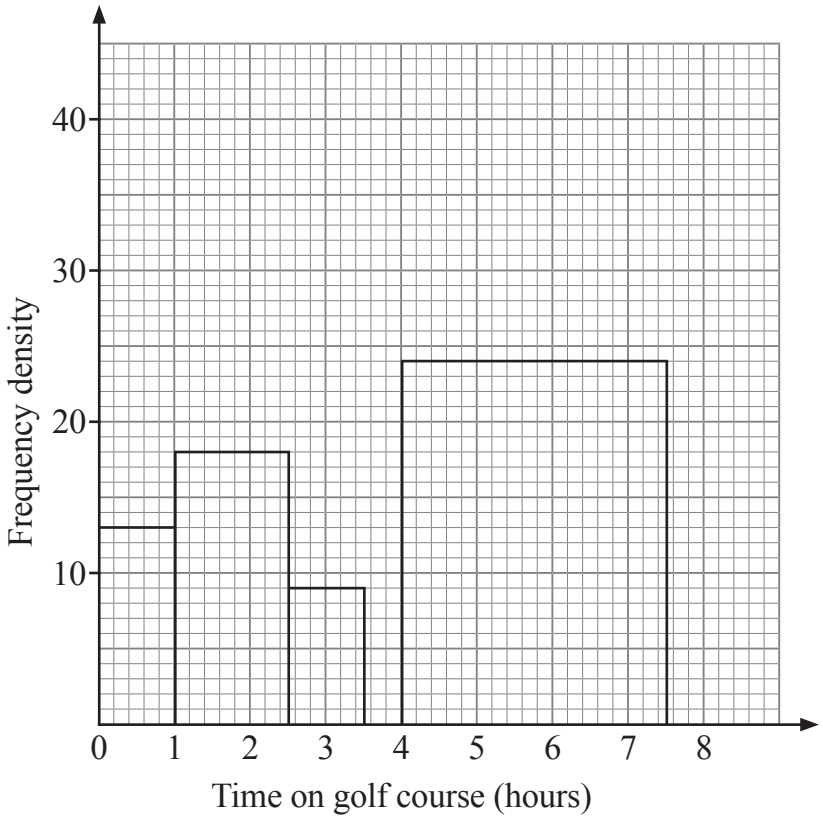
Let n be the original number of guests. Form an equation in n and solve to find n.

Answer n = _____ [6]

[Turn over

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21 The histogram represents some information about the length of time a number of golfers spent on the golf course one Saturday. No one spent more than $7\frac{1}{2}$ hours on the course.



The charges for using the golf course are shown in the table below.

Length of time	**Up to 2.5 hours**	**2.5 up to 3.5 hours**	**3.5 to 4 hours**	**Over 4 hours**
Cost (£)	25	30	35	40

The amount of money raised for the Saturday was £5295

Use all the given information to complete the missing bar on the histogram.

Show all your working clearly.

[7]

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For Examiner's use only	
Question Number	**Marks**
1	
2	
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10	
11	
12	
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16	
17	
18	
19	
20	
21	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
January 2016

Mathematics

Unit T4

(With calculator)

Higher Tier

[GMT41]

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	Arranged in order	MA1	
	Median = 6	A1	
	Minimum/Maximum = 2, 12	A1	
	Quartiles = 3, 10	A1	4
2	**(a)** **(i)** **18**, **70**, 152, 188, 200	A1	
	(ii) **18**, **52**, 82, 36, 12	M1 A1	
	(b) 48	MA1	
	(c) Reading at 170 to get 66	MA1	
	Range = 100 − 66 = 34	MA1	6
3	Radius = 23 ÷ 2π = 3.66 (056369…)	M1 A1	
	Volume = $\pi \times (3.66)^2 \times 10.5$	MA1	
	= 442.0 (130657…)	A1	4
4	$\tan 37.5 = \frac{V}{260}$	MA1	
	260 tan 37.5 = V	MA1	
	199.5 (050169)	A1	3
5	165% = 80058	MA1	
	$1\% = \frac{80058}{165} = 485.2$	MA1	
	100% = 48520	A1	3
6	**(a)** Gradient $= \frac{(-4 - -1)}{(6 - 0)} = \frac{-3}{6} = -\frac{1}{2}$	MA1 MA1	
	$y = -\frac{1}{2}x - 1$	MA1	
	(b) Gradient of perpendicular = 2	MA1	
	$y = 2x + c$		
	$-4 = 12 + c, c = -16$	MA1	
	$y = 2x - 16$	MA1	6
7	$5b + 2w = 21.6$		
	$3b + 5w = 23.6$	MA1	
	$25b + 10w = 108$ or $15b + 25w = 118$		
	$6b + 10w = 47.2$ $\quad 15b + 6w = 64.8$	MA1 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

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			AVAILABLE MARKS
8	$2(3x-2)-4(x-2)=21$	MA1	
	$6x-4-4x+8=21$	MA1	
	$2x=17$	MA1	
	$x=8.5$	MA1	4
9	**(a)** $T=k\sqrt{L}$	MA1	
	$1.8=k\sqrt{0.81}$		
	$k=2$	MA1	
	$T=2\sqrt{L}$	MA1	
	(b) $T=2\sqrt{1.21}=2.2$	MA1	
	(c) $0.5=2\sqrt{L}$		
	$L=0.0625\left(\frac{1}{16}\right)$	MA1	5
10	$180-102=78$		
	$78\times 2=156$	C1	
	$180-156=24$	C1	
	$360\div 24=15$ sides	C1	3
11	diagram with angles (27, 144, 9, 36) and 30 m	MA1	
	Either hypotenuse calculated: $30\frac{\sin 144}{\sin 9}=112.7216919$		
	or $30\frac{\sin 27}{\sin 9}=87.06339098$	M1 A1	
	height $=112.7216919\sin 27=51.17457724$		
	or $87.06339098\sin 36=51.17457723$	M1 A1	5
12	**(a)** $3(x-3y)(x+3y)$	A1 A2	
	(b) $\frac{3(x-3y)(x+3y)}{(x-3y)^2}$	A2	
	$=\frac{3(x+3y)}{(x-3y)}$	A1	6
13	$(4x-7)^2=(3x+4)^2+(x-3)^2$	MA2	
	$16x^2-56x+49=9x^2+24x+16+x^2-6x+9$	MA1	
	$6x^2-74x+24=0$	MA1	
	$(6x-2)(x-12)$	MA1	
	$(x=\frac{1}{3}$ or) $x=12$	MA1	
	$x=12$, Longest side $=41$	A1	7

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			AVAILABLE MARKS
14	$36.5\% = 876$		
	$100\% = 2400$ total number of cars	MA1	
	$63.5\% = 1524$ diesel cars	MA1	
	$\frac{160}{2400} = \frac{1}{15}$th	MA1	
	$\frac{1}{15} \times 1524 = 101$ or 102	MA1	4
	alternatively		
	$36.5\% = 876$		
	$100\% = 2400$ total number of cars	MA1	
	$\frac{160}{2400} = \frac{1}{15}$th	MA1	
	$\frac{1}{15} \times 876 = 58$ or 59 petrol	MA1	
	$160 - 58$ (or 59) $= 102$ or 101 diesel	MA1	
	alternatively		
	36.5% of population are petrol		
	63.5% of population are diesel	MA1	
	63.5% of sample are diesel	A1	
	63.5% of 160	M1	
	$= 101$ or 102	A1	
15	$\frac{30}{50} \times$ s.f. $= 6 \quad \therefore \quad$ s.f. $= 10$ (scale factor)	MA1	
	$\frac{8}{20} \times 10 = 4$	MA1	
	$\frac{1.5}{10} = \frac{f}{40} \quad f = 6$	MA2	4
16	$32^{\frac{6}{5}} = (\sqrt[5]{32})^6 = 64$	C1	
	$\frac{1}{\sqrt{\frac{1}{4}}} = \frac{1}{(\frac{1}{2})} = 2$	C1	
	$64 \div 2 = 32$	C1	3
17	$\cos \text{ACB} = \frac{(100 + 25 - 81)}{100} = 0.44$	MA2	
	$\text{ACB} = 63.89611886 \quad (\text{DCB} = 116.10388114)$	MA1	
	$\sin \text{BDC} = \frac{5 \sin \text{DCB}}{7} = 0.6414269806$	MA1	
	Ans 39.89830833 (rounded)	A1	5
18	diagonal $= \sqrt{6}$	MA1	
	$\sin x = \frac{1}{\sqrt{6}}$ **or** $\tan x = \frac{1}{\sqrt{5}}$ **or** $\cos x = \frac{\sqrt{5}}{\sqrt{6}}$	M1	
	$x = 24.09484255$ rounded	A1	3

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			AVAILABLE MARKS
19	$x = -3 - 2y$	MA1	
	$(-3 - 2y)^2 - 2(-3 - 2y)y = 20$	MA1	
	$9 + 12y + 4y^2 + 6y + 4y^2 = 20$	MA1	
	$8y^2 + 18y - 11 = 0$	MA1	
	$(4y + 11)(2y - 1)$	MA1	
	$y = \frac{1}{2}$ or $-\frac{11}{4}$	MA1	
	$x = -4$ or $\frac{5}{2}$	MA1	7
20	$\frac{600}{n} - \frac{600}{(n + 10)} = 2$	MA2	
	$600(n + 10) - 600n = 2n(n + 10)$	MA1	
	$2n^2 + 20n - 6000 = 0$		
	$n^2 + 10n - 3000 = 0$	MA1	
	$(n + 60)(n - 50) = 0$	MA1	
	$n = 50$	A1	6
21	Frequencies 13 27 9 84	MA2	
	Money 325 675 270 3360	MA2	
	£5295 – £4630 = £665	MA1	
	$\frac{665}{35} = 19$ people	MA1	
	Missing bar to a height of 38	MA1	7
		Total	**100**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015

Mathematics

Unit T4 **(With calculator)**
Higher Tier



[GMT41]

GMT41

THURSDAY 21 MAY, 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 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-three** 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, 11** and **16(d)**
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

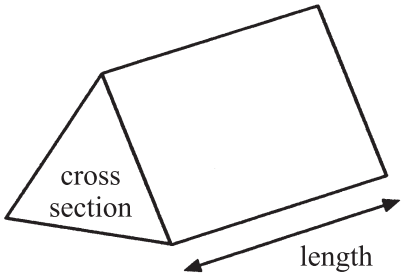
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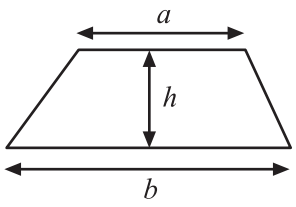
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Formula Sheet

Volume of prism = area of cross section × length

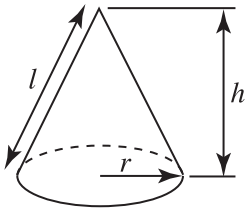


Area of trapezium $= \frac{1}{2}(a+b)h$



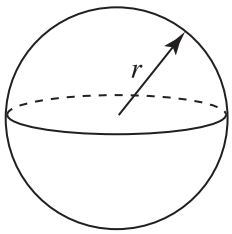
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

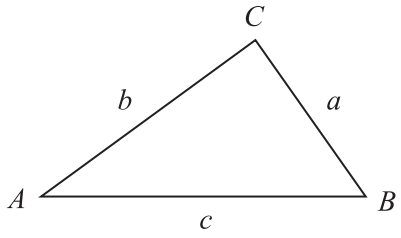


Volume of sphere $= \frac{4}{3}\pi r^3$

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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(Questions start overleaf)

1 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

(i) the median,

Answer _____ [1]

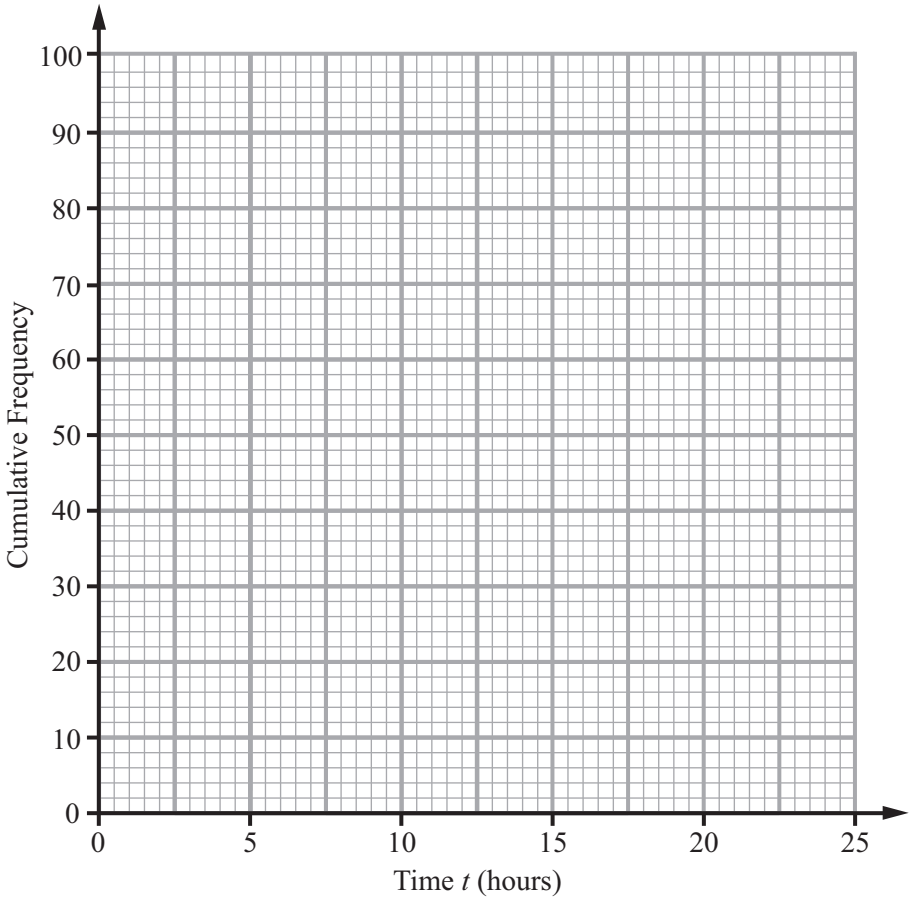
(ii) the inter-quartile range.

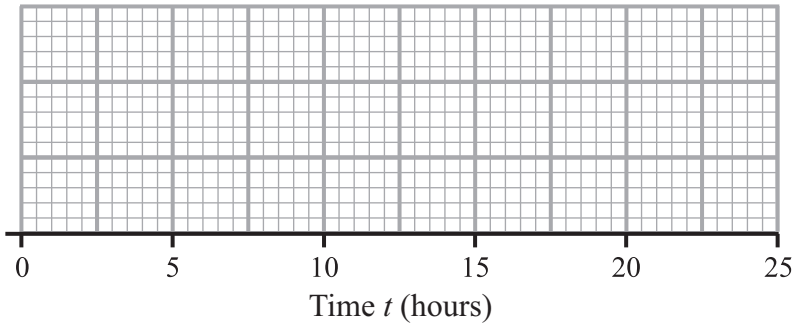
Answer _____ [2]

(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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24GMT4105

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

Answer _____ [2]

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

Write down the n^{th} term

Answer _____ [1]

Quality of written communication will be assessed in this question.

4 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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5 Solve the simultaneous equations

$$5x + 2y = 19$$
$$4x - 3y = 29$$

A solution by trial and improvement will not be accepted.

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

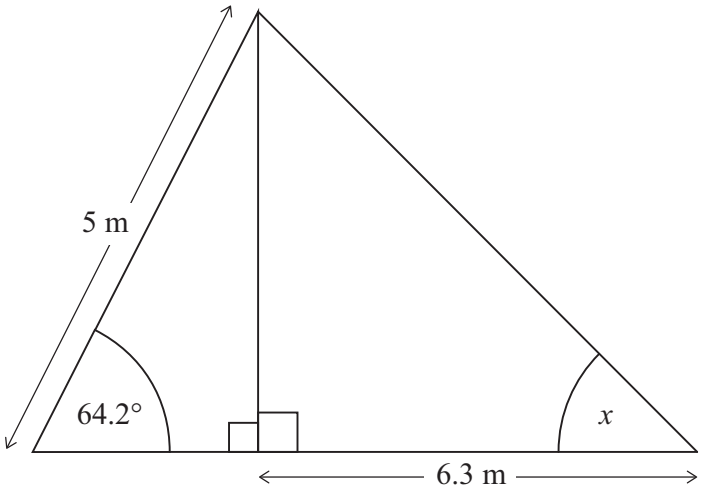
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6 Factorise fully $14x^2y - 35x$

Answer _____ [2]

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



Answer $x =$ _____ ° [6]

[Turn over

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

Show all your work.

Answer $x =$ _____ [4]

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9

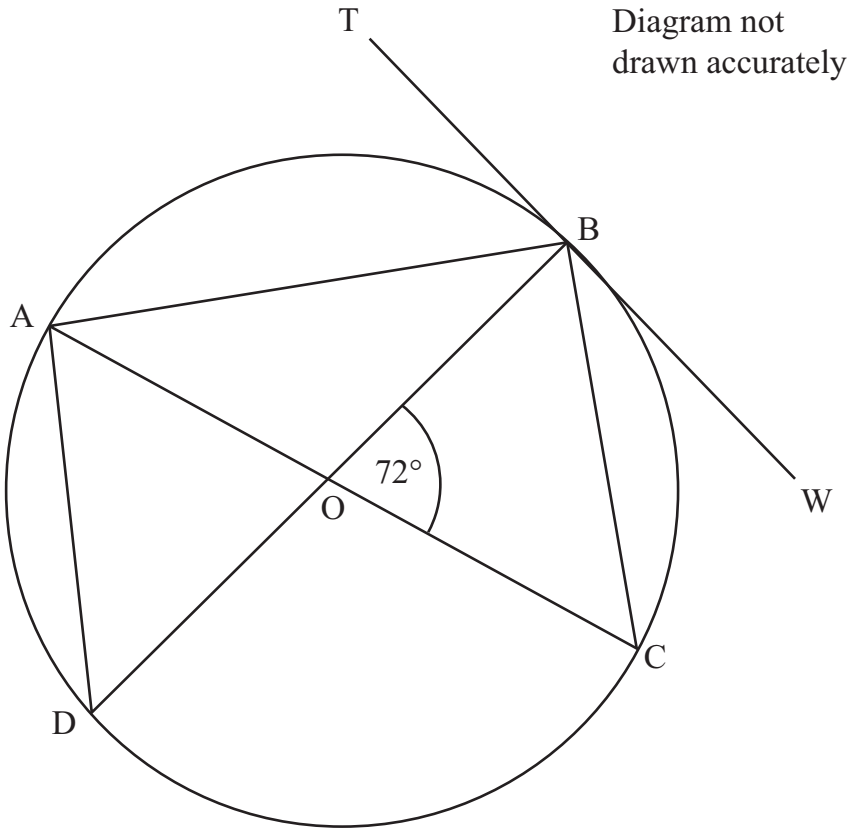


Diagram not drawn accurately

O is the centre of the circle and the tangent TW touches the circle at B.

Find the size of the angles

(a) TBO

Answer _____ ° [1]

(b) CAB

Answer _____ ° [1]

(c) CBW

Answer _____ ° [1]

(d) DBC

Answer _____ ° [1]

[Turn over

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10 Eleven pencils each measuring 13 cm, to the nearest cm, in length are placed end to end.

Find the shortest possible total length and longest possible total length of the pencils.

Shortest length _____ cm [1]

Longest length _____ cm [1]

Quality of written communication will be assessed in this question.

11 Prove that BC is parallel to the tangent TU in the diagram shown.

Justify each step of your proof.

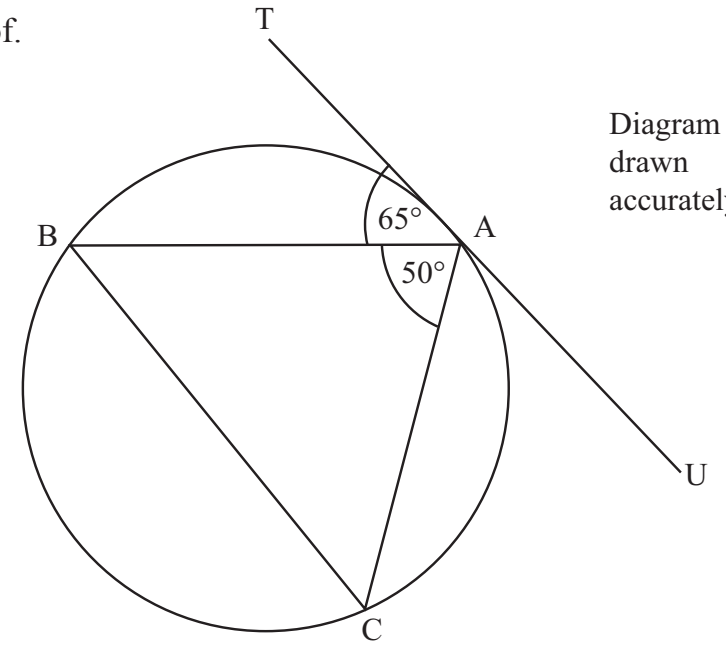


Diagram not drawn accurately

[3]

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12 Simplify fully $\dfrac{x^2 + x - 6}{2x^2 - 9x + 10}$

Answer _____ [3]

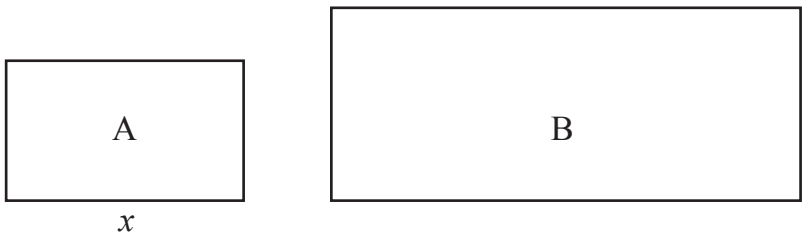
13 Solve $x^2 = \dfrac{2x + 7}{3}$, giving your answers correct to two decimal places.

Answer x = _____ [4]

[Turn over

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14



The diagram shows two rectangles, A and B.
The width of A is x cm.
The height of A is 20 cm less than the width.

The width of B is three times the width of A.
The height of B is 5 cm more than the height of A.
The area of B is 450 cm^2 greater than the area of A.
Find an equation for x and solve it to find the width of A.

Answer _____ cm [6]

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15 The force, F newtons, between two particles is inversely proportional to the square of the distance, d mm, between them.
When the particles are 4 mm apart the force between them is 12.5 newtons.
How far apart are the particles when the force between them is 3.125 newtons?

Answer _____ mm [5]

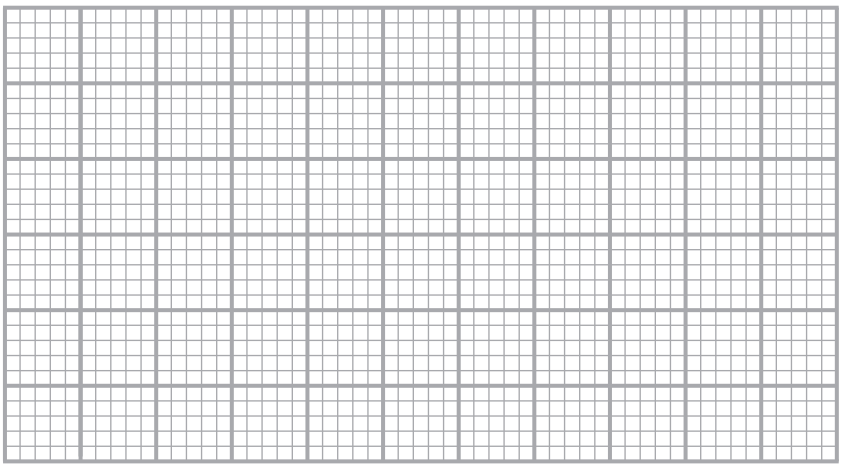
[Turn over

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

16 The table shows the lengths of a collection of leaves.

Lengths (cm)	Frequency		
$0 < x \leqslant 8$	12		
$8 < x \leqslant 12$	18		
$12 < x \leqslant 15$	15		
$15 < x \leqslant 20$	14		
$20 < x \leqslant 27$	14		
$27 < x \leqslant 35$	6		

(a) Draw a histogram on the axes provided to illustrate this data. [3]



(b) Estimate the number of leaves with lengths longer than the middle of the modal class.

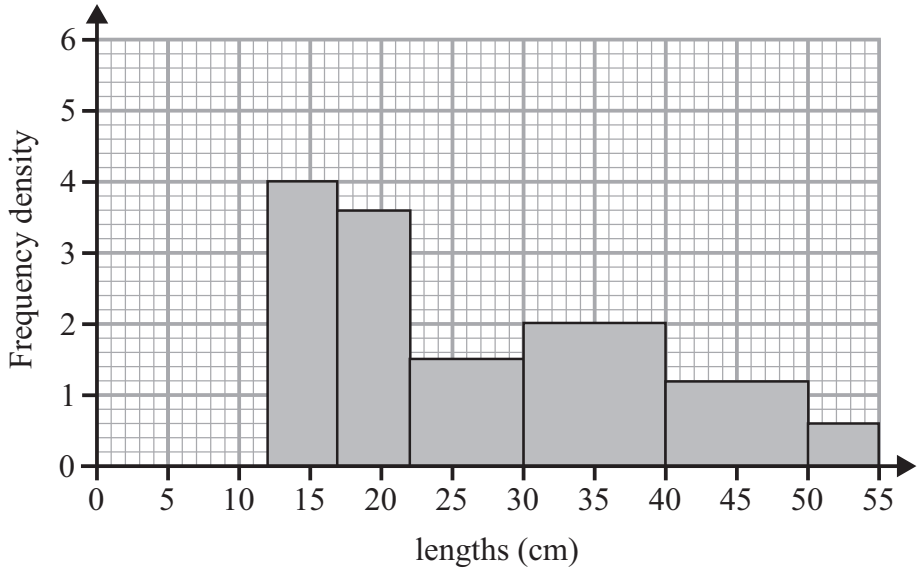
Answer _____ [3]

A stratified sample of 10 leaves is to be selected from those with lengths longer than 21 cm.

(c) Estimate how many of this sample would have lengths between 26 and 33 cm.

Answer _____ [3]

The lengths for a second collection of leaves are shown in the histogram below.



(d) State two comparisons between these two histograms.

_____

_____

_____

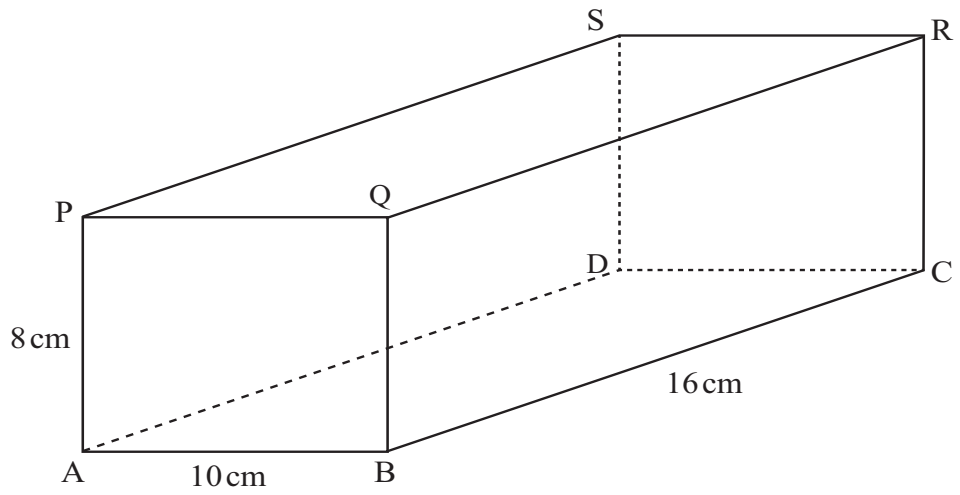
_____

_____ [2]

[Turn over

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17



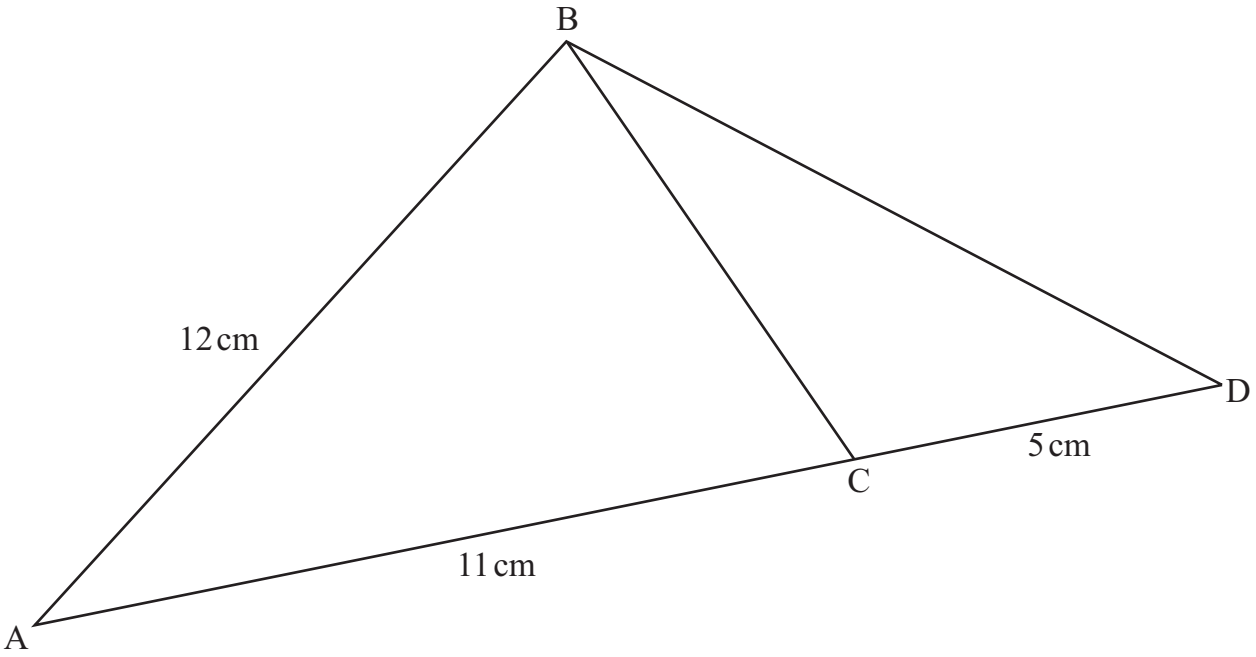
(a) Calculate the length of the space diagonal PC of the cuboid.

Answer _____ cm [2]

(b) Find the angle between PC and the face PSDA.

Answer _____ ° [3]

18 The area of the triangle ABC in the diagram below is 49 cm^2
The angle A is acute.
ACD is a straight line.



Find the area of the triangle BCD.

Answer _____ cm^2 [4]

[Turn over

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19 **(a)** Given that $x^2 + ax + b$ can be written as $(x - 5)^2 + a$ work out the values of a and b.

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

(b) Hence, write down the smallest possible value of $y = x^2 + ax + b$, using the values of a, b from above.

Answer _____ [1]

20 Solve the simultaneous equations

$$y^2 = 6x - 23$$
$$y = x - 3$$

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

Answer _____ [5]

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

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

Answer $x =$ _____ [6]

22 Factorise $6x^2 - 17xy + 12y^2$

Answer _____ [2]

[Turn over

23 A group of men and women were asked to give their ages in complete years.
The total of the men's ages was 1000
The total of the women's ages was 900
There were 5 more women than men and the mean of the women's ages was 10 smaller than the mean of the men's ages.
Find the number of men.

Answer _____ [4]

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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	
Total Marks	

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Rewarding Learning

General Certificate of Secondary Education
2015

Mathematics

Unit T4

(With calculator)

Higher Tier

[GMT41]

THURSDAY 21 MAY
9.15 am–11.15 am

MARK SCHEME

STEMUP.CO.UK

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.

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)**	**(i)**	18 48 80 95 100	A1	
		(ii)	points at upper boundaries	A1	
			points plotted correctly	A1	
			smooth curve	A1	
	(b)	**(i)**	10.3 follow candidate's curve	MA1	
		(ii)	14 – 6.3 follow candidate's curve	MA1	
			7.7	A1	
	(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	10
2	$15w^2 - 24w - 35w + 56$			M1	
	$15w^2 - 59w + 56$			A1	2
3	$\frac{n}{n+1}$			A1	1
4	$3299 - 560 = 2739$			C1	
	$\frac{2739}{22} \times 100$			C1	
	12 450			C1	3
5	$15x + 6y = 57$			M1	
	$8x - 6y = 58$			M1	
	$23x = 115 \Rightarrow x = 5$			A1	
	$25 + 2y = 19$				
	$y = -3$			A1	4
6	$7x(2xy - 5)$			A2	
	(A1 for correct partial factorisation)				2
7	$\sin 64.2 = \frac{h}{5}$			MA1	
	$h = 5 \sin 64.2$			A1	
	$h = 4.5(0159\ldots)$			A1	
	$\tan x = \frac{4.5}{6.3}$			M1 A1	
	$x = 35.547\ldots$			A1	6

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			AVAILABLE MARKS
8	$3(2x + 3) + 4(x - 1) = 60$	M1	
	$6x + 9 + 4x - 4 = 60$	MA1	
	$10x = 55$	MA1	
	$x = 5.5$	A1	4
9	**(a)** 90	A1	
	(b) 36	A1	
	(c) 36	A1	
	(d) 54	A1	4
10	Shortest 137.5	A1	
	Longest 148.5	A1	2
11	ACB = 65° AST	C1	
	ABC = 65° Angles of a triangle	C1	
	So TU is parallel to BC, alternate angles equal	C1	3
12	$\frac{(x + 3)(x - 2)}{(2x - 5)(x - 2)}$	MA2	
	$\frac{x + 3}{2x - 5}$	A1	3
13	$3x^2 = 2x + 7$	M1	
	$3x^2 - 2x - 7 = 0$	MA1	
	$x = \frac{2 \pm \sqrt{4 + 84}}{6}$	MA1	
	$x = 1.90$ or $x = -1.23$	A1	4
14	x, $(x - 20)$, $3x$, $(x - 15)$	MA1	
	$3x(x - 15) = x(x - 20) + 450$	MA1	
	$3x^2 - 45x = x^2 - 20x + 450$	MA1	
	$2x^2 - 25x - 450 = 0$	MA1	
	$(2x - 45)(x + 10) = 0$	MA1	
	$x = 22\frac{1}{2}$	MA1	6

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			AVAILABLE MARKS
15	$F = \frac{k}{d^2}$	M1	
	$12.5 = \frac{k}{16}$	MA1	
	$k = 200$	A1	
	$F = \frac{200}{d^2} \Rightarrow 3.125 = \frac{200}{d^2}$	M1	
	$d^2 = 64 \Rightarrow d = 8$	A1	5
16	**(a)** f.d. 1.5 4.5 5 2.8 2 0.75	MA1	
	Scales and labels	A1	
	Bars	A1	
	(b) Middle of modal class is 13.5 **or** Middle of modal class is 10	MA1	
	7.5 + 14 + 14 + 6 9 + 15 + 14 + 14 + 6	MA1	
	41 or 42 = 58	A1	
	(c) 18 longer than 21 6.5 between 26 and 33	MA1	
	Sample required $= \frac{6.5}{18} \times 10$	MA1	
	= 3.61 (accept 4)	A1	
	(d) One comment on central tendency	C1	
	One comment on spread	C1	11
17	**(a)** $\sqrt{(10^2 + 16^2 + 8^2)} = \sqrt{420}$	MA1	
	= 20.5	A1	
	(b) Angle CPD required	M1	
	$\sin x = \frac{10}{\sqrt{420}}$ or $\cos x = \frac{\sqrt{320}}{\sqrt{420}}$ or $\tan x = \frac{10}{\sqrt{320}}$	MA1	
	= 29.2°	A1	5
18	$49 = \frac{1}{2}(12)(11) \sin A$ **or** $\frac{1}{2} \times 11 \times h = 49$	MA1	
	$\sin A = \frac{49}{66}$		
	A = 47.94° $h = 8.90(90 \ldots)$	A1	
	Area ABD $= \frac{1}{2}(12)(16) \sin 47.94° = 71.27$ $\frac{1}{2} \times 5 \times 8.90$	MA1	
	So Area BCD = 71.27 – 49		
	$= 22.27\,\text{cm}^2$ $= 22.27\ \text{cm}^2$	A1	4
19	**(a)** $x^2 - 10x + 25 + a$	MA1	
	$a = -10$	A1	
	$b = 15$	A1	
	(b) –10	A1	4

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			AVAILABLE MARKS
20	$(x-3)^2 = 6x - 23$	MA1	
	$x^2 - 6x + 9 = 6x - 23$		
	$x^2 - 12x + 32 = 0$	MA1	
	$(x-4)(x-8) = 0$	MA1	
	$x = 4, x = 8$	A1	
	$y = 1, y = 5$	A1	5
21	$\frac{x(x+1)+4(2x-3)}{(2x-3)(x+1)} = 1$	M1	
	$\frac{x^2+9x-12}{2x^2-x-3} = 1$	MA1	
	$2x^2 - x - 3 = x^2 + 9x - 12$	MA1	
	$x^2 - 10x + 9 = 0$	MA1	
	$(x-1)(x-9) = 0$	MA1	
	$x = 1, x = 9$	A1	6
22	$(3x-4y)(2x-3y)$	MA2	2
23	$\frac{1000}{n} - \frac{900}{(n+5)} = 10$	MA2	
	$n^2 - 5n - 500 = 0$	MA1	
	$n = 25$	A1	4
		Total	**100**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
January 2015

Mathematics

Unit T4

(With calculator)

Higher Tier

[GMT41]

GMT41

FRIDAY 9 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 with a gel pen**.
Answer **all eighteen** 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

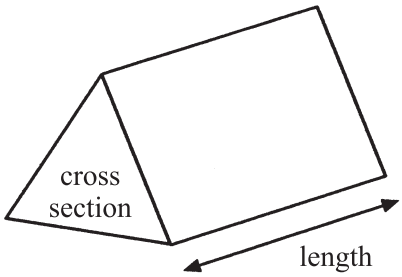
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **Question 8**.
You should have a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

9313

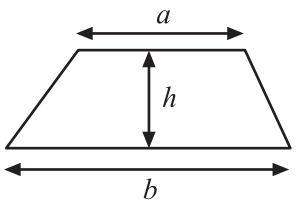
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Formula Sheet

Volume of prism = area of cross section × length

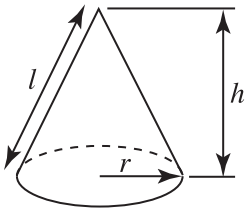


Area of trapezium $= \frac{1}{2}(a+b)h$



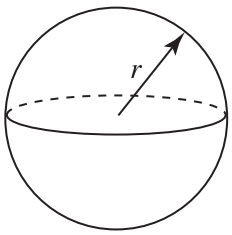
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

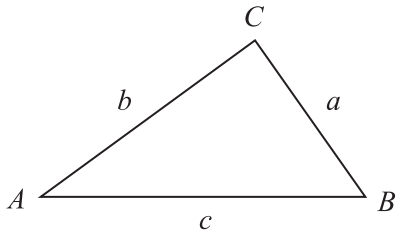


Volume of sphere $= \frac{4}{3}\pi r^3$

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

Weekly wage (£)	Frequency	≤(£)	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]

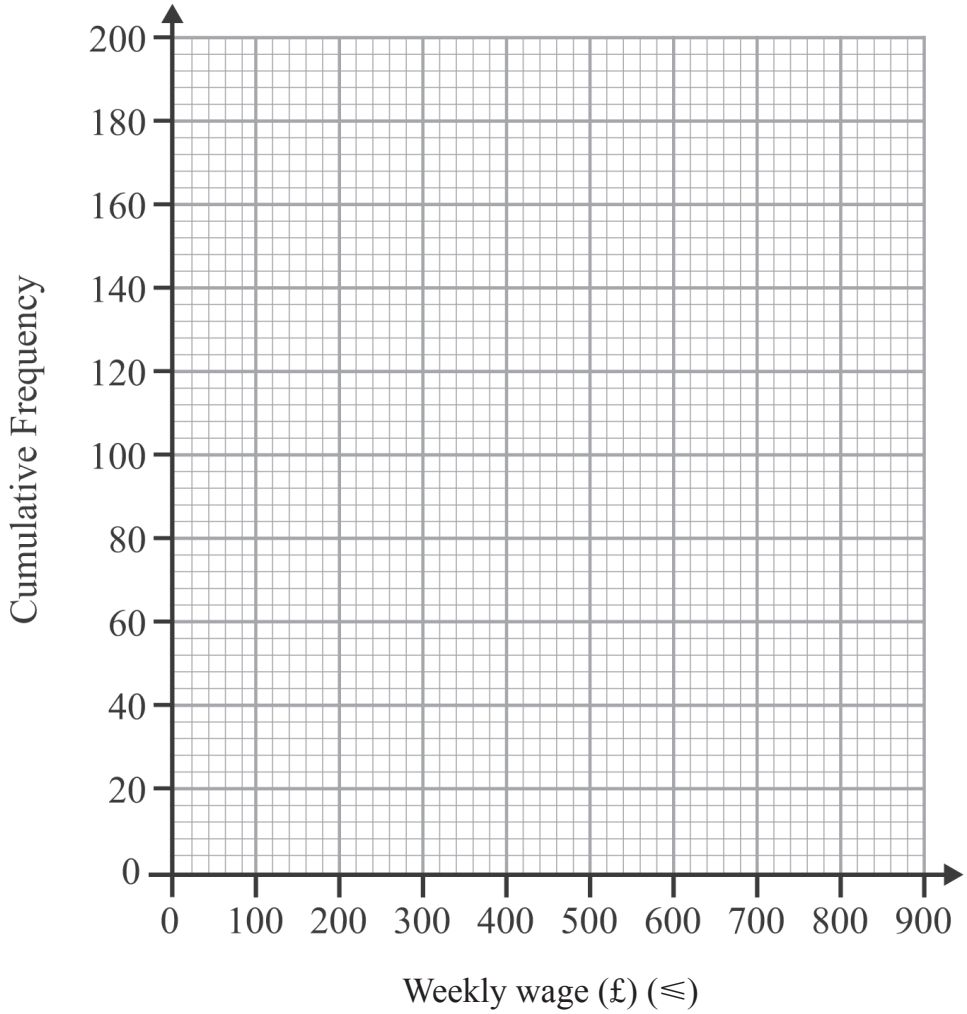
(ii) the inter-quartile range,

Answer £_____ [2]

(iii) the percentage of people who earn at least £640 per week.

Answer _____ % [2]

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[Turn over

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2 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]

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

Answer _____ [2]

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4 **(a)** Solve the simultaneous equations $9x + 4y = 51$
$5x + y = 32$

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

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

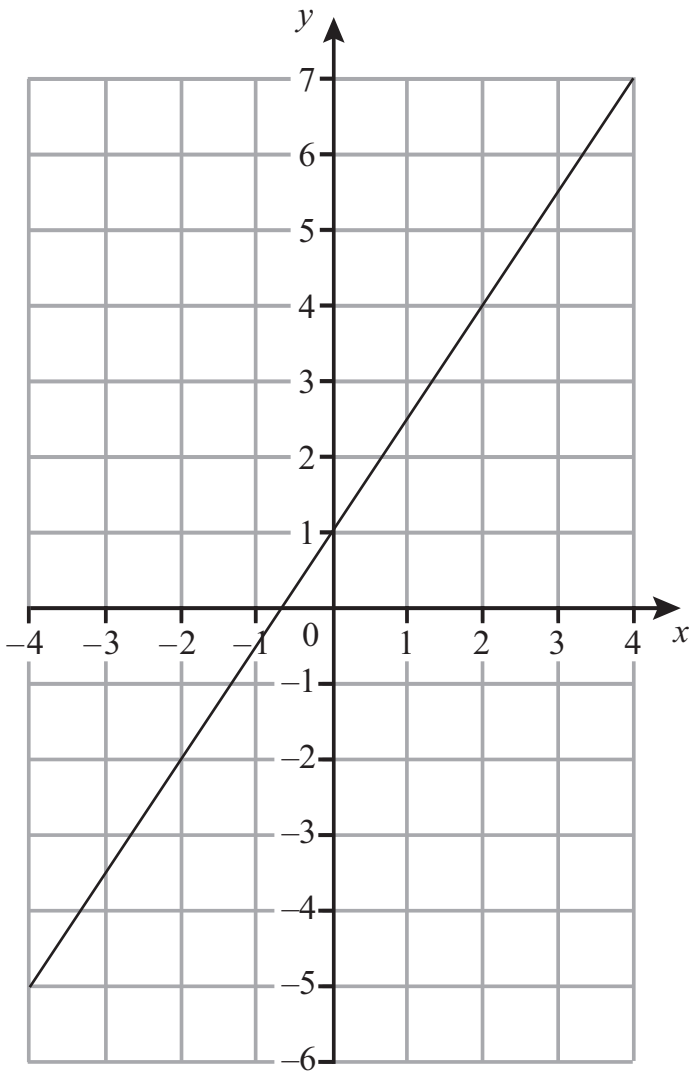
(b) Solve the equation $\frac{2x - 1}{5} + \frac{4x + 5}{10} = \frac{5}{2}$

Answer $x =$ _____ [4]

[Turn over

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5



(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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6

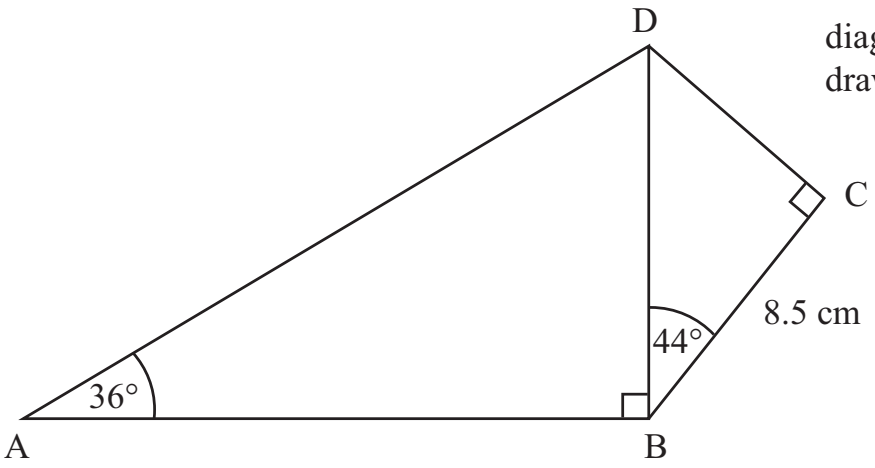


diagram not drawn accurately

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.

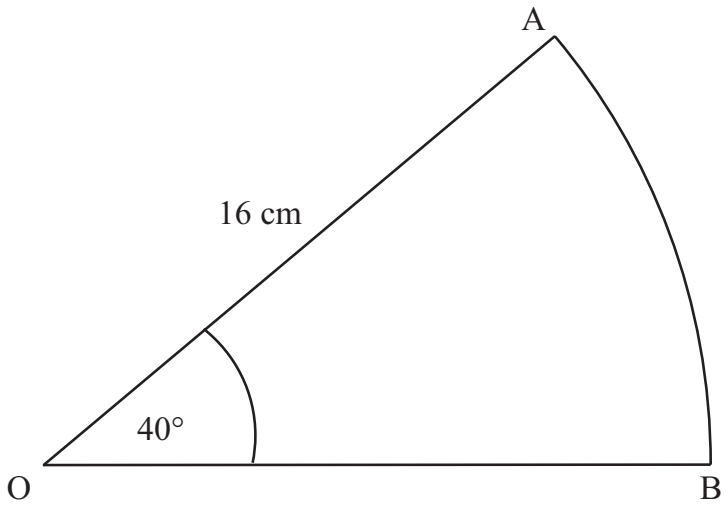
Answer _____ cm [6]

[Turn over

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

Angle AOB = 40°



Work out the perimeter of the sector AOB.

Answer _____ cm [3]

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Quality of written communication will be assessed in this question.

8 16 buckets each hold 8 litres, to the nearest litre.
Find the largest and smallest total volume of the 16 buckets.
Explain your reasoning clearly.

[3]

9 **(a)** Expand and simplify $(5x + 2)(4x - 3)$

Answer _____ [2]

(b) Simplify $\frac{x^2 + 4x}{x^2 - 16}$

Answer _____ [3]

(c) Factorise $8ax^2 - 26axy + 15ay^2$

Answer _____ [3]

[Turn over

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10 Find the equation of the line through (0, –5) which is perpendicular to the line $y = 4x + 9$

Answer _____ [2]

11 P is inversely proportional to the square of Q.
P = 6 when Q = 3

(a) Express P in terms of Q.

Answer _____ [2]

(b) Hence

(i) find the value of P when Q = 4

Answer _____ [1]

(ii) find the value of Q when P = 24

Answer _____ [2]

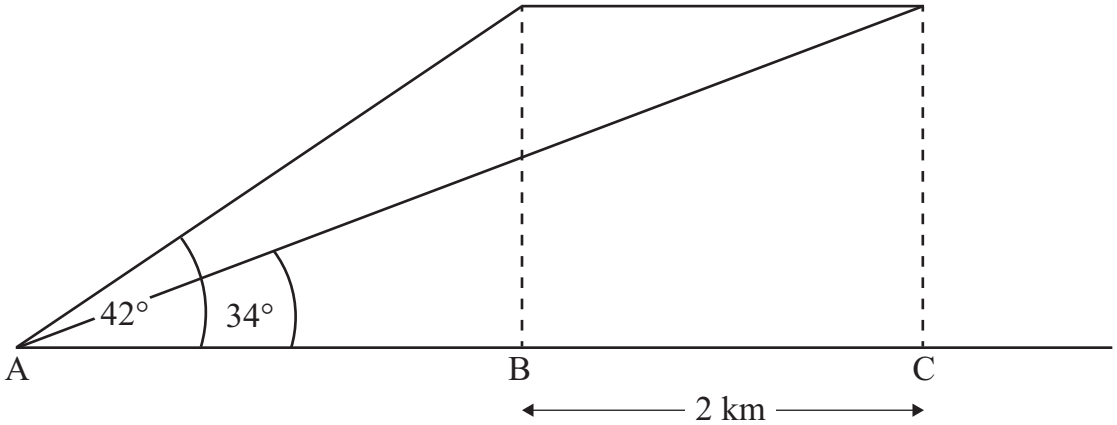
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12 Solve $3y^2 - 8y + 2 = 0$, correct to 2 decimal places.

Answer _____ [3]

13 A, B, C are three points in a straight horizontal line.
A plane is flying horizontally directly above ABC.
When the plane passes over the point B, the angle of elevation from A is 42°.
When the plane passes over the point C, the angle of elevation from A is 34°.
The horizontal distance between B and C is 2 km.

Find the height of the plane above ABC to the nearest km.



Answer _____ km [6]

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14 **(a)** Solve

(i) $7^x = 1$

Answer $x =$ _____ [1]

(ii) $2^y = \frac{1}{32}$

Answer $y =$ _____ [1]

(b) Evaluate $81^{-\frac{3}{4}}$

Answer _____ [1]

(c) $(3^a)^{b+1} \times \frac{2^c}{4} = 3^{c+a} \times 2$

Find possible values of a, b and c.

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

[Turn over

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15 The lengths of times in minutes for a group of people to complete a task are shown.

Time t (mins)	Frequency
$0 < t \leqslant 5$	9
$5 < t \leqslant 8$	12
$8 < t \leqslant 12$	10
$12 < t \leqslant 18$	15
$18 < t \leqslant 23$	11
$23 < t \leqslant 30$	14
$30 < t \leqslant 35$	6

(a) Draw a histogram on the axes provided opposite to illustrate this data. [3]

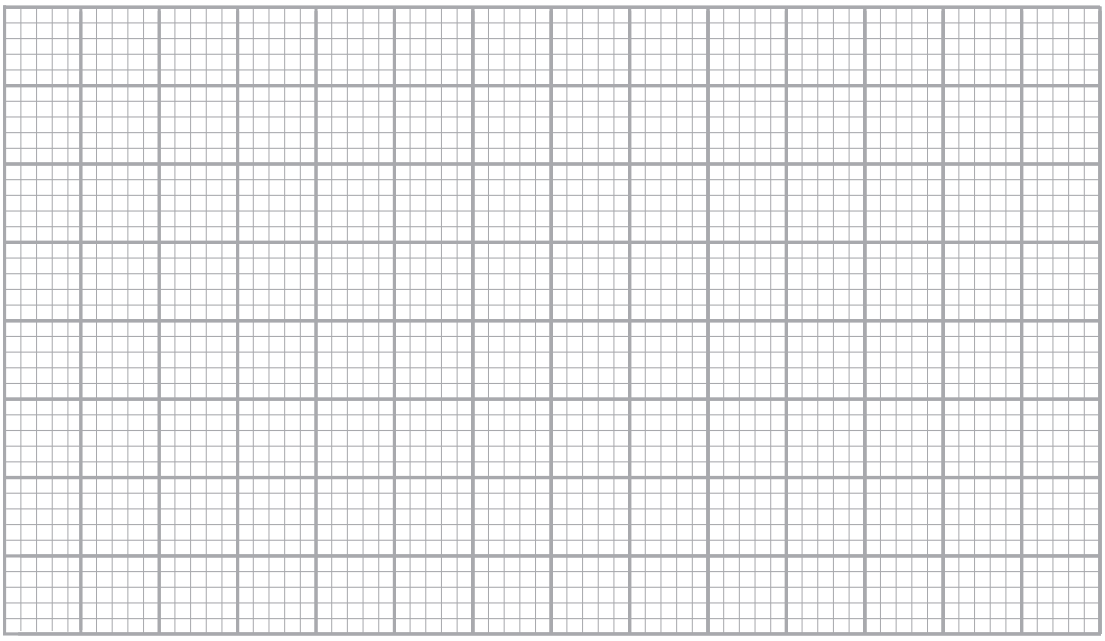
(b) Estimate the number of people who took more than 19 minutes to complete the task.

Answer _____ [3]

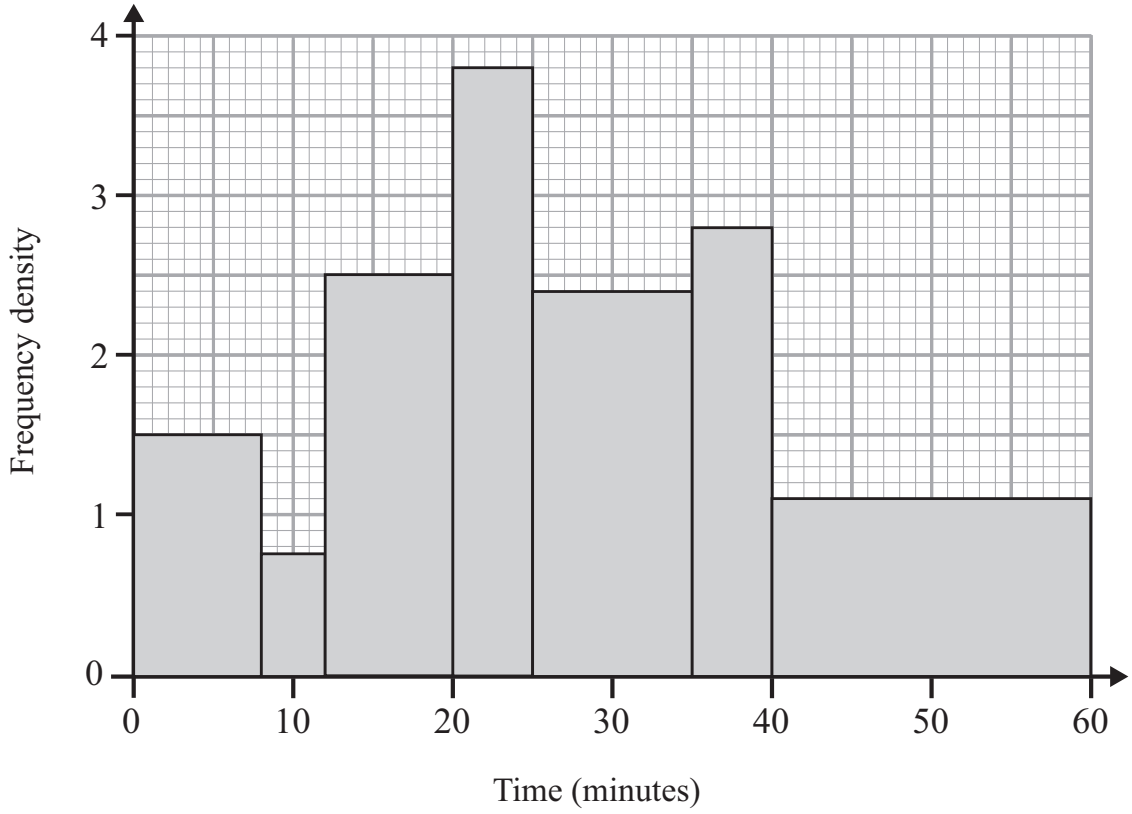
A stratified sample of 24 people is selected from those who took less than 20 minutes to complete the task.

(c) Estimate how many of this sample took less than 10 minutes.

Answer _____ [2]



The times for a second group of people are shown in the histogram below.



(d) Estimate the mean time for this second group.

Answer _____ minutes [4]

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(e) Estimate the median time for this second group.

Answer _____ minutes [3]

[Turn over



16 In a sporting competition 55% of the total prize money went to the winner, competitor A.

$\frac{3}{5}$ of the remaining money went to the runner-up, competitor B, and the rest of the money was split between competitors C, D and E who came 3rd, 4th and 5th respectively. C got 3 times as much as E and D got twice as much as E.

If competitor D received £1200, how much did the winner receive?

Answer £ _____ [4]

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17 Solve the simultaneous equations $y = 3x - 1$
$3x^2 + 2y^2 = 35$

Answer _____ [7]

[Turn over

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18 Two cars are travelling away from a crossroads on two straight roads.

At noon, one car is at A, 100 m from the crossroads, C, and the other is at B, 80 m from C. The distance AB is 82.3m. A short time later the first car has travelled 200m from A to D. The second car has travelled 250m from B to E.

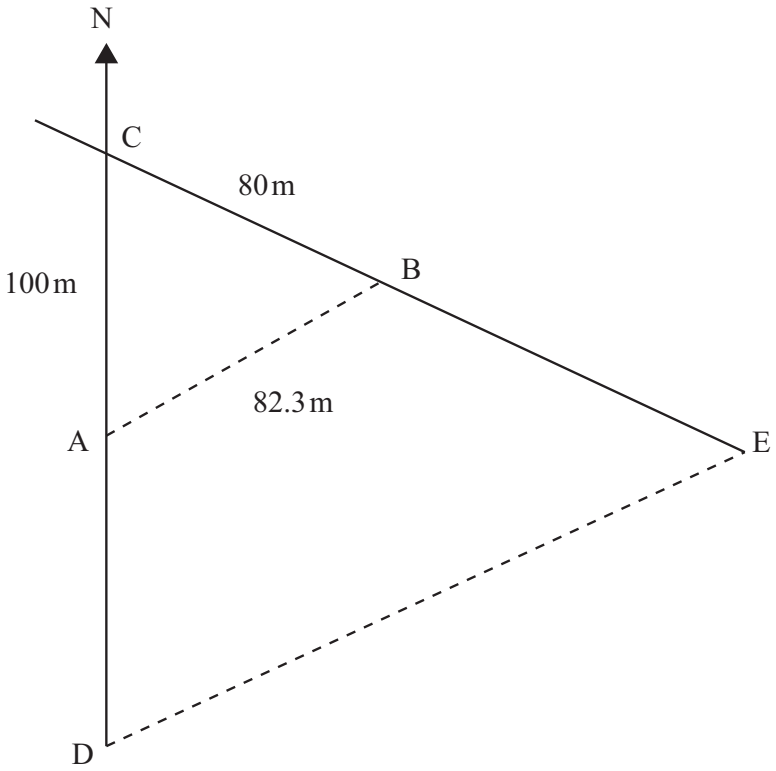


diagram not drawn accurately

(a) Find the distance, DE, between the two cars.

Answer _____ m [5]

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(b) Find the bearing of E from D.

Answer _____ ° [3]

THIS IS THE END OF THE QUESTION PAPER

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DO NOT WRITE ON THIS PAGE

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	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
January 2015

Mathematics

Unit T4
(With calculator)
Higher Tier
[GMT41]

FRIDAY 9 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)** 45, 77, 131, 156, 176, 182, 184	A1	
	(b) 9 correct points (5 correct A1)	A2	
	Lines, curve	A1	
	(c) **(i)** Reading at 92	A1	
	(ii) Readings at 46, 138	A1	
	Correct subtraction	A1	
	(iii) 184 – (their reading at 640)	MA1	
	Their answer/184 × 100	MA1	9
2	78% = 257.40	MA1	
	257.40 ÷ 0.78 = 330	M1 A1	3
3	$54 = 2 \times 3 \times 3 \times 3$ and $90 = 2 \times 3 \times 3 \times 5$	MA1	
	270	A1	2
4	**(a)** $20x + 4y = 128$	MA1	
	$11x = 77 \quad x = 7$	MA1	
	$y = -3$	MA1	
	(b) $\frac{4x - 2 + 4x + 5}{10} = \frac{5}{2}$	MA1	
	$4x - 2 + 4x + 5 = 25$	MA1	
	$8x = 22$	MA1	
	$x = \frac{22}{8}$ or $\frac{11}{4}$ or 2.75	MA1	7
5	**(a)** $\frac{3}{2}$	MA1	
	(b) $y = \frac{3}{2}x + 1$	MA2	3
6	$\cos 44° = \frac{8.5}{BD}$	M1	
	$BD = \frac{8.5}{\cos 44°}$	M1	
	$BD = 11.816$	A1	
	$\text{Sin } 36° = \frac{\text{“11.816”}}{AD}$	M1	
	$AD = \frac{\text{“11.816”}}{\text{Sin } 36°}$	M1	
	20.1	A1	6

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			AVAILABLE MARKS
7	$\pi \times 32 = 100.53$	MA1	
	$\frac{1}{9} \times 100.53 = 11.17$	MA1	
	43.2	A1	3
8	Clear explanation of bounds between 7.5 and 8.5	C1	
	Smallest volume = 16 × 7.5 = 120 litres	C1	
	Largest volume = 16 × 8.5 = 136 litres	C1	3
9	**(a)** $20x^2 - 15x + 8x - 6$	MA1	
	$20x^2 - 7x - 6$	MA1	
	(b) $\frac{x(x+4)}{(x+4)(x-4)}$	MA1	
		MA1	
	$\frac{x}{x-4}$	MA1	
	(c) $a(8x^2 - 26xy + 15y^2)$	MA1	
	$a(4x - 3y)(2x - 5y)$	MA2	8
10	$-\frac{1}{4}$	MA1	
	$y = -\frac{1}{4}x - 5$	MA1	2
11	**(a)** $P = \frac{k}{Q^2}$		
	$6 = \frac{k}{3^2}$	MA1	
	$k = 54$		
	$P = \frac{54}{Q^2}$	MA1	
	(b) **(i)** 3.375	MA1	
	(ii) $24Q^2 = 54$	MA1	
	$Q = 1.5$	A1	5
12	$y = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(3)(2)}}{2 \times 3}$	MA1	
	$y = \frac{8 \pm \sqrt{40}}{6}$	A1	
	y = 2.39 or 0.28	A1	3
13	Top angle is 180 – (8 + 34) = 138 or 34°	MA1	
	2/sin 8 = x/sin 138	MA2	
	x = 9.616 km	A1	
	Height = 9.616 sin 34	MA1	
	= 5.377 km = 5 km	A1	6

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				AVAILABLE MARKS
14	**(a)**	**(i)** 0	A1	
		(ii) –5	A1	
	(b)	$\frac{1}{27}$	MA1	
	(c)	c = 3	MA1	
		(ab = 3)		
		a = 1 and b = 3 or a = 3 and b = 1 etc	MA2	6
15	**(a)**	f.d 1.8 4 2.5 2.5 2.2 2 1.2	MA1	
		Scales and labels	A1	
		Bars	A1	
	(b)	8.8	A1	
		8.8 + 14 + 6 = 28.8	A1	
		= 29	A1	
	(c)	50.4	A1	
		$\frac{26}{50.4} \times 24$		
		12	A1	
	(d)	fx 48 30 320 427.5 720 525 1100	A2	
		$\frac{3170.5}{114}$	A1	
		27.8	A1	
	(e)	57th reading	A1	
		$25 + \frac{3}{24} \times 10$	A1	
		26.25	A1	15
16		C = £1800, D = £1200, E = £600	MA1	
		£3600 = 18% or 1200 = 6%, etc	MA1	
		20,000 = 100%	MA1	
		A = £11 000	A1	4
17		$3x^2 + 2(3x - 1)^2 = 35$	MA1	
		$3x^2 + 2(9x^2 - 6x + 1) = 35$	MA1	
		$21x^2 - 12x - 33 = 0$ or $7x^2 - 4x - 11 = 0$	A1	
		$3(7x - 11)(x + 1) = 0$ or $(7x - 11)(x + 1) = 0$	MA2	
		$x = \frac{11}{7}$ or -1	MA1	
		$y = \frac{26}{7}$ or -4	MA1	7

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				AVAILABLE MARKS
18	**(a)**	$82.3^2 = 80^2 + 100^2 - 2(80)(100)\cos C$	MA1	
		$\cos C = \dfrac{100^2 + 80^2 - 82.3^2}{2(100)(80)}$	MA1	
		$x = 53°$	MA1	
		$DE^2 = 330^2 + 300^2 - 2 \times 330 \times 300 \times \cos 53$	MA1	
		$DE = 282.4$	A1	
	(b)	$\dfrac{330}{\sin a} = \dfrac{282.4}{\sin 53}$	MA2	
		$a = 68.9°$ bearing 068.9°	MA1	8
			Total	**100**

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Centre Number

Candidate Number

Rewarding Learning

General Certificate of Secondary Education
January 2014

Mathematics

Unit T4

(With calculator)

Higher Tier

[GMT41]

GMT41

FRIDAY 10 JANUARY 9.15 am–11.15 am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

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Complete in blue or black ink only. **Do not write with a gel pen**.
Answer **all twenty** questions.
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You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

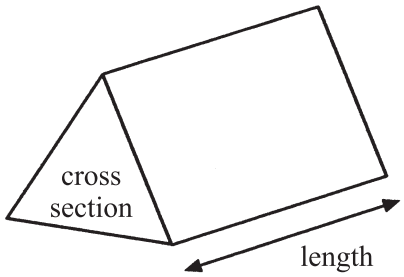
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **questions 3(b) and 10**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

8693

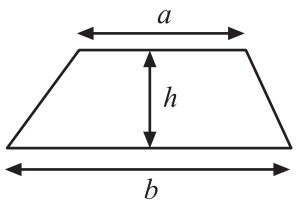
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Formula Sheet

Volume of prism = area of cross section × length

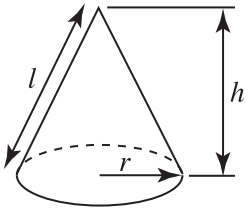


Area of trapezium $= \frac{1}{2}(a+b)h$



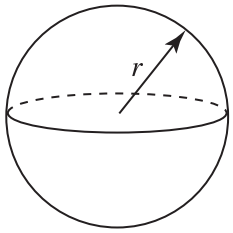
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

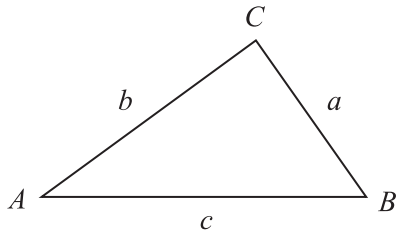


Volume of sphere $= \frac{4}{3}\pi r^3$

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

8693

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

The pendulum swings 1.8 metres on its first swing.

After how many swings will the distance first fall below 20 cm?

Answer _____ swings [2]

Examiner Only	
Marks	Remark
Total Question 1	

2 During a very cold winter a glacier increased its volume by 32%.

At the end of the winter its volume was found to be 6864 km^3.

What was its original volume at the start of that winter?

Answer _____ km^3 [3]

Total Question 2

[Turn over

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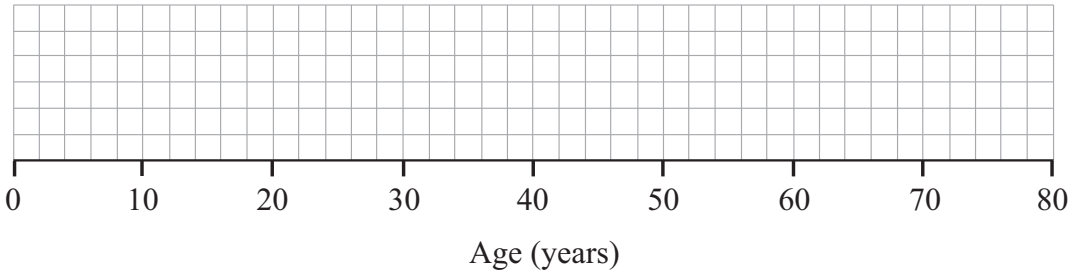
Quality of written communication will be assessed in part (b) of this question.

Examiner Only	
Marks	Remark

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

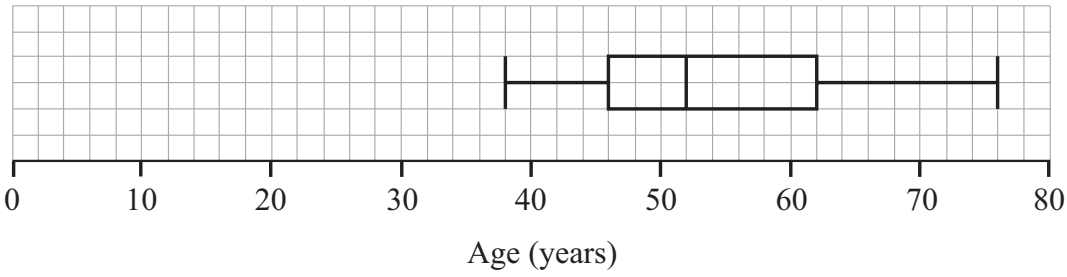
Lower Quartile = 28
Median = 32
Upper Quartile = 54
Youngest = 12
Range = 58

(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.

_____

_____

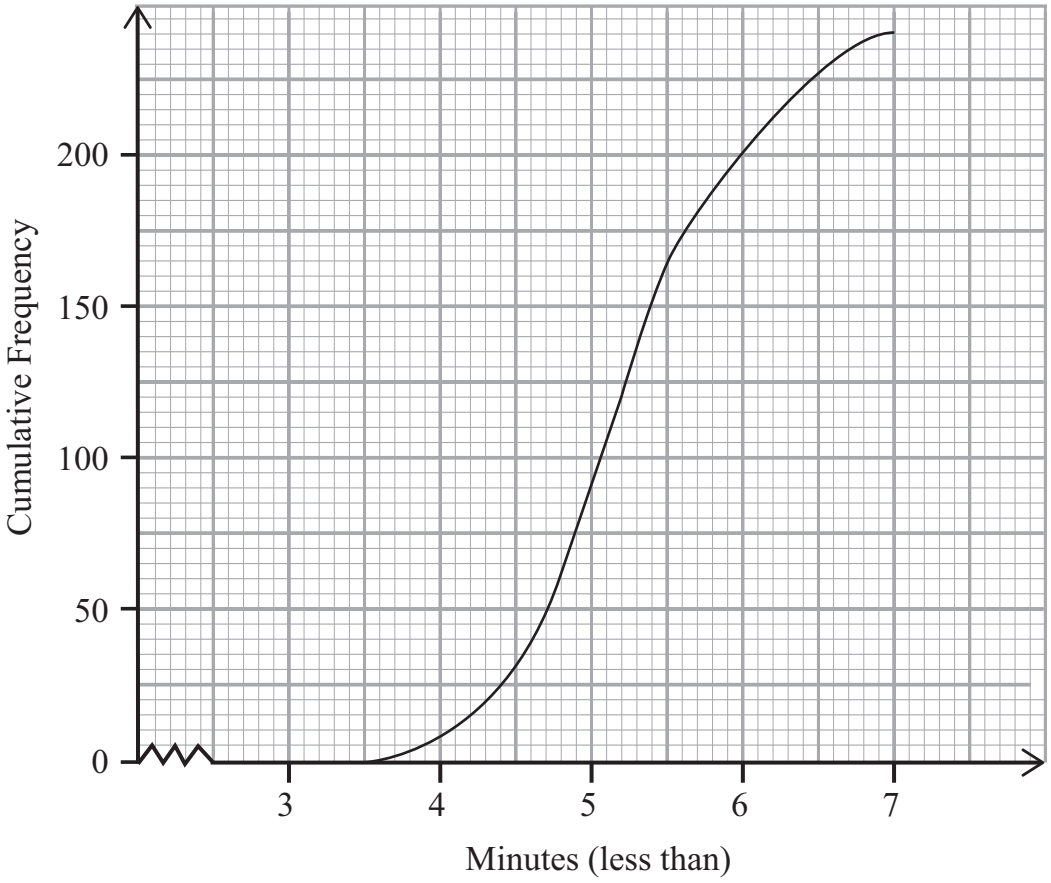
_____

_____ [2]

Total Question 3

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4 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 interquartile range.

Answer _____ minutes [2]

(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 4	

[Turn over

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24GMT4105

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

Examiner Only	
Marks	Remark

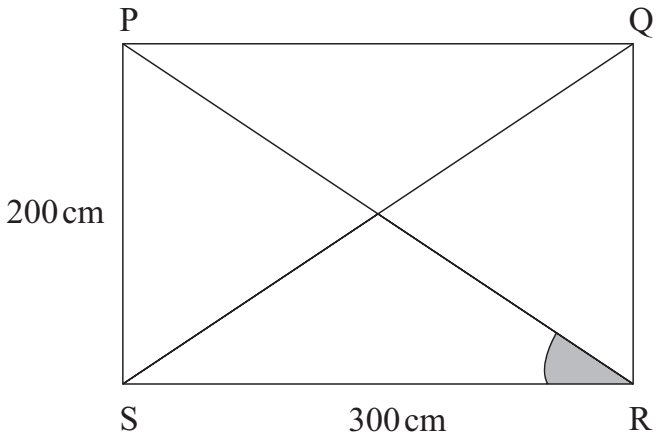


diagram not drawn accurately

(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]

Total Question 5

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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

6 **(a)** R, S, T and U are points on the circumference of a circle, centre O.
The angle RUS is 46° and the angle URT is 36°

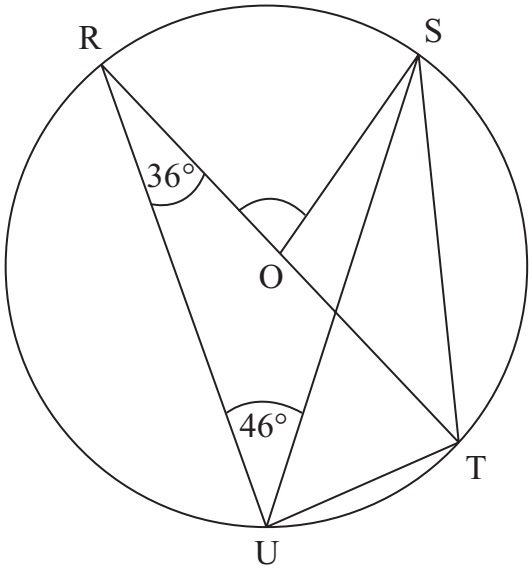


diagram not drawn accurately

Calculate

(i) the angle RTS,

Answer _____ ° [1]

(ii) the angle ROS,

Answer _____ ° [1]

(iii) the angle SUT.

Answer _____ ° [1]

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(b) D, E, F and G are points on the circumference of the circle below.
The angle FDG = 62° and the angle DFG = 31°
HG is a tangent to the circle.

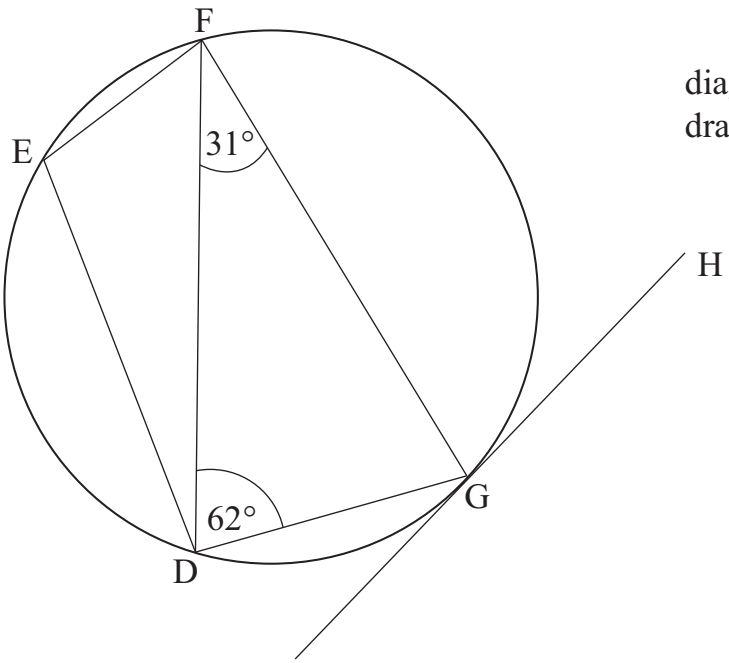


diagram not drawn accurately

(i) Write down the size of angle FGH.

Answer _____ ° [1]

(ii) Calculate the size of angle DEF.

Answer _____ ° [2]

Examiner Only	
Marks	Remark
Total Question 6	

[Turn over

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7 The straight line, L, passes through the points (0, –2) and (3, 2).

Examiner Only	
Marks	Remark

(a) Work out the gradient of L.

Answer _____ [2]

(b) Show that the equation of L is $4x - 3y = 6$

[2]

(c) Write down the equation of another line that is parallel to L.

Answer _____ [1]

(d) Write down the gradient of a line perpendicular to L.

Answer _____ [1]

Total Question 7	



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8 **(a)** 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]

(b) Hence write down the coordinates of the point of intersection of the two lines whose equations are

$3x + 2y = 10$ and $2x - 6y = 3$

Answer (_____ , _____) [1]

Examiner Only	
Marks	Remark
Total Question 8	

[Turn over

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24GMT4111

9 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]

Examiner Only	
Marks	Remark
Total Question 9	

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Quality of written communication will be assessed in this question.

Examiner Only	
Marks	Remark

10 (a) The test results for a class are recorded as

26 26 29 32 37 38 40 41 99

Why would the mean **not** be the **most suitable** average to use when commenting on these results?

_____

_____ [1]

(b) In another test the results are recorded as

18 18 18 18 19 27 29 36 39 47 59 62

Which average would be **least suitable** to use when commenting on these results? Give a reason for your answer.

_____ because _____

_____ [1]

Total Question 10

[Turn over

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24GMT4113

11 A park keeper wishes to estimate the number of frogs in a large pond.
He catches 180 frogs, tags them and returns them to the pond.
Later he catches 80 frogs and records that 24 of them are tagged.
Estimate the number of frogs in the pond.

Answer _____ [2]

Examiner Only	
Marks	Remark
Total Question 11	

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12 The electrical resistance, R ohms, of a wire varies inversely as the square of its diameter, d mm.
A wire, 6 mm in diameter, made from a certain alloy has a resistance of 36 ohms.

(a) Express R in terms of d.

Answer $R =$ _____ [3]

(b) (i) Work out the electrical resistance of a wire made from the same alloy whose diameter is 9 mm.

Answer _____ ohms [1]

(ii) Another wire made from the same alloy has an electrical resistance of 20 ohms.
Work out the diameter of this wire.

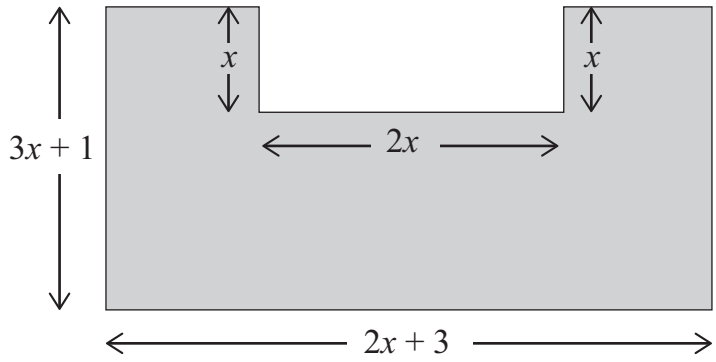
Answer _____ mm [2]

Examiner Only	
Marks	Remark
Total Question 12	

[Turn over

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13 A rectangular piece of card has a length of $(2x + 3)$ cm and a width of $(3x + 1)$ cm.
A rectangle of length $2x$ cm and width x cm is cut from it as shown in the diagram.
The remaining piece of card, shown shaded in the diagram, has an area of 25 cm^2.



(a) Show that $4x^2 + 11x - 22 = 0$

[3]

(b) Solve the equation $4x^2 + 11x - 22 = 0$ to find the value of x.
Give your answer to 3 significant figures.

Answer $x =$ _____ [3]

Examiner Only	
Marks	Remark
Total Question 13	

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14 Without using a calculator and showing **every** step clearly in your working, find the value of

$$\left(2\frac{1}{4}\right)^{-1.5}$$

Answer _____ [4]

Examiner Only	
Marks	Remark
Total Question 14	

[Turn over

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24GMT4117

15 Town B is 73 km from Town A on a bearing of 069°

Town C is 64 km from A on a bearing of 112°

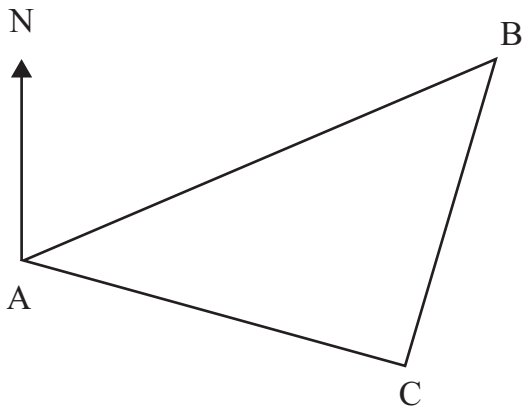


diagram not drawn accurately

Calculate

(a) the distance between B and C,

Answer _____ km [3]

(b) the area of triangle ABC,

Answer _____ km^2 [2]

Examiner Only	
Marks	Remark

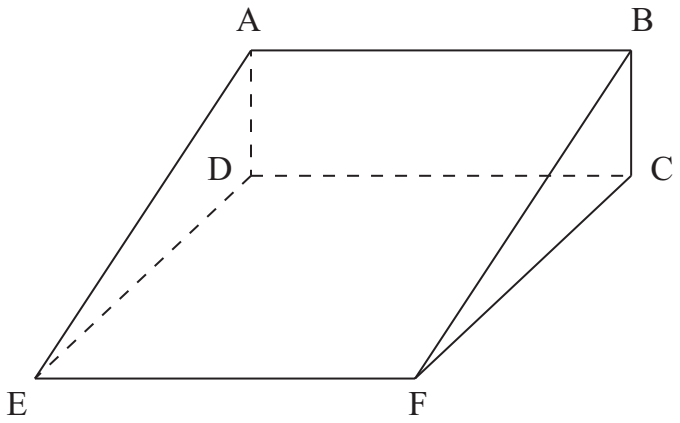
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24GMT4118

(c) the bearing of B from C.

Answer _____ ° [4]

Total Question 15

16 ABCDEF is a ramp which is in the shape of a triangular prism.
AB = 120 cm, FC = 90 cm and BC = 30 cm. Angle FCB = 90°
Calculate the angle between EB and the base DCFE.



Answer _____ ° [3]

Total Question 16

[Turn over

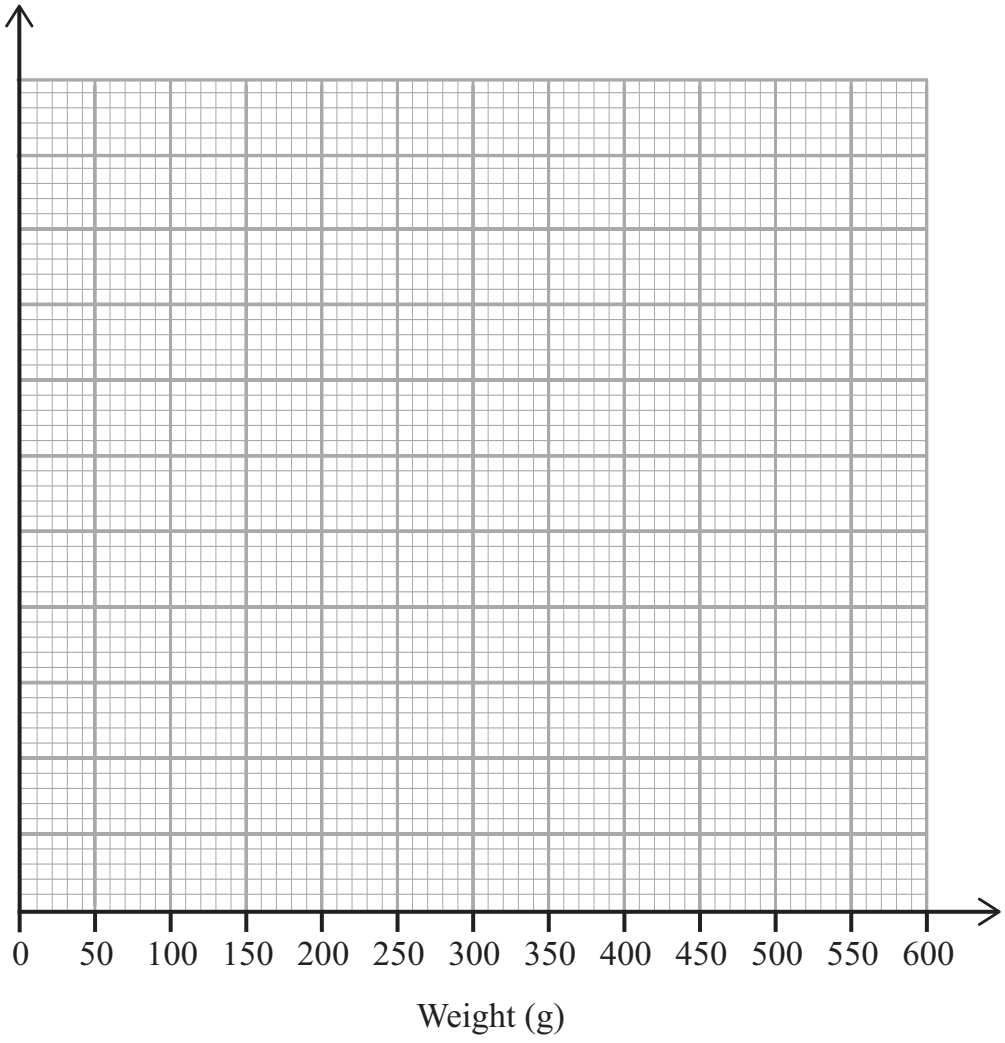
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17 (a) The weights of packages passing through a Post Office in one day are recorded below.

Examiner Only	
Marks	Remark

Weight (g)	Frequency
$0 < w \leqslant 100$	80
$100 < w \leqslant 150$	200
$150 < w \leqslant 250$	160
$250 < w \leqslant 400$	540
$400 < w \leqslant 550$	360
$550 < w \leqslant 600$	130

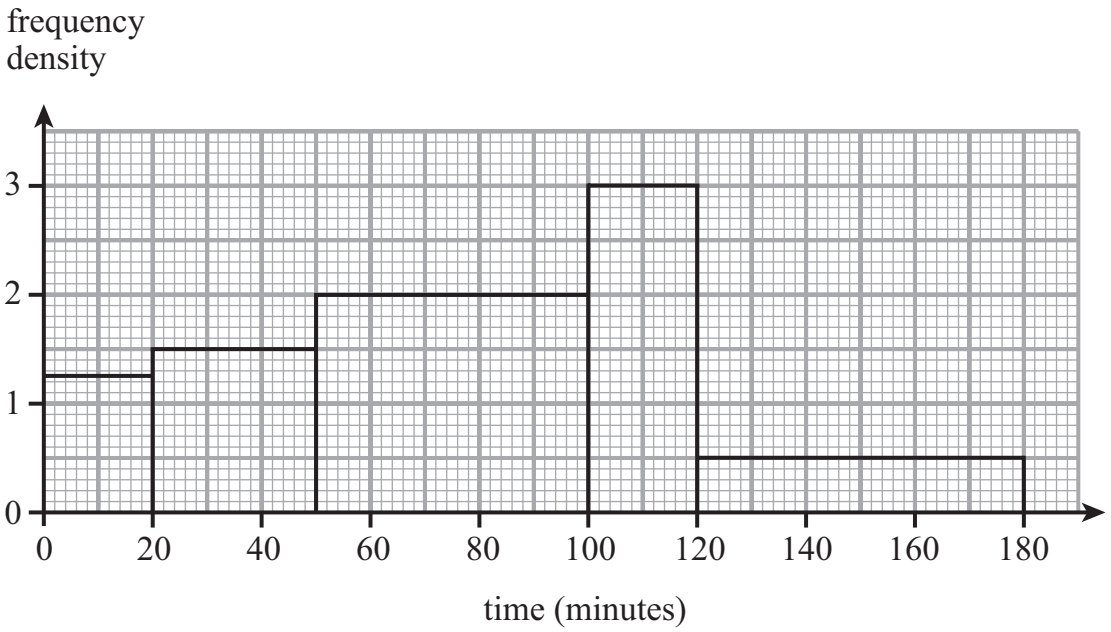
On the axes below draw a clearly labelled histogram to illustrate this information.



[3]

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(b) The histogram illustrates how much time cars spent in a car park.



(i) Calculate an estimate for the mean time.

Answer _____ minutes [4]

(ii) Half the cars using the car park were there for more than M minutes.
Calculate an estimate for the value of M.

Answer _____ minutes [3]

Examiner Only	
Marks	Remark
Total Question 17	

[Turn over

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18 Solve the simultaneous equations

$$y - 2x = 6$$
$$x^2 + y^2 = 20$$

Answer _____ [7]

Examiner Only	
Marks	Remark
Total Question 18	

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19 Simplify fully $\dfrac{3}{x+3} + \dfrac{2x+21}{x^2+x-6}$

Answer _____ [5]

Examiner Only	
Marks	Remark
Total Question 19	

20 Given that $\dfrac{16^a}{9^b} = 54^{\frac{1}{2}}$

find the values of a and b.

Answer a = _____ , b = _____ [5]

Total Question 20	

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Question Number	**Marks**
1	
2	
3	
4	
5	
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9	
10	
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12	
13	
14	
15	
16	
17	
18	
19	
20	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
January 2014

Mathematics

Unit T4
Higher Tier

[GMT41]

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.

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	1st = 1.8 2nd = 1.08 3rd = 0.648 4th = 0.3888 5th = 0.23328 6th = 0.139968	}	MA1	
	6th swing		A1	2
2	132% = 6864		M1	
	$1\% = \frac{6864}{132} = (52)$		MA1	
	$100\% = \frac{6864}{132} \times 100 = 5200$		M1	3
3	**(a)** median		A1	
	quartiles		A1	
	max/min		A1	
	(b) 1 comment relating to average, e.g. median for ages of members of bowls club greater		C1	
	1 comment relating to dispersion, e.g. smaller range of ages of bowls members		C1	5
4	**(a)** 5.7 – 4.8 (readings from graph) = 0.9 minutes		MA2	
	(b) 240 – 165 = 75		MA1	
	$\frac{75}{240} \times 100 = 31.25$		MA1	4
5	**(a)** $\tan x = \frac{200}{300}$		M1, A1	
	$x = 33.69$		MA1	
	(b) 199.5, 299.5		MA1	
	2(499) = 998		A1	5
6	**(a)** **(i)** 46		A1	
	(ii) 92		A1	
	(iii) 44		A1	
	(b) **(i)** 62		A1	
	(ii) DGF = 87		MA1	
	180 – 87 = 93		MA1	6

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				AVAILABLE MARKS
7	**(a)**	$\frac{2-(-2)}{3-0}$	MA1	
		$\frac{4}{3}$	A1	
	(b)	$y = \frac{4}{3}x - 2$	MA1	
		$3y = 4x - 6 \ \therefore \ 4x - 3y = 6$	MA1	
	(c)	$y = \frac{4}{3}x + c$ where $c \neq -2$	A1	
	(d)	$-\frac{3}{4}$	A1	6
8	**(a)**	$9x + 6y = 30$ or $\left.\begin{matrix} 6x + 4y = 20 \\ 6x - 18y = 9 \end{matrix}\right\}$	MA1	
		$x = 3, y = \frac{1}{2}$	A1, A1	
	(b)	$\left(3, \frac{1}{2}\right)$	A1	4
9	**(a)**	use of $y - 1$	MA1	
		$6y(y - 1) = 72$		
		$6y^2 - 6y - 72 = 0$	MA1	
		$y^2 - y - 12 = 0$	MA1	
	(b)	$(y - 4)(y + 3) = 0$	MA1	
		$y = 4, y = -3$	A1	
		$y = 4$ only answer since y cannot be negative	A1	6
10	**(a)**	There is one extreme value which would affect the mean.	C1	
	(b)	Mode because although it occurs most often it is actually the lowest result and so is not representative of all the results	C1	2
11		$\frac{24}{80} = \frac{180}{x}$	MA1	
		$x = 600$	MA1	2
12	**(a)**	$R = \frac{k}{d^2}$ $\quad 36 = \frac{k}{6^2}$	MA1	
		$k = 1296$	A1	
		$R = \frac{1296}{d^2}$	MA1	
	(b)	**(i)** $R = 16$	A1	
		(ii) $20 = \frac{1296}{d^2}$, $d^2 = 64.8$	MA1	
		$d = 8.05$	A1	6

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			AVAILABLE MARKS
13	**(a)** $(2x + 3)(3x + 1) - 2x^2 = 25$	MA1	
	$6x^2 + 9x + 2x + 3 - 2x^2 = 25$	MA1	
	$4x^2 + 11x - 22 = 0$	MA1	
	(b) $x = \frac{-11 \pm \sqrt{473}}{8}$	MA1	
	$x = \frac{10.748563}{8}$ (= 1.34357...)	MA1	
	$x = 1.34$	A1	6
14	$\left(\frac{9}{4}\right)^{-\frac{3}{2}}$	MA1	
	$\frac{1}{\left(\frac{9}{4}\right)^{\frac{3}{2}}}$	MA1	
	$\frac{1}{\left(\sqrt{\frac{9}{4}}\right)^3} = \frac{1}{\left(\frac{3}{2}\right)^3}$	MA1	
	$\frac{1}{\frac{27}{8}} = \frac{8}{27}$	MA1	4
15	**(a)** $BC^2 = 73^2 + 64^2 - 2(73)(64)\cos 43°$	M1, A1	
	50.9(0413551)	A1	
	(b) $\frac{1}{2}(73)(64)\sin 43°$	MA1	
	1593.(148169) or 1600	A1	
	(c) $\sin C = \frac{73 \sin 43}{50.904}$	MA1	
	C = 77.9689 or 78	MA1	
	Bearing = 010°	MA2	9
16	EC = 150	MA1	
	$\tan x = \frac{30}{150}$	MA1	
	11.3	MA1	3

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				AVAILABLE MARKS
17	**(a)**	Frequency density = 0.8, 4, 1.6, 3.6, 2.4, 2.6	MA1	
		correct bars	MA1	
		vertical axis scale and label	A1	
	(b)	**(i)** $0 < t \leqslant 20$ 25 $20 < t \leqslant 50$ 45 $50 < t \leqslant 100$ 100 $100 < t \leqslant 120$ 60 $120 < t \leqslant 180$ 30	MA2	
		$\frac{25 \times 10 + 45 \times 35 + 100 \times 75 + 60 \times 110 + 30 \times 150}{260}$	MA1	
		$= 78.6$	A1	
		(ii) 60 + 30 = 90 cars in last 2 groups so 40 more cars from 50–100 group	MA1	
		$\frac{40}{100}$ = 2/5th of 50–100 hence 20 more minutes	A1	
		So M = 80 minutes	A1	10
18	$y = 2x + 6$		MA1	
	$x^2 + (2x + 6)^2 = 20$		MA1	
	$x^2 + 4x^2 + 24x + 36 = 20$		MA1	
	$5x^2 + 24x + 16 = 0$		MA1	
	$(5x + 4)(x + 4) = 0$		MA1	
	$x = -\frac{4}{5}, x = -4$		A1	
	$y = 4\frac{2}{5}, y = -2$		A1	7
19	$\frac{3}{x+3} + \frac{2x+21}{(x+3)(x-2)}$		MA1	
	$\frac{3(x-2)+2x+21}{(x+3)(x-2)}$		MA1	
	$\frac{5x+15}{(x+3)(x-2)}$		MA1	
	$\frac{5(x+3)}{(x+3)(x-2)}$		MA1	
	$\frac{5}{x-2}$		MA1	5

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			AVAILABLE MARKS
20	$\frac{(2^4)^a}{(3^2)^b} = (2\times 3^3)^{\frac{1}{2}}$	MA2	
	$2^{4a}\times 3^{-2b} = 2^{\frac{1}{2}}\times 3^{\frac{3}{2}}$	MA1	
	$4a = \frac{1}{2}$ $a = \frac{\frac{1}{2}}{4} = \frac{1}{8}$	A1	
	$-2b = \frac{3}{2}$ $b = \frac{\frac{3}{2}}{-2} = -\frac{3}{4}$	A1	5
		Total	**100**

Centre Number

Candidate Number

Rewarding Learning

General Certificate of Secondary Education
2013

Mathematics

Unit T4
(With calculator)
Higher Tier



[GMT41]

GMT41

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-two** 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

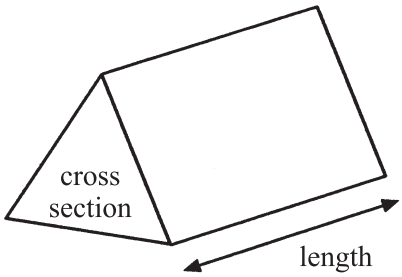
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **questions 11 and 15**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

8168

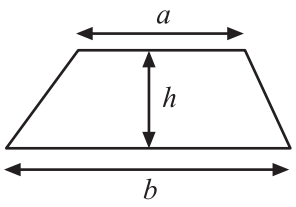
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Formula Sheet

Volume of prism = area of cross section × length

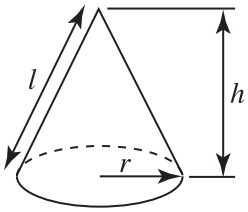


Area of trapezium $= \frac{1}{2}(a+b)h$



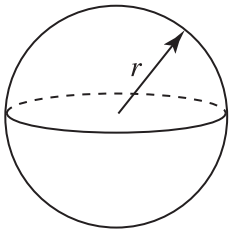
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

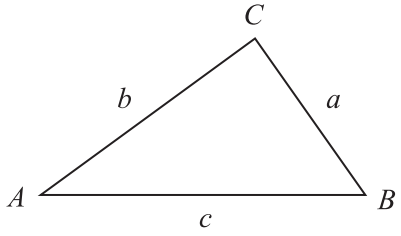


Volume of sphere $= \frac{4}{3}\pi r^3$

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

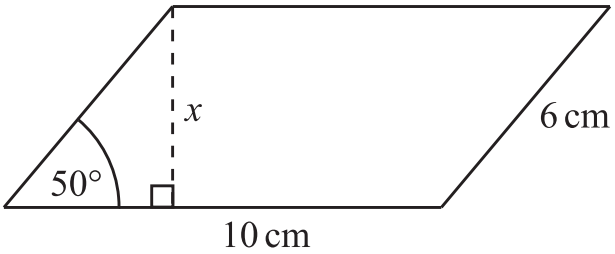
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

1



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]

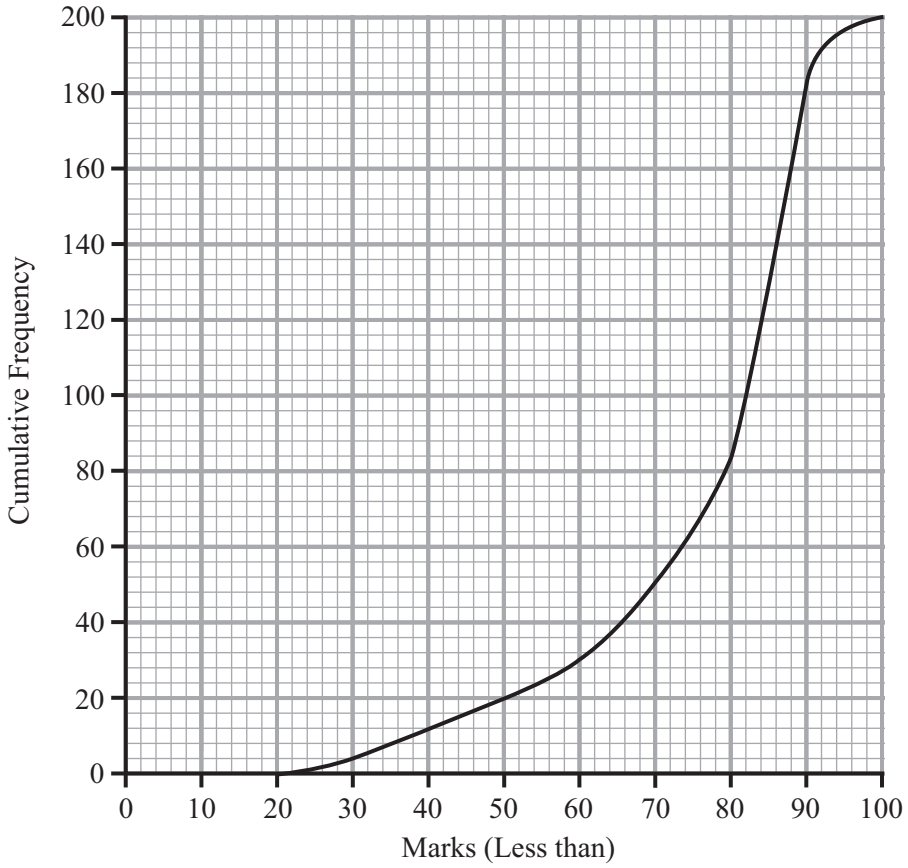
Examiner Only	
Marks	Remark
Total Question 1	

[Turn over

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20GMT4103

2 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 inter-quartile range.

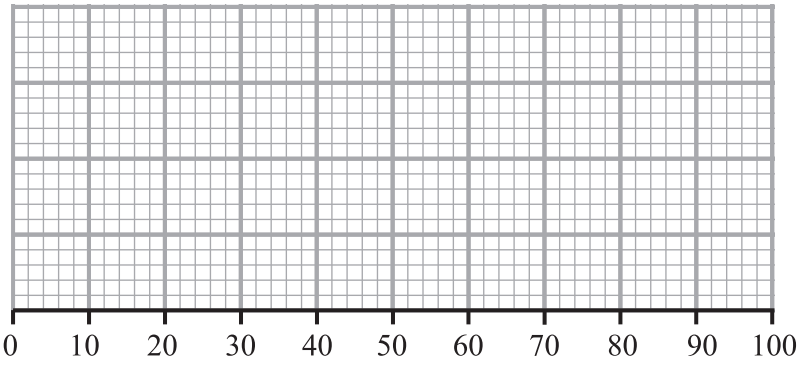
Answer _____ [2]

(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 2	

3 **(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 3	

[Turn over

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20GMT4105

4 **(a)** Factorise $15xy - 5y^2$

Answer _____ [2]

(b) **(i)** Factorise $x^2 - 9x - 36$

Answer _____ [2]

(ii) Hence solve $x^2 - 9x - 36 = 0$

Answer _____ [2]

Total Question 4

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

Answer _____ [2]

Total Question 5

6 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 6

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

7 **(a)** Write 7^{-2} as a fraction.

Answer _____ [1]

(b) Hence find the value of $7^0 + 7^{-2}$

Answer _____ [1]

Total Question 7

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

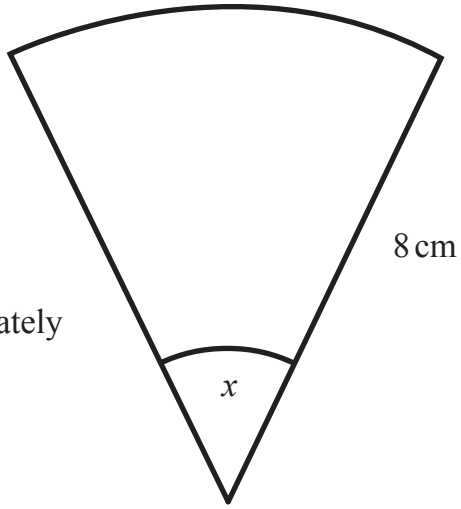


diagram not drawn accurately

Answer _____ ° [4]

Total Question 8

[Turn over

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9 Find the equation of the line which passes through the points

(–2, 11) and (0, 5)

Answer _____ [3]

Examiner Only	
Marks	Remark
Total Question 9	

10 The load L which can be supported by a metal girder varies inversely as its length x.
A load of 10 tonnes can be supported by a girder 2 m long.
What length of girder will support a load of 12.5 tonnes?

Answer _____ m [3]

Total Question 10	

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Quality of written communication will be assessed in this question.

Examiner Only	
Marks	Remark

11 The table shows information about 500 pupils in a school.

Year	Number of Boys	Number of Girls
8	70	90
9	85	75
10	80	100

The headmaster wants to carry out a survey of the pupils' views on the new school library. He decides to choose a stratified sample of 60 pupils to take part in the survey.

(a) How many boys in Year 9 should be in the sample?

Answer _____ [2]

(b) For this data, why is it better to select a stratified sample than a random sample?

Answer _____

_____ [2]

Total Question 11

[Turn over

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20GMT4109

12

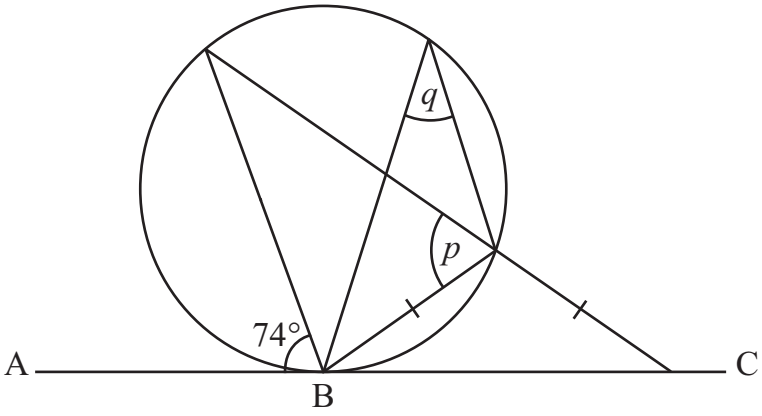


diagram not drawn accurately

(a) AC is a tangent to the circle at B.
Find the size of angle p, giving a reason.

Answer p = _____°,

because _____ [2]

(b) Calculate the size of angle q.

Answer q = _____° [2]

Examiner Only	
Marks	Remark
Total Question 12	

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13

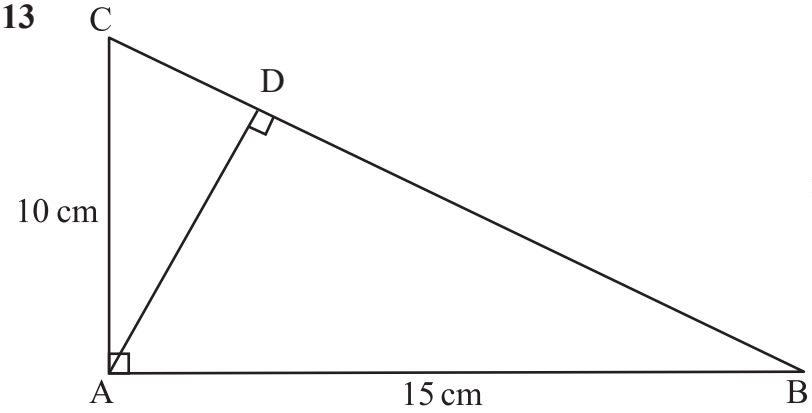


diagram
not drawn
accurately

Calculate the length AD.

Answer _____ cm [5]

Total Question 13

14 The median of ten numbers is 40
The mean of the numbers is 55
20 is subtracted from the smallest number.
Calculate the median and mean of the ten numbers now.

Answer median = _____, mean = _____ [4]

Total Question 14

[Turn over

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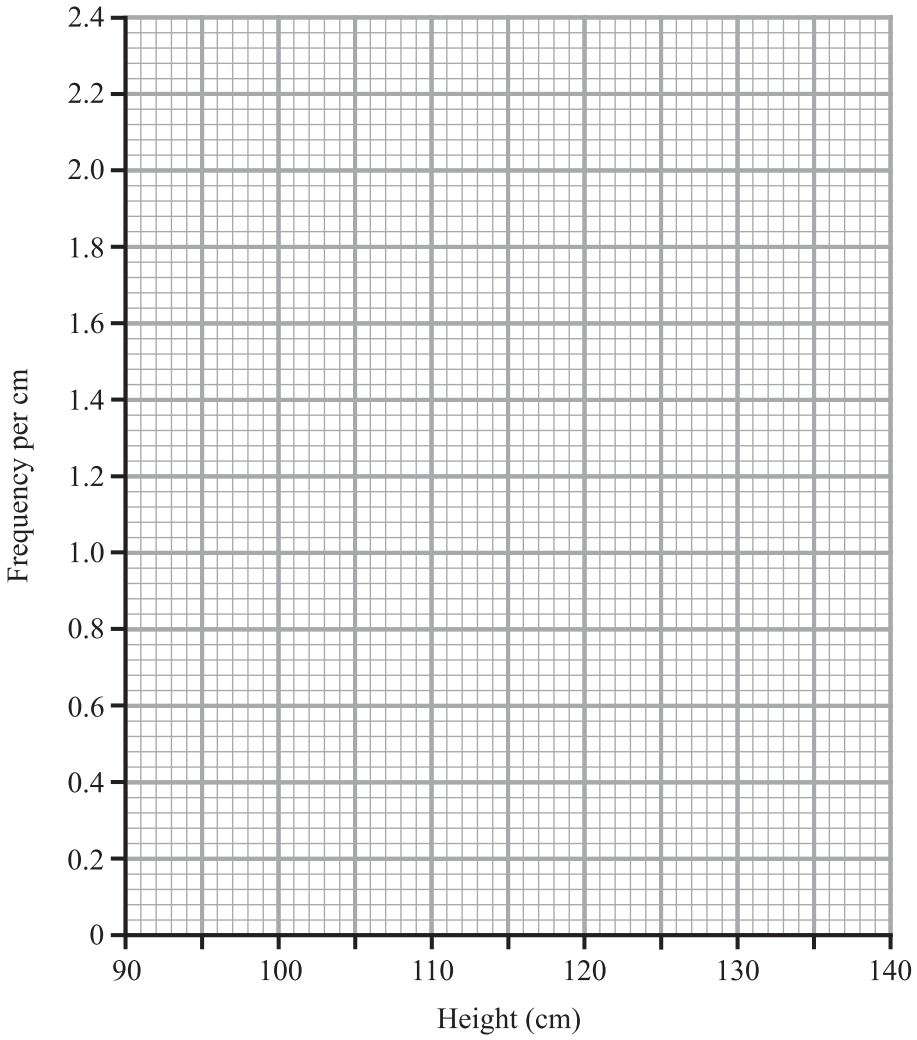
Quality of written communication will be assessed in this question.

Examiner Only	
Marks	Remark

15 The table gives information about heights of 60 swimmers.

Height, h cm	Number of swimmers
$90 \leqslant h < 95$	11
$95 \leqslant h < 105$	16
$105 \leqslant h < 120$	18
$120 \leqslant h < 130$	8
$130 \leqslant h < 140$	7

(a) Illustrate the data by drawing a histogram on the graph paper below.



Histogram A [3]

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(b) The histogram drawn below illustrates the heights of a different group of 60 swimmers.
Compare this histogram with the one you have drawn.
Give two comparisons.

1. _____

_____ [1]

2. _____

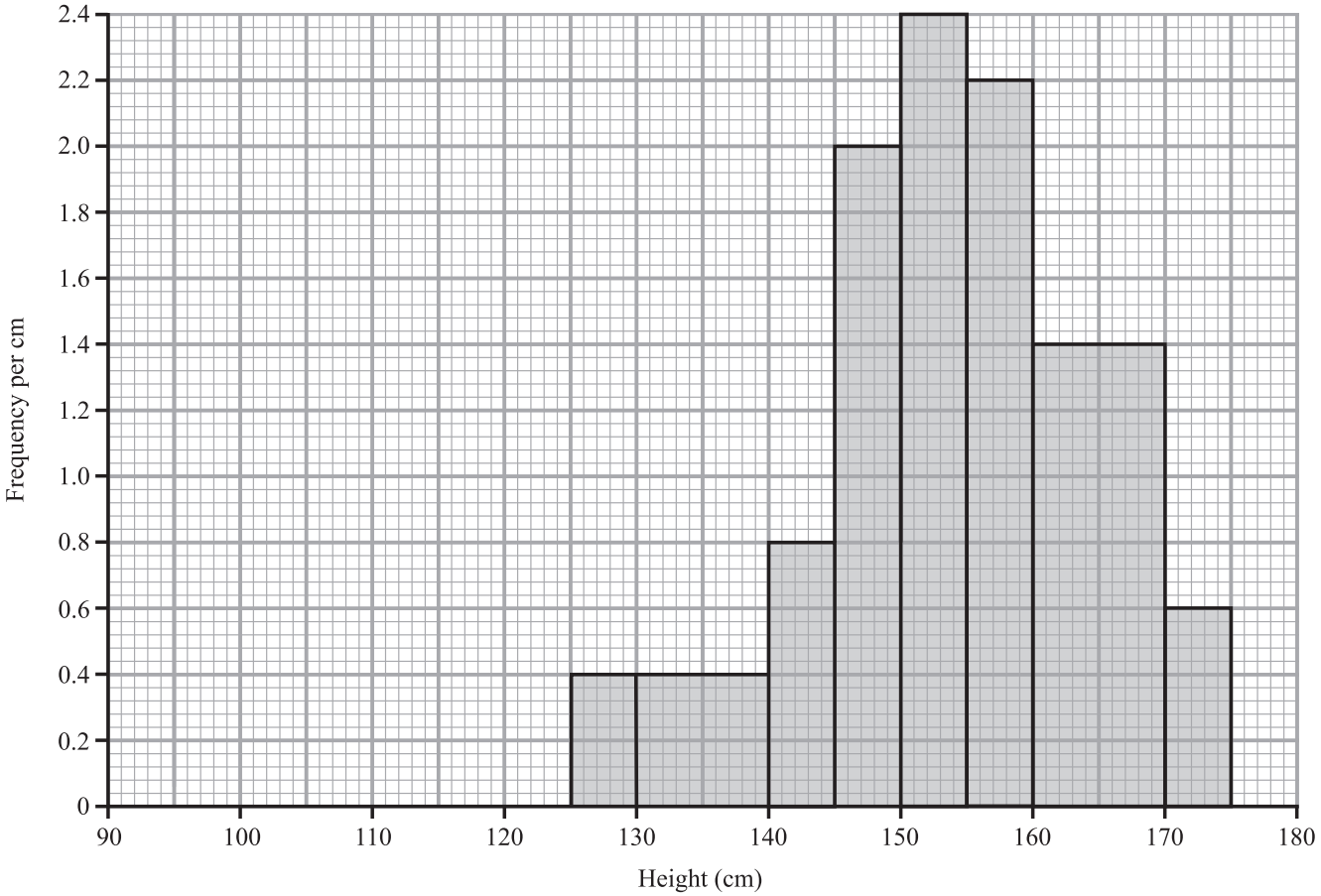
_____ [1]

(c) Suggest a reason for the difference in the two histograms.

Answer _____

_____ [1]

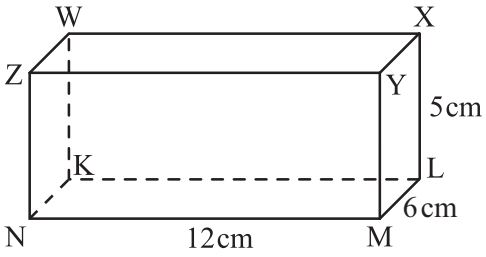
Examiner Only	
Marks	Remark
Total Question 15	



Histogram B

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20GMT4113

16 A cuboid is shown.



(a) Calculate the length of the space diagonal NX.

Answer _____ cm [2]

(b) Calculate the angle between NX and the base of the cuboid.

Answer _____ ° [3]

Total Question 16

17 **(a)** Expand and simplify $(3x - y)(x + 2y)$

Answer _____ [3]

(b) Factorise $4x^2 - 4xy - 3y^2$

Answer _____ [2]

Total Question 17

Examiner Only

Marks	Remark

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18 **(a)** What is the meaning of

(i) $15^{\frac{1}{2}}$

Answer _____ [1]

(ii) $16^{\frac{2}{3}}$

Answer _____ [2]

(b) Explain why $2^{-1} \times \left(\frac{1}{16}\right)^{\frac{1}{2}}$ is equal to $\frac{1}{8}$

[1]

(c) Show how to evaluate $32^{-\frac{4}{5}}$ **without using a calculator**.

You must show clearly **each** stage of your method and write your final answer as simply as possible.

Answer _____ [4]

Examiner Only	
Marks	Remark
Total Question 18	

[Turn over

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20GMT4115

19 5 consecutive positive integers are such that twice the product of the smallest and largest integers exceeds the square of the middle integer by 41

By letting the smallest integer equal x, set up and solve a quadratic equation to find the middle integer.

Answer The middle integer is _____ [5]

Examiner Only	
Marks	Remark
Total Question 19	

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20 A field ABCD is shown.

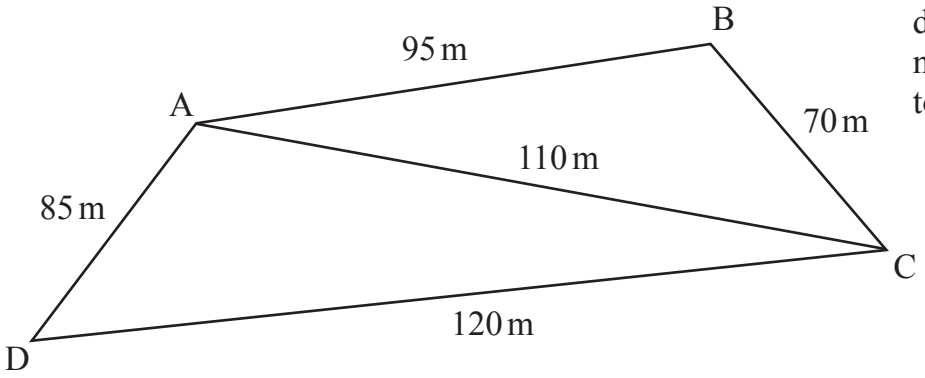


diagram not drawn to scale

A track AC runs diagonally from A to C. Angle CAB = 39.1°
Calculate the shortest distance from B to D.

Answer _____ m [4]

Examiner Only	
Marks	Remark
Total Question 20	

[Turn over

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20GMT4117

21 Simplify $\dfrac{2x^2 - 8}{x^2 - 14x + 24}$

Answer _____ [4]

Examiner Only	
Marks	Remark
Total Question 21	

22 Solve $\dfrac{x+1}{x-2} + \dfrac{x-2}{x+1} = \dfrac{5}{2}$

Answer _____ [7]

Total Question 22	

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THIS IS THE END OF THE QUESTION PAPER

DO NOT WRITE ON THIS PAGE

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	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2013

Mathematics

Unit T4
Higher Tier

[GMT41]

TUESDAY 11 JUNE

9.15 a.m. – 11.15 a.m.

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 andthey 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. 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).

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	$\sin 50 = \frac{x}{6}$	MA1	
	$6 \sin 50 = x$	MA1	
	$x = 4.596$ or 4.6	A1	3
2	**(a)** 87 – 70	MA1	
	17	A1	
	(b) 200 – 64	MA1	
	136	A1	
	(c) median of 82	A1	
	quartiles of 70, 87	A1	
	range	A1	7
3	**(a)** $3x = 12$ or $3y = 33$	A1	
	$x = 4$ and $y = 11$	A1	
	(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
4	**(a)** $5y(3x - y)$	A1, A1	
	(b) **(i)** $(x + 3)(x - 12)$	A2	
	NB: both factors must be correct. 1 mark cannot be gained.		
	(ii) $x = -3$ or 12	A1, A1	6
5	$210 = 2 \times 3 \times 5 \times 7$		
	$252 = 2^2 \times 3^2 \times 7$	MA1	
	HCF = 42	A1	2
6	106% = £710.20	MA1	
	$\frac{710.20}{106} \times 100$	MA1	
	£670	A1	3
7	**(a)** $\frac{1}{49}$	A1	
	(b) $\frac{50}{49}$ or $1\frac{1}{49}$	A1	2

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			AVAILABLE MARKS
8	$\pi \times 8^2 = 201.1$	MA1	
	$\frac{20.11}{201.1} = \frac{1}{10}$ **or** $\frac{20.11}{201.1} \times 360$ **or** $\frac{20.11}{201.1} = \frac{x}{360}$	MA2	
	$x = 36$	A1	
	Alternatively		
	$\frac{x}{360} \times \pi \times 8^2 = 20.11$	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
9	Gradient $= -3$	A1	
	Intercept $= 5$	A1	
	Equation $y = -3x + 5$	A1	3
10	$10 = \frac{k}{2}$		
	$20 = k$	MA1	
	$12.5 = \frac{20}{x}$	MA1	
	$x = 1.6$	A1	3
	NB: no marks for L = kx, L = $\frac{k}{x^2}$ etc.		
11	**(a)** $\frac{60}{500} \times 85$	MA1	
	10	A1	
	(b) suitable explanation, e.g. a stratified sample will ensure that the sample will contain pupils from boys and girls of each year group in the same proportion as the original numbers **or** a random sample may be biased towards boys or girls or a particular year group.	C2	4

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			AVAILABLE MARKS
12	**(a)** $p = 74$, alternate segment theorem	A1, A1	
	(b) Base angles of large triangle 106 and 37	MA1	
	3rd angle in triangle and hence angle q (same segment) = 37	MA1	
	or		
	base angles of isosceles triangle = 37 and 37	MA1	
	by alternate segment $q = 37$	MA1	4
13	$\text{Tan B} = \frac{10}{15}$ or $\text{Tan C} = \frac{15}{10}$	MA2	
	B = 33.69 or C = 56.31	A1	
	$\text{Sin } 33.69 = \frac{AD}{15}$ or $\text{Sin } 56.31 = \frac{AD}{10}$	MA1	
	AD = 8.32 or AD = 8.32	A1	
	Alternative		
	Area of ABC = 75 cm^2 MA1		
	BC = $\sqrt{325}$ cm MA1		
	$\frac{1}{2} \times \sqrt{325} \times x = 75$ MA2		
	$x = 8.32$ A1		
	Alternative		
	BC = $\sqrt{325}$ MA1		
	Use of cosine to find $\hat{C}$ (33.69) MA2		
	Use of trigonometery to find AD MA2		5
14	Median = 40	A1	
	$10 \times 55 = 550$	MA1	
	$550 - 20 = 530$		
	$530 \div 10$	MA1	
	53	A1	4
15	**(a)** 2.2, 1.6, 1.2, 0.8, 0.7	M1, A1	
	correct histogram	A1	
	(b) 1. heights of Histogram B group are on average higher	A1	
	2. both histograms have the same range	A1	
	(c) suitable reason, e.g.		
	second group could be older swimmers	A1	6
16	**(a)** $\sqrt{12^2 + 6^2 + 5^2}$ = 14.32 or NL = 13.416, NX = 14.32	MA1, A1	
	(b) $\tan \alpha = \frac{5}{13.416}$ $\left(\text{or } \sin \alpha = \frac{5}{14.32} \text{ or } \cos \alpha = \frac{13.416}{14.32}\right)$	MA2	
	A = 20.44	A1	5
	NB: Only the angle XNL is acceptable for marks in **(b)**		

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			AVAILABLE MARKS
17	**(a)** $3x^2 + 6xy - xy - 2y^2$	MA2	
	$= 3x^2 + 5xy - 2y^2$	MA1	
	(b) $(2x - 3y)(2x + y)$	A2	5
18	**(a)** **(i)** $\sqrt{15}$	A1	
	(ii) $\sqrt[3]{256}$ or $\left(\sqrt[3]{16}\right)^2$ or $\sqrt[3]{16^2}$	A2	
	(b) $\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$	A1	
	(c) $\frac{1}{32^{\frac{4}{5}}}$	A1	
	$\frac{1}{\left(\sqrt[5]{32}\right)^4}$	A1	
	$\frac{1}{2^4}$	A1	
	$\frac{1}{16}$	A1	8
19	$2x(x+4) - (x+2)^2 = 41$	MA1	
	$2x^2 + 8x - (x^2 + 4x + 4) = 41$	MA1	
	$x^2 + 4x - 45 = 0$	MA1	
	$(x-5)(x+9) = 0$	MA1	
	$x = 5 \quad x = -9$		
	Middle integer = 7	A1	5
20	$\cos A = \frac{85^2 + 110^2 - 120^2}{2(85)(110)}$	MA1	
	CAD = 74.7°	A1	
	$BD^2 = 85^2 + 95^2 - 2(85)(95)\cos(74.7 + 39.1)$	MA1	
	BD = 150.9	A1	
	Alternative		
	Finds BĈA (sine rule) = 58.9°		
	Finds AĈD (cosine rule) = 43.1°	MA2	
	Finds BD (cosine rule) = 150.9	MA2	4
	NB: The use of sine rule **only** in this question gains no marks.		
21	$\frac{2(x-2)(x+2)}{(x-12)(x-2)}$	MA2 MA1	
	$= \frac{2(x+2)}{(x-12)}$	MA1	4

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			AVAILABLE MARKS
22	$(x+1)^2+(x-2)^2=\frac{5}{2}(x-2)(x+1)$	MA2	
	$2(x^2+2x+1+x^2-4x+4)=5(x^2-x-2)$	MA1	
	$4x^2-4x+10=5x^2-5x-10$	MA1	
	$x^2-x-20=0$	MA1	
	$(x+4)(x-5)=0$	MA1	
	$x=-4$ or 5	MA1	7
		Total	**100**

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Centre Number

Candidate Number

Rewarding Learning

General Certificate of Secondary Education
January 2013

Mathematics

Unit T4

(With calculator)

Higher Tier

[GMT41]

GMT41

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-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.

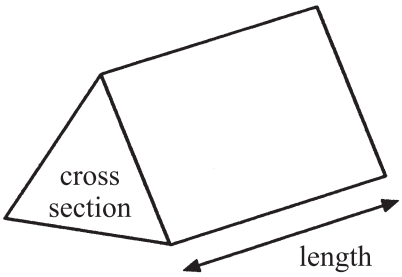
INFORMATION FOR CANDIDATES

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 **questions 6 and 18**.
You should have a calculator, ruler, compasses and a protractor.
Your Formula Sheet is on page 2.

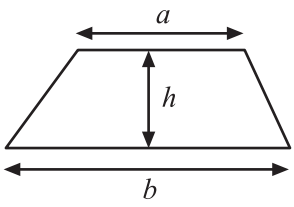
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Formula Sheet

Volume of prism = area of cross section × length

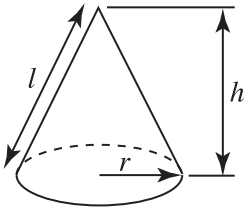


Area of trapezium $= \frac{1}{2}(a+b)h$



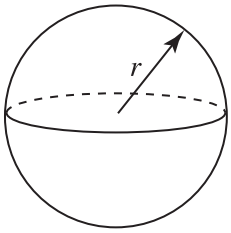
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

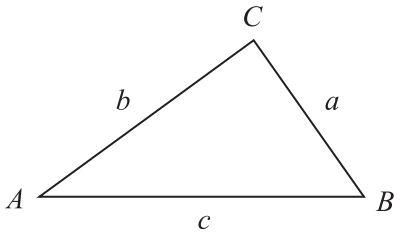


Volume of sphere $= \frac{4}{3}\pi r^3$

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

Examiner Only	
Marks	Remark

1 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?



© iStockphoto / Thinkstock

Answer £ _____ [3]

Total Question 1

2 A has coordinates (6, –1), B has coordinates (–4, 6).
Calculate the length of the line AB.

Answer _____ [3]

Total Question 2

3 Factorise fully

(a) $8p^2 + 10pq$

Answer _____ [2]

(b) $25 - a^2$

Answer _____ [1]

(c) $x^2 - x - 20$

Answer _____ [2]

Total Question 3

[Turn over

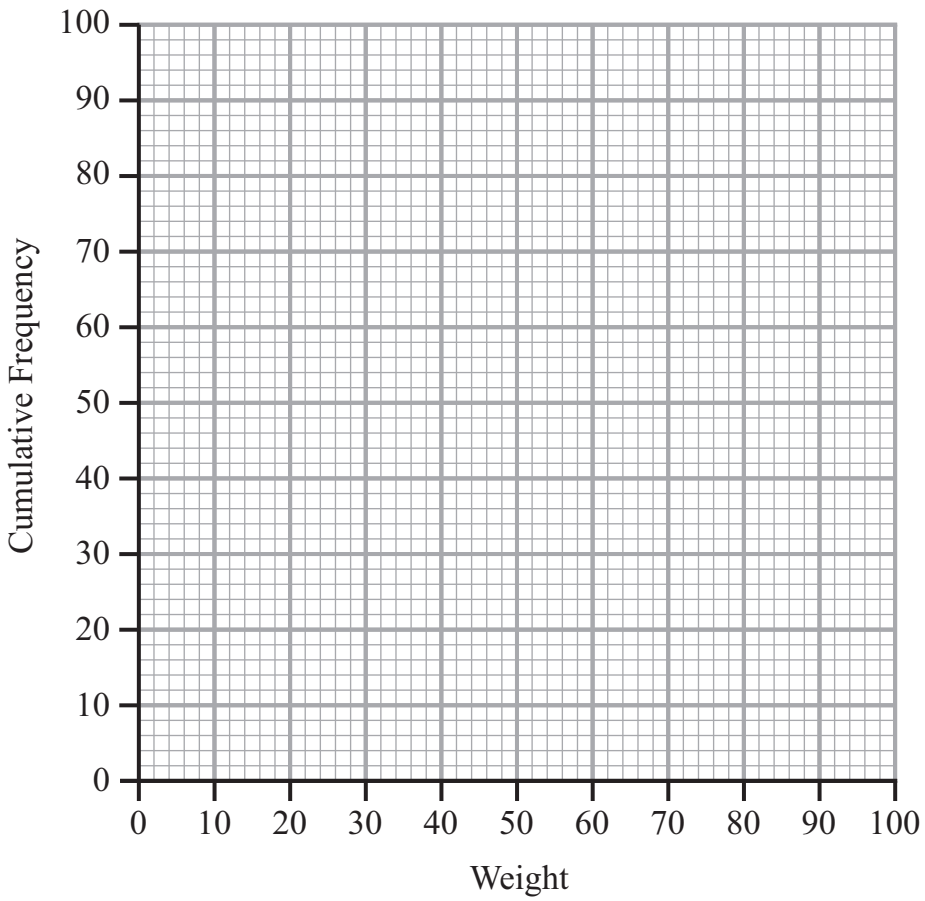
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4 The weights of potatoes collected from 100 garden plots are shown in the table.

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

(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]

Examiner Only	
Marks	Remark
Total Question 4	

[Turn over

5 **(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]

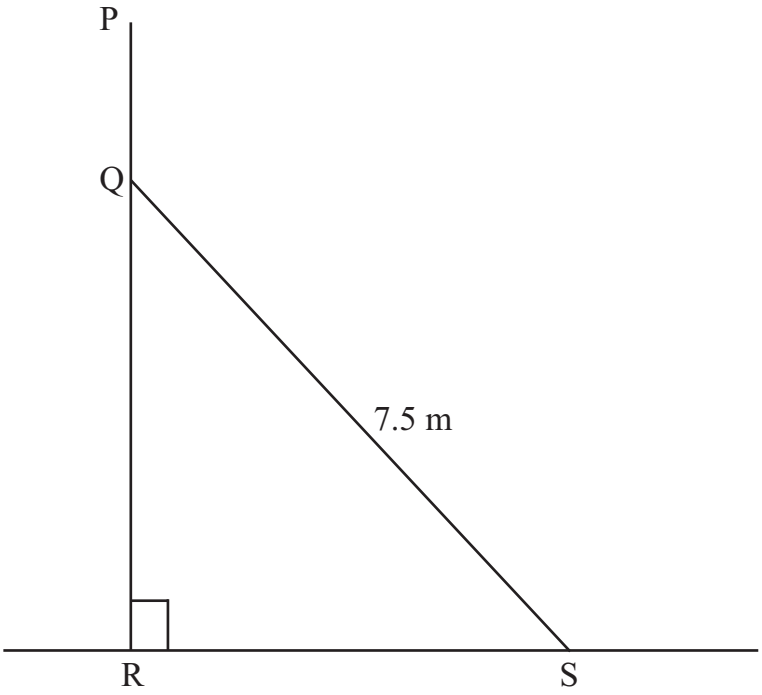
Examiner Only	
Marks	Remark
Total Question 5	

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

Examiner Only	
Marks	Remark

6



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 6

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

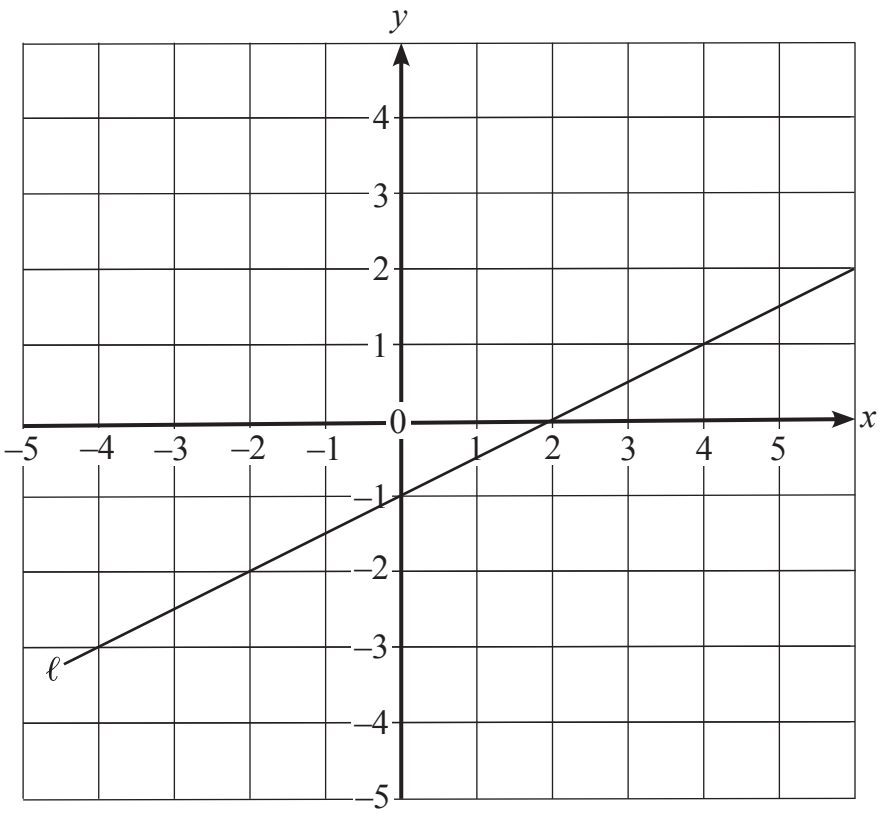
Show all your working.

Answer _____ [2]

Examiner Only	
Marks	Remark
Total Question 7	

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8 **(a)** Write down the equation of line ℓ.



Answer _____ [3]

(b) Write down the equation of the line which passes through (0, 2) and is perpendicular to the line $y = 1 - 4x$.

Answer _____ [2]

Examiner Only	
Marks	Remark
Total Question 8	

[Turn over

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9

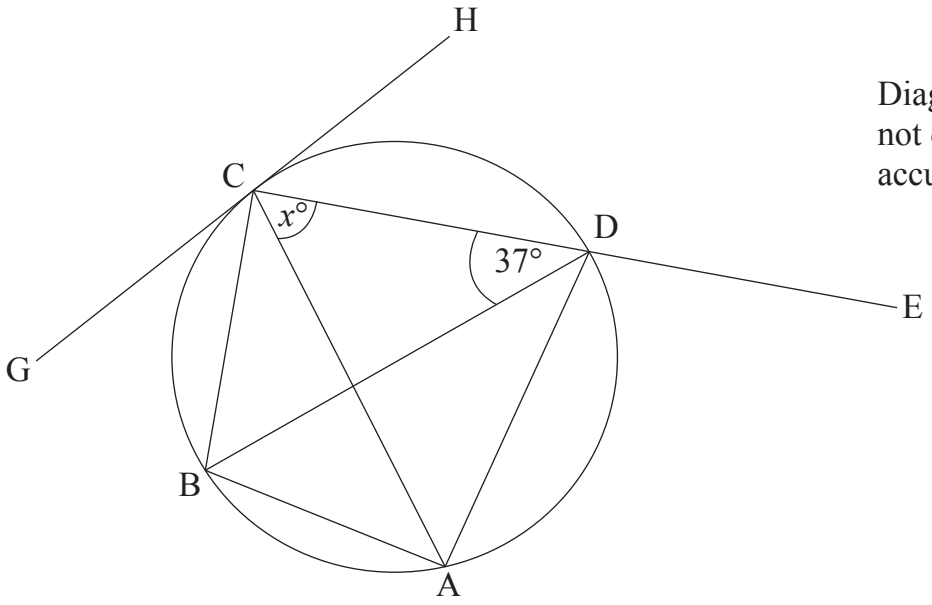


Diagram not drawn accurately

Examiner Only	
Marks	Remark

A, B, C and D are points on the circumference of a circle.
BD is a diameter of the circle.
CDE is a straight line.
GCH is a tangent to the circle.
Angle BDC = 37°.

(a) (i) Explain why the angle BAC is equal to 37°.

_____

_____ [1]

(ii) Calculate the size of angle CBD.

Answer _____ ° [1]

(iii) Angle ACD = x°. Work out the size of angle ADE in terms of x.

Answer _____ [1]

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(b) Find the size of angle DCH.

Give a reason for your answer.

Answer _____ °

Reason _____

_____ [2]

Examiner Only

Marks	Remark

Total Question 9

10 A teacher has recorded the marks of all the papers of the 40 students who sat a test for her. Before handing back the papers to the students she realises that she has incorrectly marked the student who scored the highest mark and she has to increase his mark by three. Which statistical average would have been altered by this change and by how much?

_____

_____

_____

_____ [2]

Total Question 10

11 **(a)** Solve

(i) $3^x = 1$

Answer x = _____ [1]

(ii) $3^y = \frac{1}{81}$

Answer y = _____ [1]

(b) Evaluate $625^{-\frac{3}{4}}$

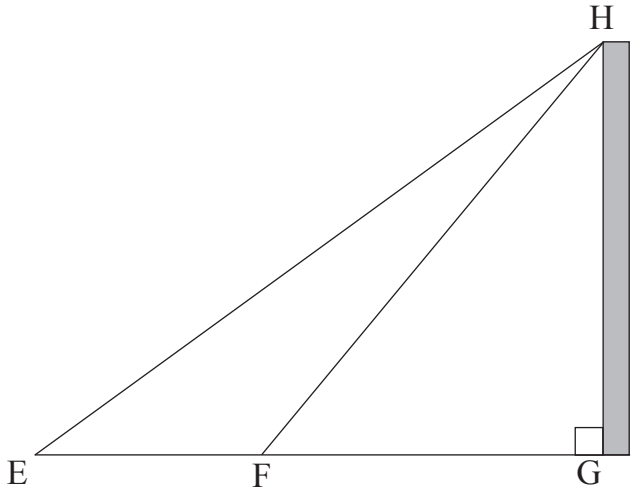
Answer _____ [1]

Total Question 11

[Turn over

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12



Not drawn to scale

Arthur wants to work out the height of a tall chimney GH which is standing on horizontal ground.

To do this, Arthur measures the angle of elevation of the top of the chimney from two different points E and F on the ground.
The angle of elevation from E is 56°.
The angle of elevation from F is 71°.
EF = 28 metres.
Calculate the height of the chimney.

Answer _____ metres [5]

Examiner Only	
Marks	Remark
Total Question 12	

13 Simplify $\dfrac{4x^2 + 6xy}{2x^2 + 3xy - 8x - 12y}$

Answer _____ [4]

Examiner Only	
Marks	Remark
Total Question 13	

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14 The pressure P, in a weather balloon is **inversely** proportional to the square root of the height h, at which it is flying.
At a height of 25 m, the pressure is 1.44 atmospheres.

(a) Find a formula connecting P and $\sqrt{h}$.

Answer _____ [3]

(b) What will the pressure be at a height of 36 m?

Answer _____ atmospheres [1]

(c) At what height will the balloon be flying when the pressure is 1.6 atmospheres?

Answer _____ m [2]

(d) If the height quadruples (becomes four times greater), what effect will this have on the pressure?

Answer _____ [1]

Examiner Only	
Marks	Remark
Total Question 14	

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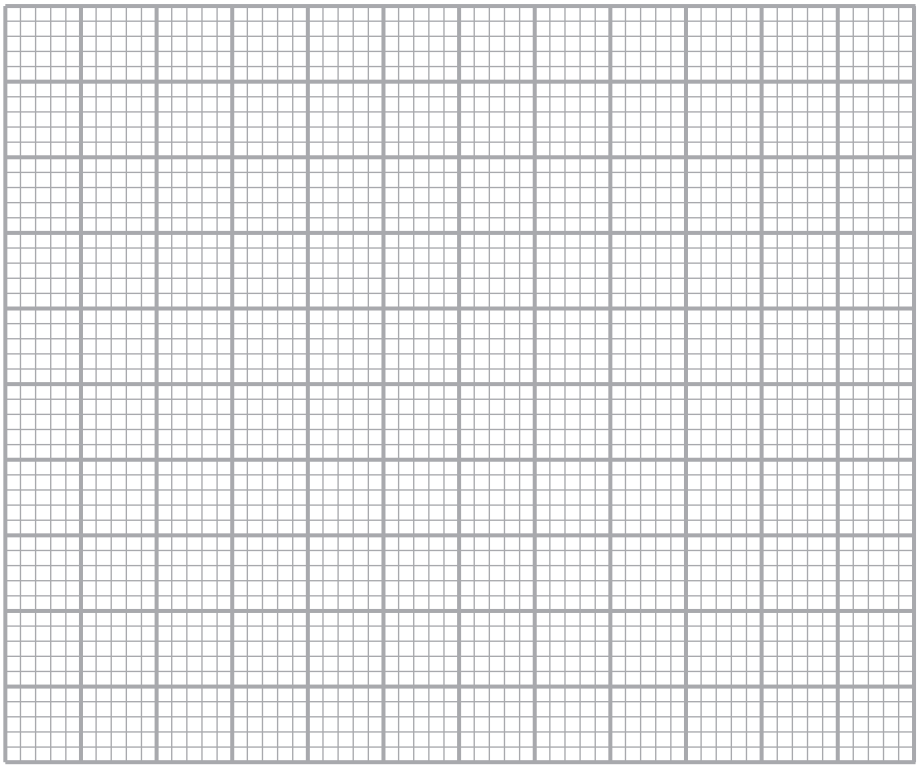
(Questions continue overleaf)

DO NOT WRITE ON THIS PAGE

15 The lengths of pieces of wood cut by a machine are shown in the table.

Lengths (cm)	Frequency
$10 < l \leqslant 20$	12
$20 < l \leqslant 40$	36
$40 < l \leqslant 55$	48
$55 < l \leqslant 65$	25
$65 < l \leqslant 95$	24
$95 < l \leqslant 120$	15

(a) Draw a clearly labelled histogram for this information on the grid provided.



[3]

Examiner Only	
Marks	Remark

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(b) Estimate the number of pieces that have a length longer than the middle length in the modal class.

Answer _____ [2]

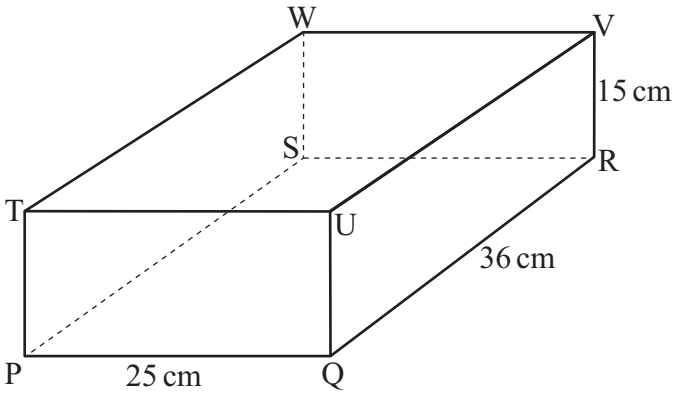
(c) A sample of size 50 is to be taken from the lengths which are shorter than 75 cm. Estimate how many of this sample will have a length shorter than 45 cm.

Answer _____ [4]

Examiner Only	
Marks	Remark
Total Question 15	

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16



The cuboid above has dimensions 36 cm × 25 cm × 15 cm.

(a) Find the length of the space diagonal TR.

Answer _____ cm [2]

(b) Find the angle which TR makes with the face PQUT of the cuboid.

Answer _____ ° [3]

Examiner Only	
Marks	Remark
Total Question 16	

17 Given that $x^2 - 6x + 15 = (x - a)^2 + b$, find a and b.

Answer a = _____ b = _____ [3]

Total Question 17	

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

Examiner Only	
Marks	Remark

18 To estimate the number of ants in an anthill a sample of 200 was collected and marked with a blue dye. The next day a sample of 400 was taken and it was found to contain 64 ants with the blue dye.

(a) Estimate the number of ants in the anthill.

Answer _____ [2]

(b) Suggest an improvement to this sampling process which would give a more accurate estimate of the population of ants in the anthill.

_____

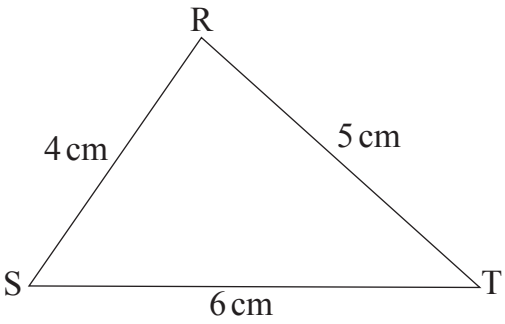
_____

_____

_____ [2]

Total Question 18

19



Not drawn to scale

RST is a triangle with sides of length 4 cm, 5 cm and 6 cm.
Find the area of the triangle RST.

Answer _____ cm^2 [4]

Examiner Only	
Marks	Remark
Total Question 19	

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20 Solve $\frac{3}{x+2} - \frac{2}{x+1} = -2$

Show all your working.

A solution by trial and improvement will not be accepted.

Answer _____ [7]

Examiner Only	
Marks	Remark
Total Question 20	

[Turn over

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21



In an election 45% of the votes went to Candidate A, $\frac{2}{3}$ of the remaining votes went to Candidate B and the rest of the votes were split evenly between Candidates C, D and E. Candidate D received 957 votes.
If no votes were spoiled, how many people voted altogether?

Answer _____ [4]

Examiner Only	
Marks	Remark
Total Question 21	

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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	
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14	
15	
16	
17	
18	
19	
20	
21	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
January 2013

Mathematics

Unit T4
Higher Tier

[GMT41]

FRIDAY 11 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** (method0 marks, hence **M0 A1** 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.

Positive marking:

It is our intention to reward candidates for any demonstration of relevant knowledge, skills or understanding. For this reason we adopt a polity 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).

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	82% = 52.48	MA1	
	52.48 ÷ 0.82 = 64	M1, A1	3
2	$\sqrt{10^2 + 7^2}$	MA1	
	$\sqrt{149}$	A1	
	12.2(065556)	A1	3
3	**(a)** $2p(4p+ 5q)$	A1, A1	
	(b) $(5 – a)(5 + a)$	A1	
	(c) $(x – 5)(x + 4)$	A1, A1	5
4	**(a)** 4, 12, 23, 36, 46, 78, 88, 96, 100	A1	
	(b) 9 points correct (7, 8 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 – (reading) = Answer	A1	9
5	**(a)** $2x – 4y = 10$		
	$6x + 4y = 14$ (or equivalent equating of coefficients)	MA1	
	$8x = 24$ $x = 3$	A1	
	$y = –1$	A1	
	(b) $\frac{4(x – 1) + 3(3x – 2)}{12} = \frac{16}{12}$	MA1	
	$4(x – 1) + 3(3x – 2) = 16$	MA1	
	$4x – 4 + 9x – 6 = 16$		
	$13x = 26$	MA1	
	$x = 2$	MA1	7
6	Sin 67° = $\frac{QR}{7.5}$	C1	
	QR = 6.903786	C1	
	PQ = 10 – 6.903786 = 3.096214	C1	
	PQ > 3 metres	C1	4

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			AVAILABLE MARKS
7	$\frac{3}{4}+\frac{10}{3}$ **or** $\frac{3}{4}+\frac{20}{6}$ (working shown)	MA1	
	$4\frac{1}{12}$	A1	2
8	**(a)** gradient $=\frac{1}{2}$	MA1	
	$y=\frac{1}{2}x-1$	A1, A1	
	(b) $y=\frac{1}{4}x+2$	A1, A1	5
9	**(a)** **(i)** angles in the same segment are equal	A1	
	(ii) 53	A1	
	(iii) $x + 53$	A1	
	(b) 53 Alternate segment theorem	MA2	5
10	Mean by $\frac{3}{40}$ **or** 0.075	A1, A1	2
11	**(a)** **(i)** 0	A1	
	(ii) -4	A1	
	(b) $\frac{1}{125}$ **or** 0.008 **or** 8×10^{-3}	MA1	3
12	$\frac{FH}{\sin 56°}=\frac{28}{\sin 15°}$	MA1	
	$FH=\frac{28 \times \sin 56°}{\sin 15°}$	MA1	
	FH = 89.69	A1	
	$\text{Sin } 71°=\frac{GH}{89.69}$	MA1	
	GH = 84.8	A1	5
13	$\frac{2x(2x+3y)}{x(2x+3y)-4(2x+3y)}$	A1 A1	
	$\frac{2x(2x+3y)}{(x-4)(2x+3y)}$	A1	
	$\frac{2x}{x-4}$	A1	4

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				AVAILABLE MARKS
14	**(a)**	$P = \frac{k}{\sqrt{h}}$	MA1	
		$1.44 = \frac{k}{\sqrt{25}}$		
		$k = 7.2$	MA1	
		$P = \frac{7.2}{\sqrt{h}}$	A1	
	(b)	1.2	A1	
	(c)	$1.6\sqrt{h} = 7.2$		
		$\sqrt{h} = 4.5$	MA1	
		$h = 20.25$ m	A1	
	(d)	Pressure halves	A1	7
15	**(a)**	frequency per cm 1.2, 1.8, 3.2, 2.5, 0.8, 0.6	MA1	
		Correct labels and scales	A1	
		6 bars correct	A1	
	(b)	24 + 25 + 24 + 15 = 88 (allow 1 for use of 1st 24)	M1, A1	
	(c)	12 + 36 + 48 + 25 + 8 = 129	MA1	
		sample fraction = $\frac{50}{129}$	A1	
		12 + 36 + 16 = 64 (must see 16)	MA1	
		$\therefore \frac{50}{129} \times 64 = 24$ **or** 25	A1	9
16	**(a)**	$\sqrt{15^2 + 25^2 + 36^2}$	MA1	
		46.325	A1	
	(b)	Identify angle RTQ	MA1	
		Sin RTQ = $\frac{36}{46...}$	MA1	
		$\theta = 50.9976$ **or** 51	A1	5
17		$-2a = -6$ $a = 3$	MA1	
		$a^2 + b = 15$	MA1	
		$b = 6$	A1	3

			AVAILABLE MARKS
18	**(a)** $\frac{64}{400}$ sample fraction (must be used)	A1	
	$\frac{64}{400} = \frac{200}{x} \therefore x = \frac{200 \times 400}{64} = 1250$	A1	
	(b) Suitable improvement e.g. take larger initial sample, i.e. dye more ants take larger second sample repeat sampling process for several days	C2	4
19	Cos RST $= \frac{4^2 + 6^2 - 5^2}{2 \times 4 \times 6}$ (= 0.5625)	MA2	
	Angle RST = 55.77°	A1	
	Area of triangle $= 0.5 \times 4 \times 6 \times \sin 55.77°$ $= 9.92$	MA1	4
20	$3(x + 1) - 2(x + 2) = -2(x + 1)(x + 2)$	MA2	
	$3x + 3 - 2x - 4 = -2(x^2 + 3x + 2)$	MA1	
	$x - 1 = -2x^2 - 6x - 4$	MA1	
	$2x^2 + 7x + 3 = 0$	MA1	
	$(2x + 1)(x + 3) = 0$ or use of formula		
	$x = -\frac{1}{2}$ **or** $x = -3$	MA1, MA1	7
21	2871 (C + D + E) (3×957)	MA1	
	5742 (B) (2×2871)	MA1	
	7047 (A) $\left(8613 \times \frac{45}{55}\right)$	MA1	
	15660 (7047 + 8613)	A1	4
	Alternative method		
	$0.45x + \frac{2}{3}(0.55x) + 3 \times 957 = x$	MA2	
	$\frac{9}{20}x + \frac{11}{30}x + 2871 = x$	MA1	
	$\frac{11}{60}x = 2871$		
	$x = 15660$	A1	
		Total	**100**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2012

Mathematics

Unit T4
(With calculator)
Higher Tier



[GMT41]

GMT41

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 fourteen** 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

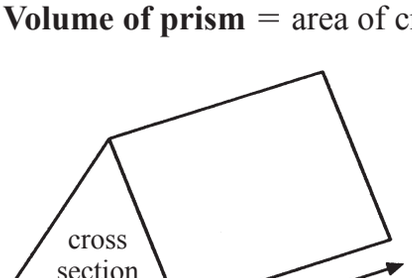
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **questions 1 and 7**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is overleaf.

7415

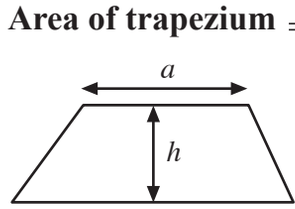
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Formula Sheet

Volume of prism = area of cross section × length

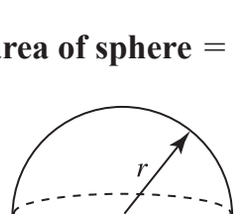


Area of trapezium = $\frac{1}{2}(a+b)h$



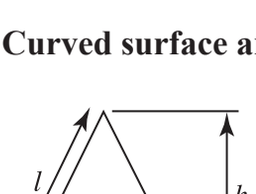
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

Curved surface area of cone = πrl

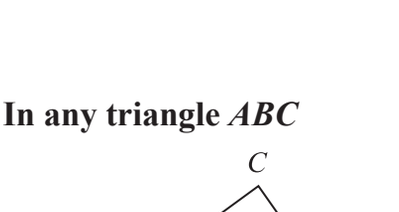


Quadratic Equation

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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Quality of written communication will be assessed in this question.

Show your working.

Examiner Only	
Marks	Remark

1 **(a)** In a housing estate $\frac{5}{6}$ of the houses have a garage.

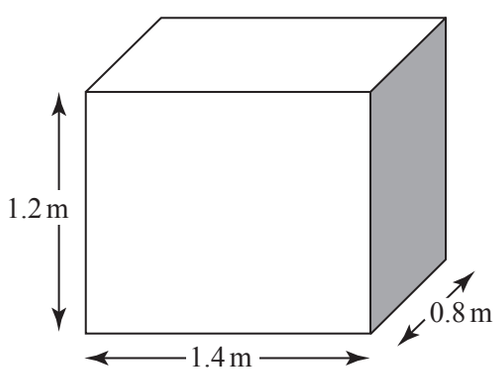
In three out of every four garages there is a car parked.

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 10 cm.

What is the smallest possible volume of the tank?



Answer _____ m^3 [3]

Total Question 1

[Turn over

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2 120 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]

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

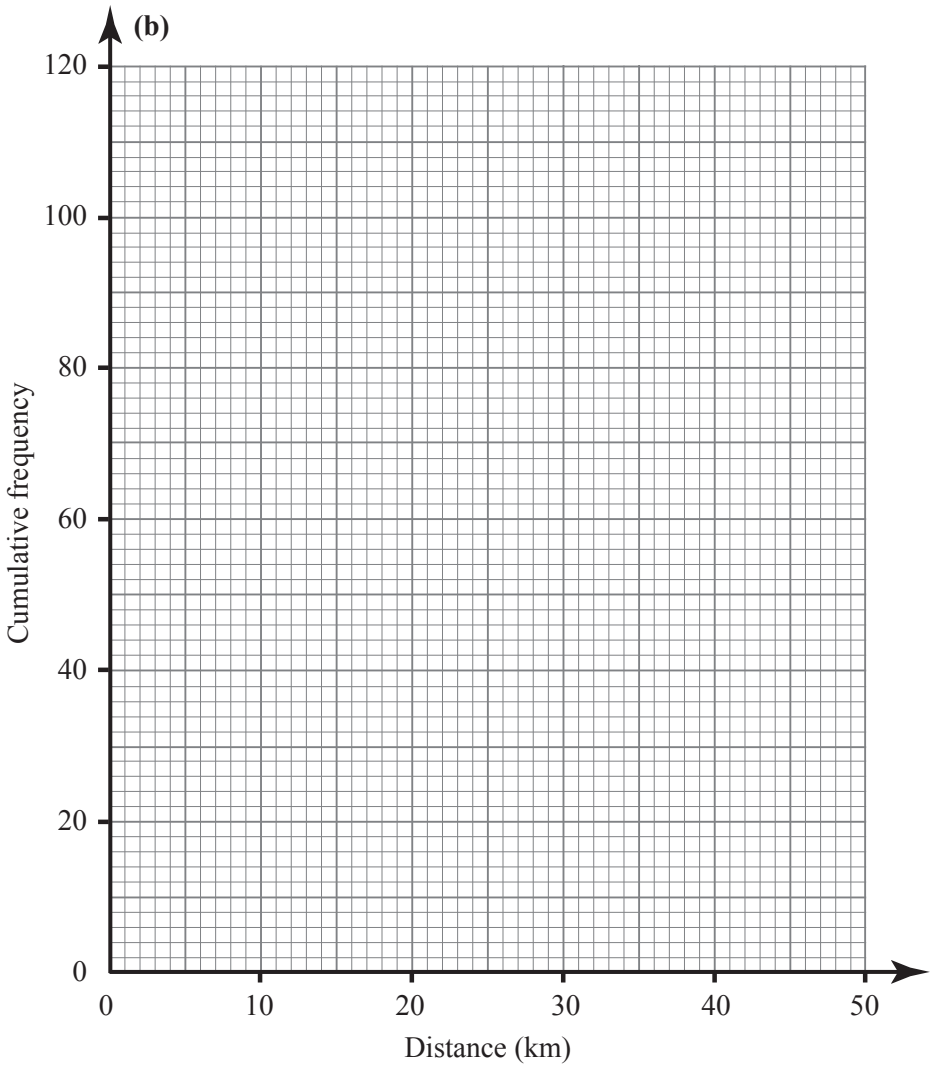
Answer _____ % [2]

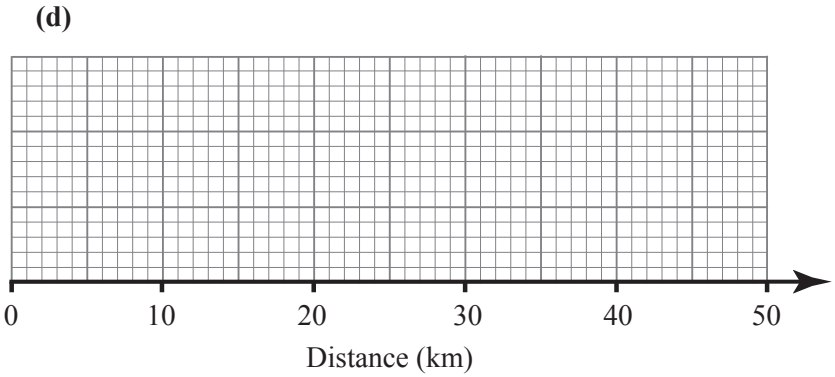
Examiner Only	
Marks	Remark

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(d) The minimum distance travelled by any employee was 2 km and the maximum distance travelled was 44 km.

Draw a box plot below to illustrate the data for all 120 employees. [3]





Examiner Only	
Marks	Remark
Total Question 2	

[Turn over

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3 **(a)** Find the least common multiple (LCM) of 60 and 132.

Examiner Only	
Marks	Remark

Answer _____ [2]

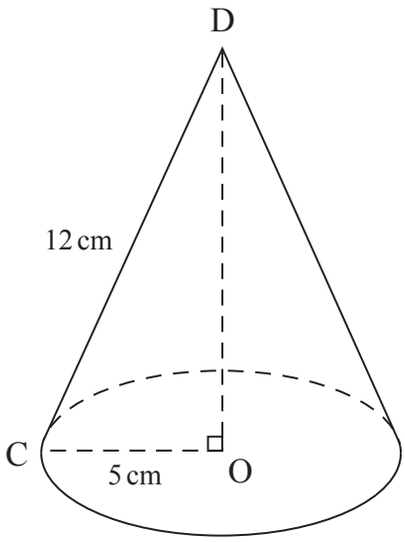
(b) M is the point $(-1, 4)$. N is the point $(5, 8)$.

Find the length of MN, correct to 2 decimal places.

Answer _____ [3]

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(c)



OC is the radius of the base of the cone. OD is the height of the cone.
OC = 5 cm. DC = 12 cm.

Calculate the angle DCO.

Answer _____ ° [3]

Examiner Only	
Marks	Remark
Total Question 3	

4 **(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) Factorise fully

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

Answer _____ [2]

(ii) $g^2 - 9h^2$

Answer _____ [2]

Examiner Only	
Marks	Remark
Total Question 4	

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Examiner Only	
Marks	Remark

5 **(a)** P, Q, R and S are points on the circumference of a circle, centre O.
The angle PSR is 48°

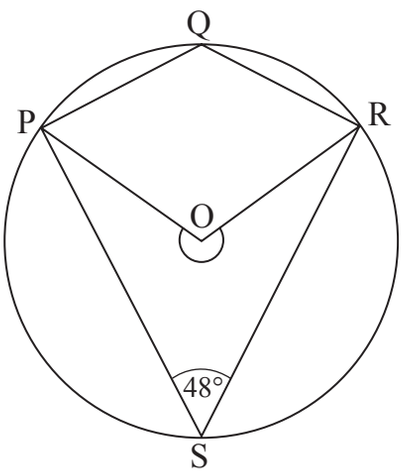


Diagram not drawn accurately

Calculate

(i) the angle PQR,

Answer _____ ° [1]

(ii) the reflex angle POR.

Answer _____ ° [1]

[Turn over

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(b)

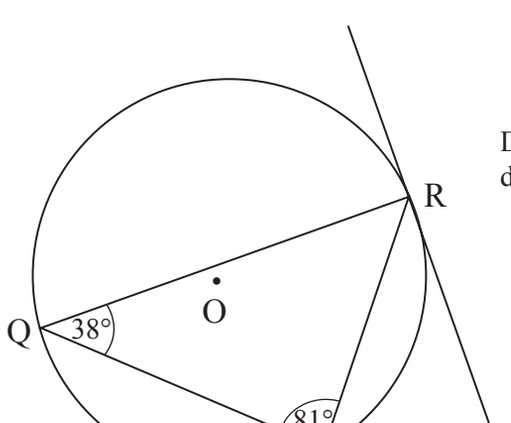


Diagram not drawn accurately

RT is a tangent to the circle, centre O.

Write down the size of angle SRT. Give a reason for your answer.

Answer _____ ° because _____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 5	

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6 **(a)** **(i)** Find the equation of the line through the points (0, 1) and (3, 13).

Answer _____ [3]

(ii) Find the equation of the line which is perpendicular to the line $y = 3x - 4$ and passes through the point (0, 7).

Answer _____ [2]

Examiner Only	
Marks	Remark

(b) Solve the equation

$$\frac{3x-5}{2} - \frac{2x+7}{9} = \frac{11}{6}$$

A solution by trial and improvement will not be accepted.

Answer $x =$ _____ [4]

Examiner Only	
Marks	Remark
Total Question 6	

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Quality of written communication will be assessed in this question.

Examiner Only	
Marks	Remark

7 **(a)** In a forest, the warden wishes to estimate the number of rabbits. He catches and marks 140 rabbits and releases them again.

The next day he catches 80 rabbits and finds 23 of the marked ones among these.

Estimate the number of rabbits in the forest.

Show your work clearly.

Answer _____ [3]

(b) "Lightup" claim that the lifetime of their light bulbs is over 1200 hours.

(i) Explain why it is necessary to use sampling to find the lifetime of the light bulbs.

_____

_____ [1]

(ii) Describe a suitable sampling method for testing the lifetime of the light bulbs.

_____

_____ [1]

[Turn over

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(c) In a hospital 840 patients were treated for tonsillitis during one year.

Some information on the gender and age groups of these patients is shown in the table below.

	Under 15	**15–50**	**Over 50**
Male	62	260	25
Female		413	

The hospital wishes to interview some of the patients.

They take a stratified sample of 80 patients.

(i) How many patients in the sample should be males under 15?

Answer _____ [1]

(ii) In the sample taken there were 5 females over 50. Estimate the number of females over 50 who were treated for tonsillitis in the hospital.

Answer _____ [1]

Examiner Only	
Marks	Remark
Total Question 7	

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8

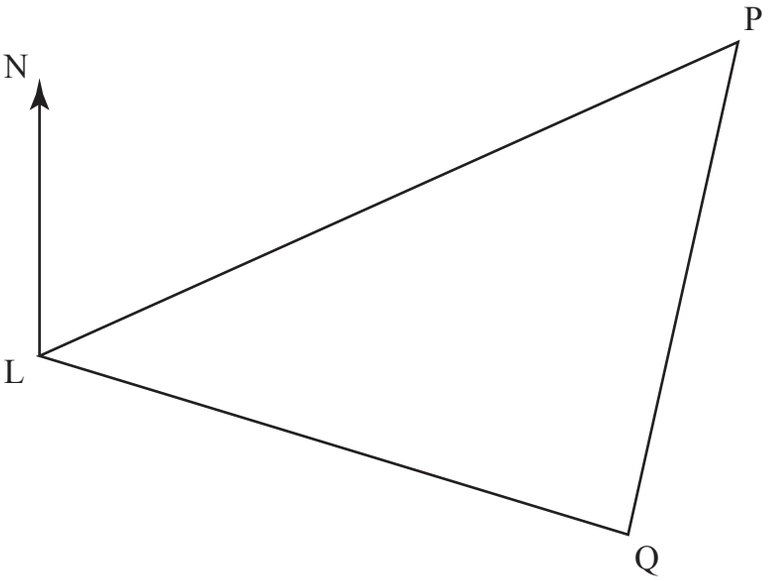


Diagram not drawn accurately

Ship P is 62 km from a lighthouse L on a bearing of 072°

Ship Q is 45 km from L on a bearing of 124°

Calculate

(a) the distance between P and Q,

Answer _____ km [3]

(b) the area of triangle LPQ,

Answer _____ [3]

Examiner Only	
Marks	Remark

[Turn over

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(c) the bearing of P from Q.

Answer _____ ° [3]

Examiner Only	
Marks	Remark
Total Question 8	

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9 The force F exerted by a magnet on a metal button is **inversely proportional** to the **square** of the distance d of the magnet from the button.

When $d = 8$ cm, $F = 2.5$ newtons.

Calculate the distance from the magnet when the force on the button is 6.4 newtons.

Answer _____ cm [5]

Examiner Only	
Marks	Remark
Total Question 9	

[Turn over

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

Answer _____ [3]

(b) Solve the quadratic equation $5h^2 - 9h + 3 = 0$
giving your answer correct to 2 decimal places.

Answer _____ [3]

Examiner Only	
Marks	Remark
Total Question 10	

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11 **(a)** Factorise $6a^2x - abx - 12b^2x$

Answer _____ [3]

(b) Solve $\dfrac{7}{3x-1} - \dfrac{5}{x+1} = 4$

A solution by trial and improvement will not be accepted.

Answer _____ [7]

Examiner Only	
Marks	Remark
Total Question 11	

[Turn over

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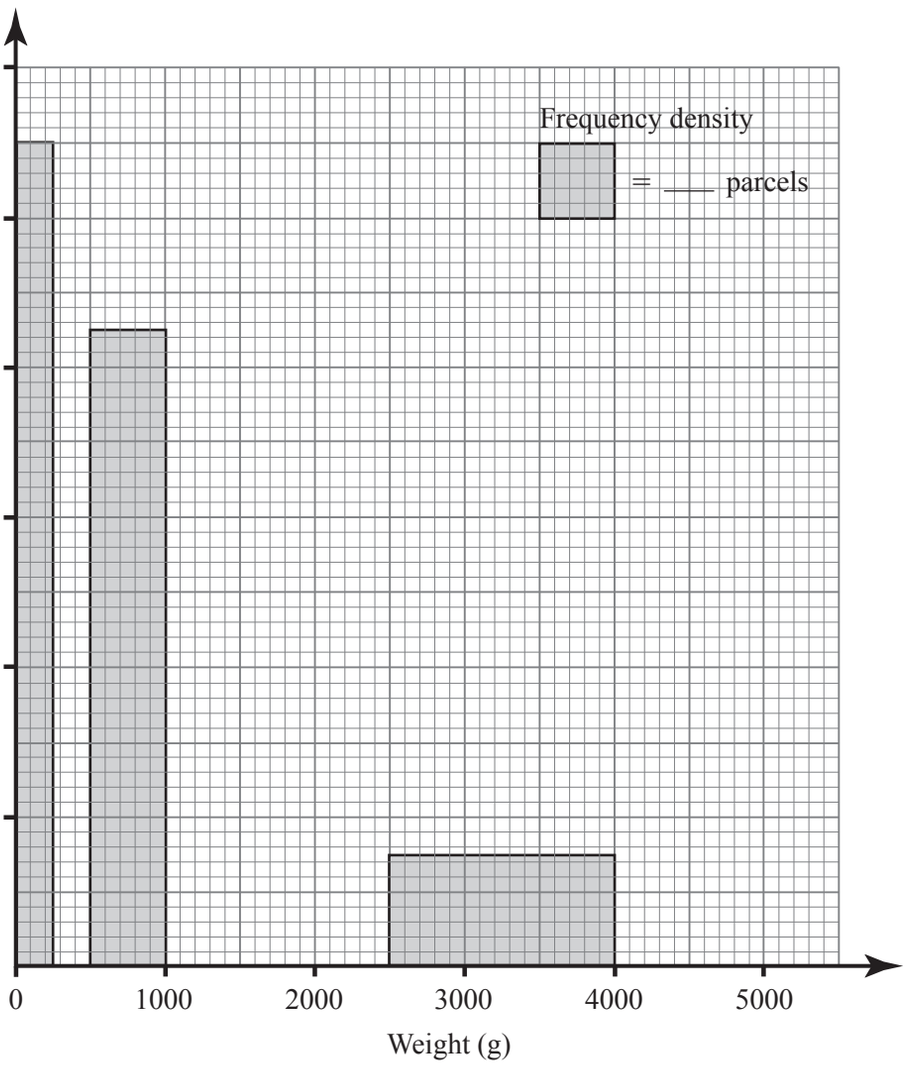
12 The table records the weight, in grams, of some of the 350 parcels which pass through a post office during 1 week.

Weight (w grams)	Frequency
$0 < w \leqslant 250$	55
$250 < w \leqslant 500$	30
$500 < w \leqslant 1000$	
$1000 < w \leqslant 2000$	60
$2000 < w \leqslant 2500$	35
$2500 < w \leqslant 4000$	
$4000 < w \leqslant 5000$	40

Examiner Only	
Marks	Remark

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The histogram illustrates the weights of some of the parcels.



(a) Complete the frequency density on the grid. [1]

(b) Use the data in the table to complete the histogram. [2]

(c) Use the data in the histogram to complete the table. [2]

(d) Estimate the median weight of the 350 parcels.

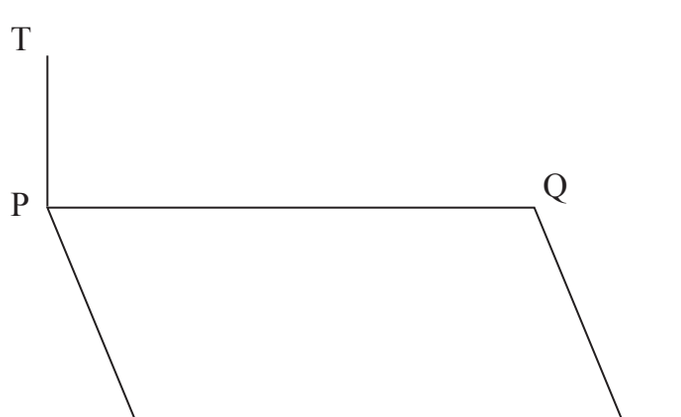
Answer _____ g [2]

Examiner Only	
Marks	Remark
Total Question 12	

[Turn over

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13



A vertical telegraph pole TP stands at the corner P of a horizontal field PQRS.

PQRS is a rectangle of length 60 m and breadth 25 m.

The height of the pole is 10 m.

Calculate the angle of elevation of the top of the pole, T, from R.

Answer _____ ° [3]

Examiner Only	
Marks	Remark
Total Question 13	

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14 (a) Calculate, **showing all your working**, the value of $\left(\frac{1}{8}\right)^{-\frac{2}{3}}$

Answer _____ [2]

(b) Find the value of n for which $9^{2n} = \frac{1}{3}$

Answer n = _____ [2]

(c) $\left(\frac{2^a}{3}\right)^b = 3 \times 2^{a+c}$

Find possible values of a, b, c.

Answer a = _____ b = _____ c = _____ [4]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark
Total Question 14	

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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	
QWC	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2012

Mathematics

Unit T4
Higher Tier

[GMT41]

WEDNESDAY 6 JUNE, MORNING

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 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	**(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 = 1.164375	M1, A1 A1	6
2	**(a)**	33 54 81 95 107 115 120	A1	
	(b)	points curve/lines	A2 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	
	(d)	LQ = 14 UQ = 28 (readings from graph) Box drawn accurately (LQ/UQ/median) Whiskers accurate	A1 MA1 MA1	10
3	**(a)**	2 | 60 → 2 | 30 → 3 | 15 → 5 2 | 132 → 2 | 66 → 3 | 33 → 11	MA1	
		LCM = 2 × 2 × 3 × 5 × 11 = 660	MA1	
	(b)	$6^2 + 4^2 = 52$ $\sqrt{52} = 7.21$	M1, A1 A1	
	(c)	cos DCO = $\frac{5}{12}$	M1, A1	
		DCO = 65.(375...)	A1	8

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						AVAILABLE MARKS
4	**(a)**	$15x + 6y = 39$ $4x - 6y = 18$ $19x = 57$ $x = 3$	**or**	$10x + 4y = 26$ $10x - 15y = 45$ $19y = -19$ $y = -1$	MA1 MA1 A1	
		$15 + 2y = 13$ $2y = 13 - 15$ $y = -1$		$5x - 2 = 13$ $5x = 15$ $x = 3$	 A1	
	(b)	**(i)** $3y(3x - 4y)$			A1, A1	
		(ii) $(g + 3h)(g - 3h)$			A1, A1	8
5	**(a)**	**(i)** 132			A1	
		(ii) 264			A1	
	(b)	38, alternate segment theorem			A1, A1	4
6	**(a)**	**(i)** Gradient $= \frac{13 - 1}{3 - 0} = 4$			MA2	
		$y = 4x + 1$			A1	
		(ii) $y = -\frac{1}{3}x + 7$			M1, A1	
	(b)	$9(3x - 5) - 2(2x + 7) = 33$ $27x - 45 - 4x - 14 = 33$ $23x - 59 = 33$ $23x = 92$ $x = 4$			MA1 MA1 MA1 A1	9
7	**(a)**	$\frac{23}{80} = \frac{140}{?}$ or equivalent $= \frac{80 \times 140}{23}$			M1 MA1	
		Approx. 500 (487)			A1	
	(b)	**(i)** Population testing would be destructive if every light bulb was tested until they burned out there would be none left to sell hence a sample needed. Too expensive, time-consuming etc.			A1	
		(ii) Systematic sample – say every 20th bulb produced and tested its lifetime. Quota sample – pick batches of 20.			A1	
	(c)	**(i)** 5 or 6			A1	
		(ii) 52 or 53			A1	7

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				AVAILABLE MARKS
8	**(a)**	$PQ^2 = 62^2 + 45^2 - 2(62)(45)\cos 52°$	M1, A1	
		49.(33162239)	A1	
	(b)	$\frac{1}{2}(62)(45)\sin 52°$	MA1	
		1099.(275) **or** 1100 km^2	A1, A1 units	
	(c)	$\sin Q = \frac{62\sin 52°}{49.33}$	MA1	
		$Q = 82(.04)$	MA1	
		bearing 026°(.04)	MA1	9
9		$F = \frac{k}{d^2}$	A1	
		$2.5 \times 64 = k$ $160 = k$	MA1	
		$6.4 = \frac{160}{d^2}$	MA1	
		$d^2 = \frac{160}{6.4} = 25$	MA1	
		$d = 5$	A1	5
10	**(a)**	$6ab + 9b^2 - 4a^2 - 6ab$	M1, A1	
		$9b^2 - 4a^2$	A1	
	(b)	$5h^2 - 9h + 3 = 0$		
		$h = \frac{9 \pm \sqrt{(9)^2 - 4(5)(3)}}{2(5)}$ $h = \frac{9 \pm \sqrt{21}}{10}$	MA2	
		$h = 1.36$ **or** 0.44	A1	6
11	**(a)**	$x(6a^2 - ab - 12b^2)$	A1	
		$x(3a + 4b)(2a - 3b)$	A1, A1	
	(b)	$7(x+1) - 5(3x - 1) = 4(3x - 1)(x + 1)$	M1, A1	
		$7x + 7 - 15x + 5 = 12x^2 + 8x - 4$	A1	
		$12x^2 + 16x - 16 = 0$	A1	
		$3x^2 + 4x - 4 = 0$	A1	
		$(3x - 2)(x + 2) = 0$	A1	
		$x = \frac{2}{3}$ **or** -2	A1	10

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				AVAILABLE MARKS
12	**(a)**	10 Accept scaling of vertical axis: 5 cm represents 0.1	MA1	
	(b)	Bars at heights of 6, 3, 3.5, 2 (A1 for 2 correct)	MA2	
	(c)	85 and 45 correct in table	MA1, MA1	
	(d)	$\frac{5}{60} \times 1000 = 83$	MA1	
		Median = 1083 g	MA1	7
13		PR = 65	MA1	
		$\tan x = \frac{10}{65}$	MA1	
		8.7(46)	MA1	3
14	**(a)**	$(8^{\frac{1}{3}})^2 = 2^2 = 4$	M1, A1	
	(b)	$3^{4n} = 3^{-1}$	MA1	
		$4n = -1$ $n = -\frac{1}{4}$	A1	
	(c)	$b = -1$	MA1	
		$-a = a + c$	MA1	
		$-2a = c$	MA1	
		e.g. $a = 1$ $c = -2$	A1	8
			Total	**100**

New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
January 2012

Mathematics



Unit T4
(With calculator)
Higher Tier

[GMT41]

GMT41

WEDNESDAY 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.
Write your answers in the spaces provided in this question paper.
Answer **all eighteen** 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

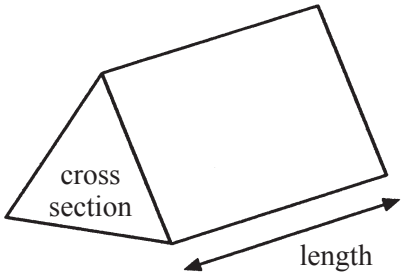
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **question 7**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is overleaf.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
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18	
Total Marks	

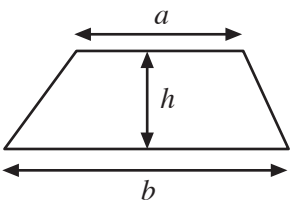
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Formula Sheet

Volume of prism = area of cross section × length

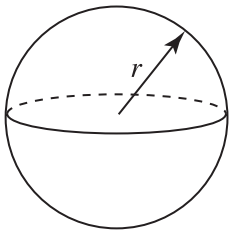


Area of trapezium = $\frac{1}{2}(a+b)h$



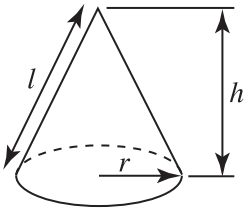
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

Curved surface area of cone = πrl

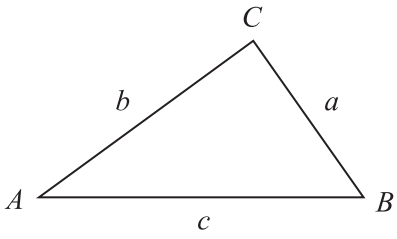


Quadratic Equation

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

Answer **all** questions.

Examiner Only	
Marks	Remark

1 **(a)** 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]

(b) An electric fire cost £135.66 including VAT at 20%.

How much VAT was payable on the bill?

Answer £ _____ [3]

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2 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 opposite to illustrate this information. [3]

(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.

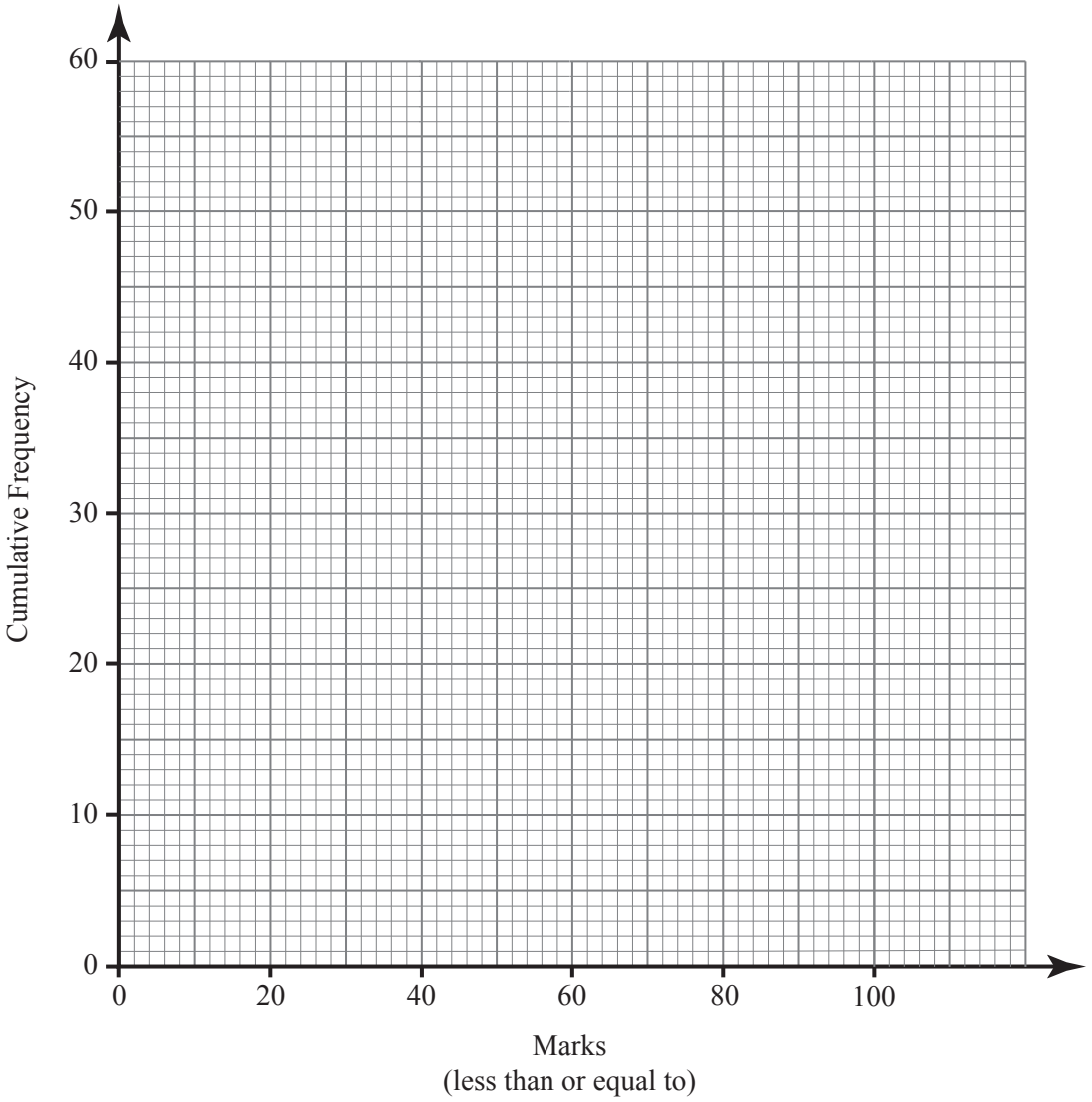
Answer _____ [2]

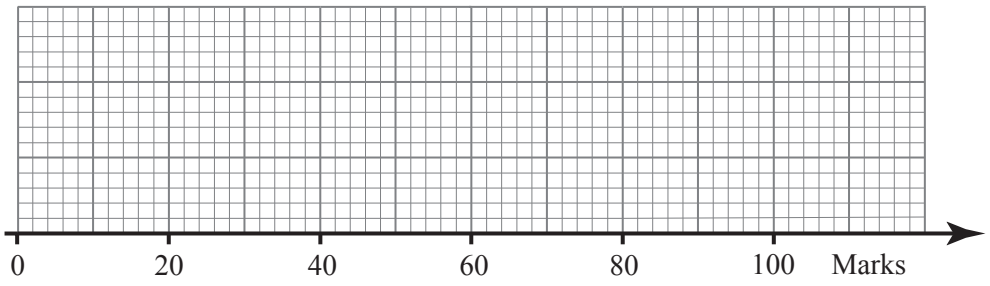
(e) Draw a box plot for the data on the grid below your graph. [3]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

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

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

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

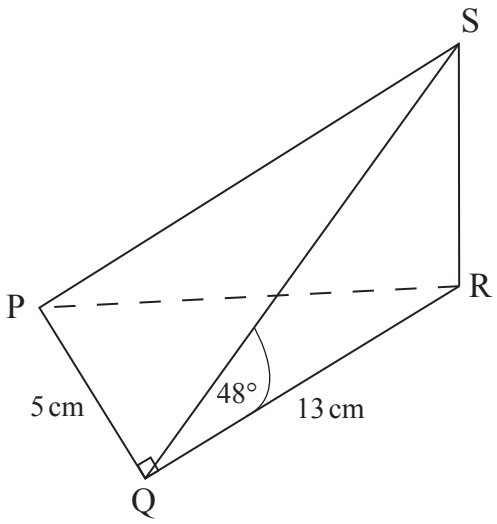
Answer $x =$ _____ [4]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

4 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°.



(a) Calculate the length SR.

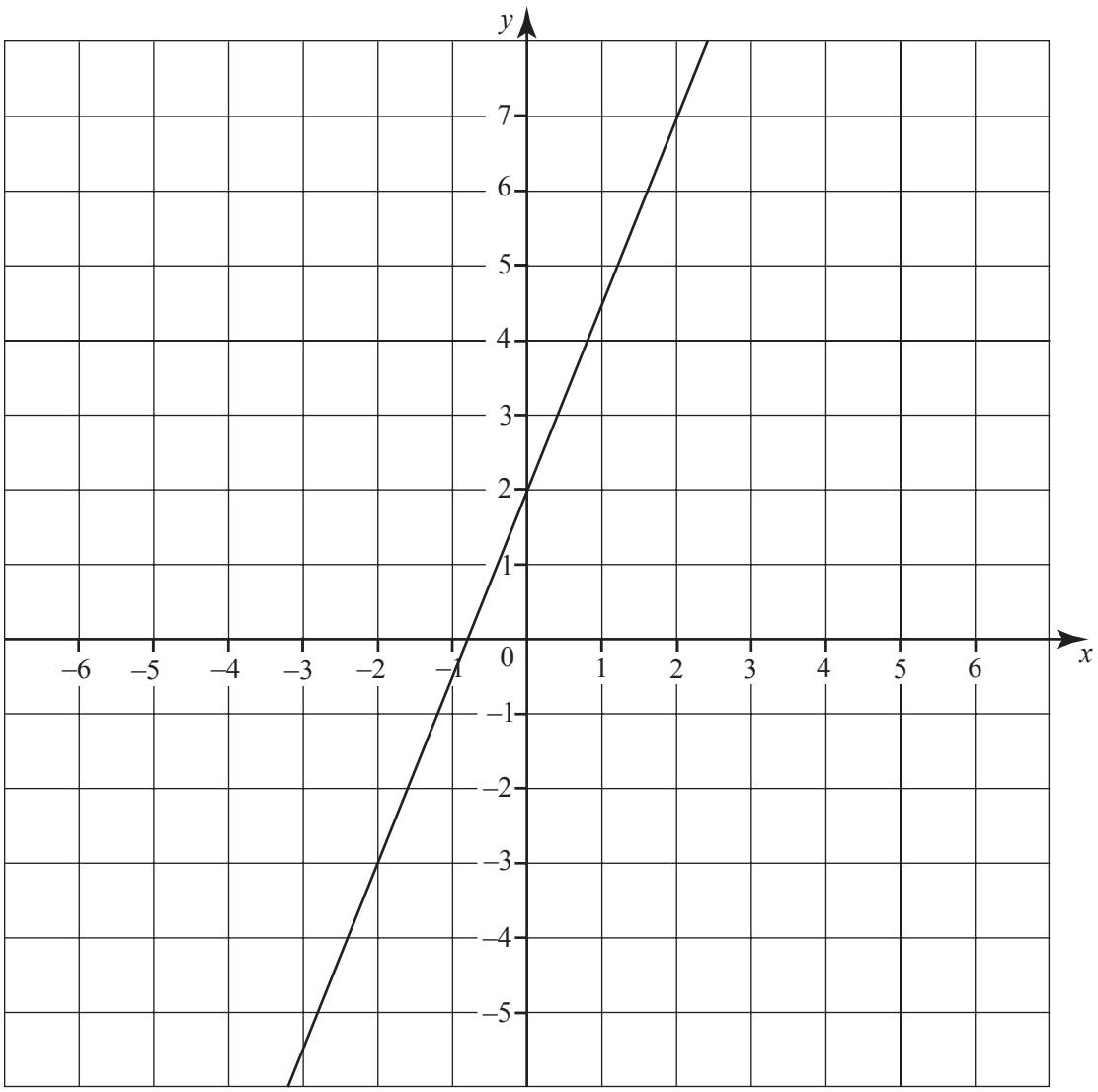
Answer _____ cm [3]

(b) Calculate the size of angle RPS.

Answer _____° [3]

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5



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

Answer _____ [1]

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

Answer _____ [2]

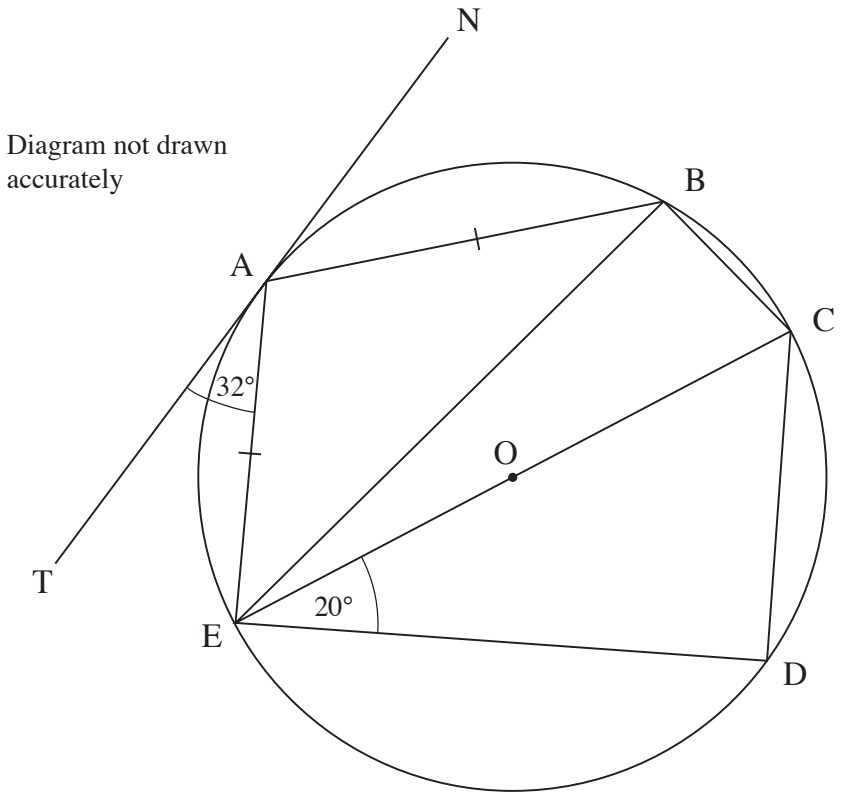
Examiner Only

Marks	Remark

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6 In the diagram EC is a diameter of the circle and AE = AB.

The line TN is the tangent at A.



Given that angle TAE = 32° and angle CED = 20°, calculate the size of each of the following:

(a) Angle EBC = _____° [1]

(b) Angle ABE = _____° [1]

(c) Angle BAE = _____° [1]

(d) Angle BCE = _____° [1]

(e) Angle BED = _____° [1]

Examiner Only

Marks	Remark

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Quality of written communication will be assessed in this question.

Examiner Only	
Marks	Remark

7 There are 600 pupils at Willow High School.

The table below shows information about the pupils.

Year group	Number of boys	Number of girls
8	82	65
9	74	64
10	57	55
11	55	58
12	49	41

Andrew, Karan and Caroline are carrying out a survey in the school to get some information about the use of the school library.

They each decide that they will survey 50 pupils but each of them selects their sample in a different way.

(a) Andrew is going to visit a different Year 8 class each morning for a week and will survey 5 boys and 5 girls each day.

Comment on this method of sampling.

_____

_____ [1]

(b) Karan gets an alphabetical list of all 600 pupils in the school and selects every 10th name on the list until she has 50 names. She then surveys these pupils.

Comment on this method of sampling.

_____

_____ [1]

(c) Caroline takes a sample, stratified both by Year group and by gender, of 50 of the 600 pupils.

(i) Calculate the number of Year 10 boys in her sample.

Answer _____ [2]

(ii) Caroline stated that "There will be twice as many Year 8 boys as Year 12 girls in my sample."

Is Caroline's statement correct?

You must explain how you reached your decision.

[2]

Examiner Only

Marks	Remark

---

8 **(a)** Factorise fully $3p^2 - 75q^2$

Answer _____ [3]

(b) Solve $x^2 - 5x - 24 = 0$

Answer $x =$ _____ [3]

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Examiner Only	
Marks	Remark

9 **(a)** Find the equation of the line through (0, 4) perpendicular to the line $y = 3x + 7$

Answer _____ [2]

(b) Expand and simplify $(3p + 2q)(4p - 7q)$.

Answer _____ [3]

---

10 y is inversely proportional to the square of x.

When $x = 3$, $y = 4$

(a) Find a formula connecting y and x.

Answer _____ [2]

(b) Calculate y when $x = 12$

Answer _____ [1]

(c) What happens to the value of y when x is doubled? **Explain your answer**.

Answer _____

_____ [2]

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11 A field ABCD has straight sides. AB = 80 m.

An underground pipeline crosses the field from B to D and is 264 m long.

Angle ABD = 44°.

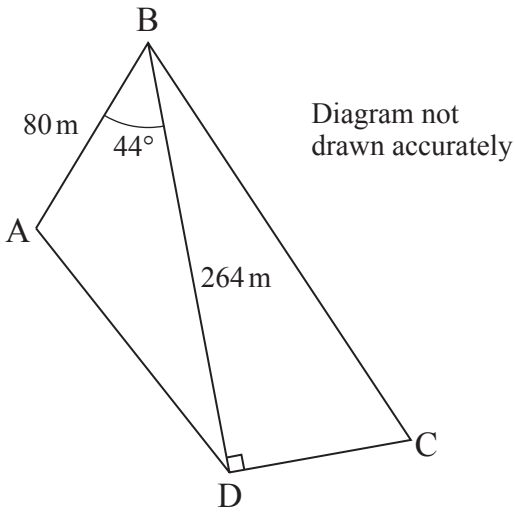


Diagram not drawn accurately

(a) Calculate the area of ABD.

Answer _____ [3]

A safety shutoff valve is placed at the midpoint of BD.

(b) Calculate the distance from the corner A to the valve.

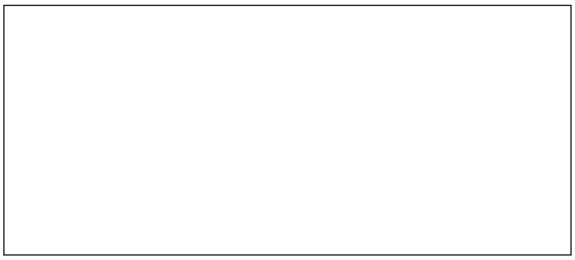
Answer _____ m [3]

Examiner Only

Marks	Remark

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12 The length of a rectangle, x, is 5 cm more than the breadth. Its diagonal is 12 cm long.



x

Diagram not drawn accurately

(a) Show that x is a solution of the equation $2x^2 - 10x - 119 = 0$ [3]

(b) Solve the equation to find the length of the rectangle.

Give your answer correct to 1 decimal place.

Answer $x =$ _____ cm [3]

Examiner Only

Marks	Remark

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(Questions continue overleaf)

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13 Martin recorded the length, in minutes, of the films shown on television in one week.

Below is a partially completed frequency table and opposite is a partially completed histogram for his data.

Length in minutes (m)	Frequency
$0 < m \leq 60$	30
$60 < m \leq 80$	
$80 < m \leq 90$	68
$90 < m \leq 100$	96
$100 < m \leq 140$	

(a) Use the information in the histogram to complete the frequency table. [2]

(b) Complete the histogram by drawing the missing bars. [2]

(c) Estimate the number of films whose length is between $\frac{3}{4}$ hour and $1\frac{1}{4}$ hours.

Answer _____ [2]

Martin also recorded the lengths, in minutes, of all the films shown on television the following week. He made a new histogram.

Some of his data are given in the table below.

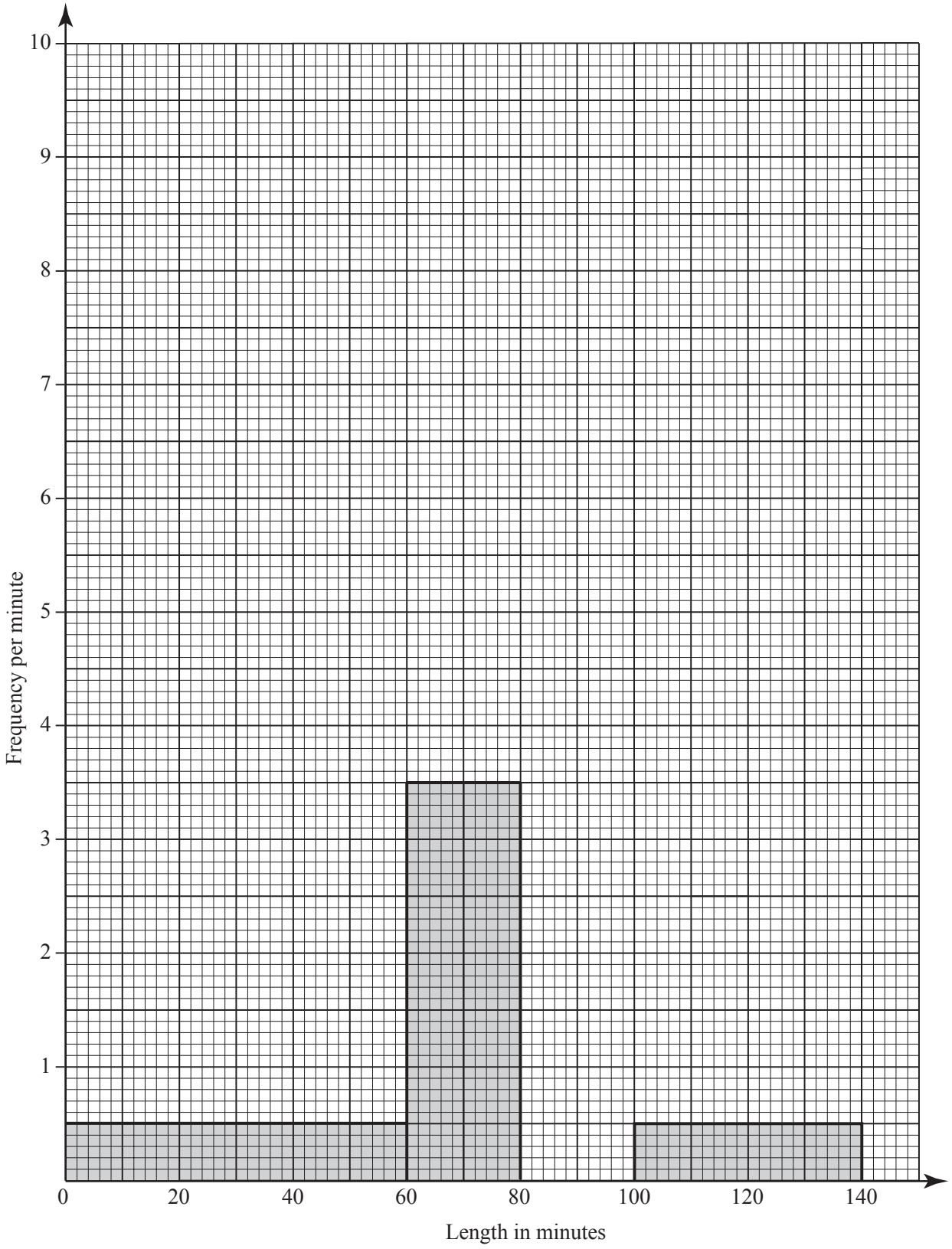
Length in minutes (m)	Frequency	Height of bar (mm)
$60 < m \leq 100$	144	72
$100 < m \leq 160$	x	

(d) Complete the table by finding the height of the second bar, giving your answer **in terms of x**. [2]

Examiner Only

Marks	Remark

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10
9
8
7
6
5
4
3
2
1
Frequency per minute
0
20
40
60
80
100
120
140
Length in minutes

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Examiner Only	
Marks	Remark

14 Prove that $\left(\frac{8}{27}\right)^{-\frac{4}{3}} \times 0.25^{-2} = 81$

Show each step of your working.

Do **not** use your calculator.

[4]

15 In a circular circus ring, centre N, three wires OA, OB and OC of **equal** length are attached from A, B, C on the circumference of the ring floor to the top of the tent O. The angles BOC, COA and AOB are each equal to 90° and the angle ANB = 120°. The chords AB, BC and CA are each 25 m in length.

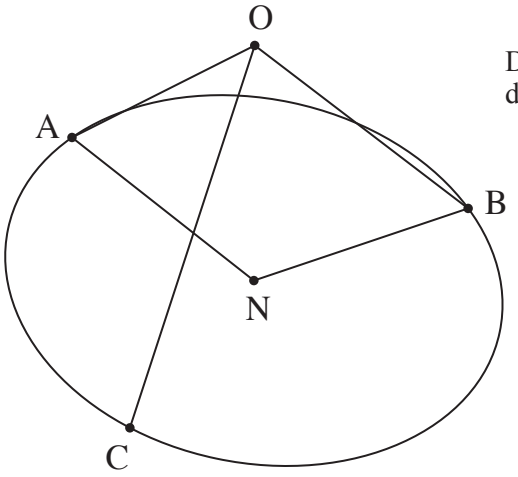


Diagram not drawn accurately

(a) Explain why angle NAB = 30°.

[1]

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(b) Calculate the radius of the circus ring.

Answer _____ m [3]

(c) Calculate the length of one of the wires.

Answer _____ m [2]

---

16 Given that $x^2 - 8x + p \equiv (x + q)^2$ find p and q.

Answer $p =$_____, $q =$_____ [3]

Examiner Only

Marks	Remark

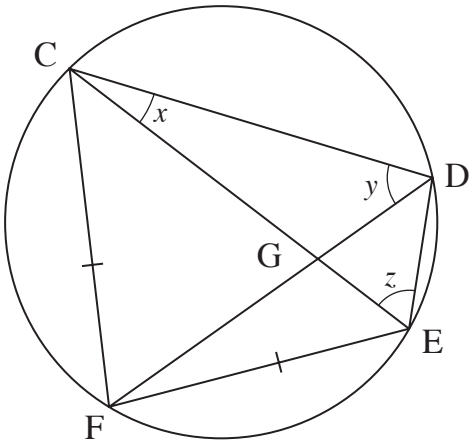
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17 Solve $\frac{2}{x+1}+\frac{6}{3x-2}=1$

Examiner Only	
Marks	Remark

Answer $x =$ _____ [7]

18



The diagonals CE and DF of a cyclic quadrilateral CDEF intersect at G.

Given that CF = FE, prove that angle CGD = angle FED.

[3]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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112515

New Specification

Rewarding Learning

General Certificate of Secondary Education
January 2012

Mathematics

Unit T4
Higher Tier

[GMT41]

WEDNESDAY 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.

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 of 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)**	LCM of 8 and 10 = 40 10th October	MA1 A1	
	(b)	135.66 = 120%	MA1	
		$\frac{135.66}{120} \times 20$ **or** 113.05	MA1	
		= £22.61	A1	5
2	**(a)**	23, 43, 52, 55	A1	
	(b)	Correctly drawn graph	A3	
	(c)	Correct reading	A1	
	(d)	Identifying 37	A1	
		55 – 37 = 18	A1	
	(e)	box plot median, quartiles, limits of range	A1, A1, A1	10
3	**(a)**	$3x = 9$ $x = 3$ $y = -2$	 MA1 MA1	
	(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
4	**(a)**	$\tan 48° = \frac{RS}{13}$	MA1	
		RS = 13 tan 48° RS = 14.4 (14.438)	MA1 A1	
	(b)	PR = $\sqrt{(5^2 + 13^2)} = \sqrt{194}$ (13.9)	MA1	
		RPS = $\tan^{-1}$ (13 tan 48/$\sqrt{194}$)	MA1	
		RPS = 46.03 ($\tan^{-1}$(14.4/13.9) = 46.01)	A1	6
5	**(a)**	$\frac{5}{2}$	MA1	
	(b)	$y = \frac{5}{2}x + 2$	MA1, MA1	3

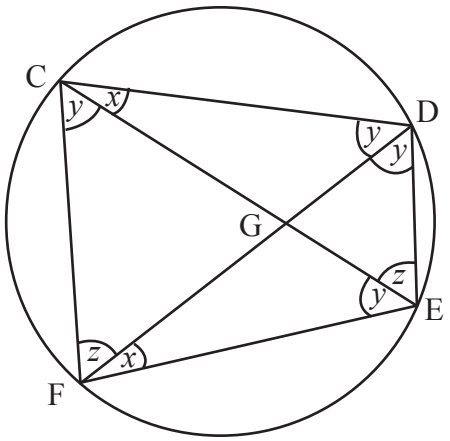
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				AVAILABLE MARKS
6	**(a)**	Angle EBC = 90°	A1	
	(b)	Angle ABE = 32°	A1	
	(c)	Angle BAE = 116°	A1	
	(d)	Angle BCE = 64°	A1	
	(e)	Angle BED = 46°	A1	5
7	**(a)**	e.g. Only sampling Year 8 pupils	A1	
	(b)	e.g. Pupils at end of list miss out	A1	
	(c)	**(i)** $57 \times \frac{50}{600}$ or using $\frac{1}{12}$	MA1	
		$4.75 \rightarrow 5$	A1	
		(ii) No, because $82 \times \frac{50}{600} = 6.83\ldots \rightarrow 7$		
		and $41 \times \frac{50}{600} = 3.416\ldots \rightarrow 3$	MA2	6
8	**(a)**	$3(p^2 - 25q^2)$	MA1	
		$3(p + 5q)(p - 5q)$	MA2	
	(b)	$(x - 8)(x + 3) = 0$	MA2	
		8 **or** –3	MA1	6
9	**(a)**	$\frac{-1}{3}$	MA1	
		$y = -\frac{1}{3}x + 4$	MA1	
	(b)	$12p^2 - 21pq + 8pq - 14q^2$	MA2	
		$12p^2 - 13pq - 14q^2$	MA1	5

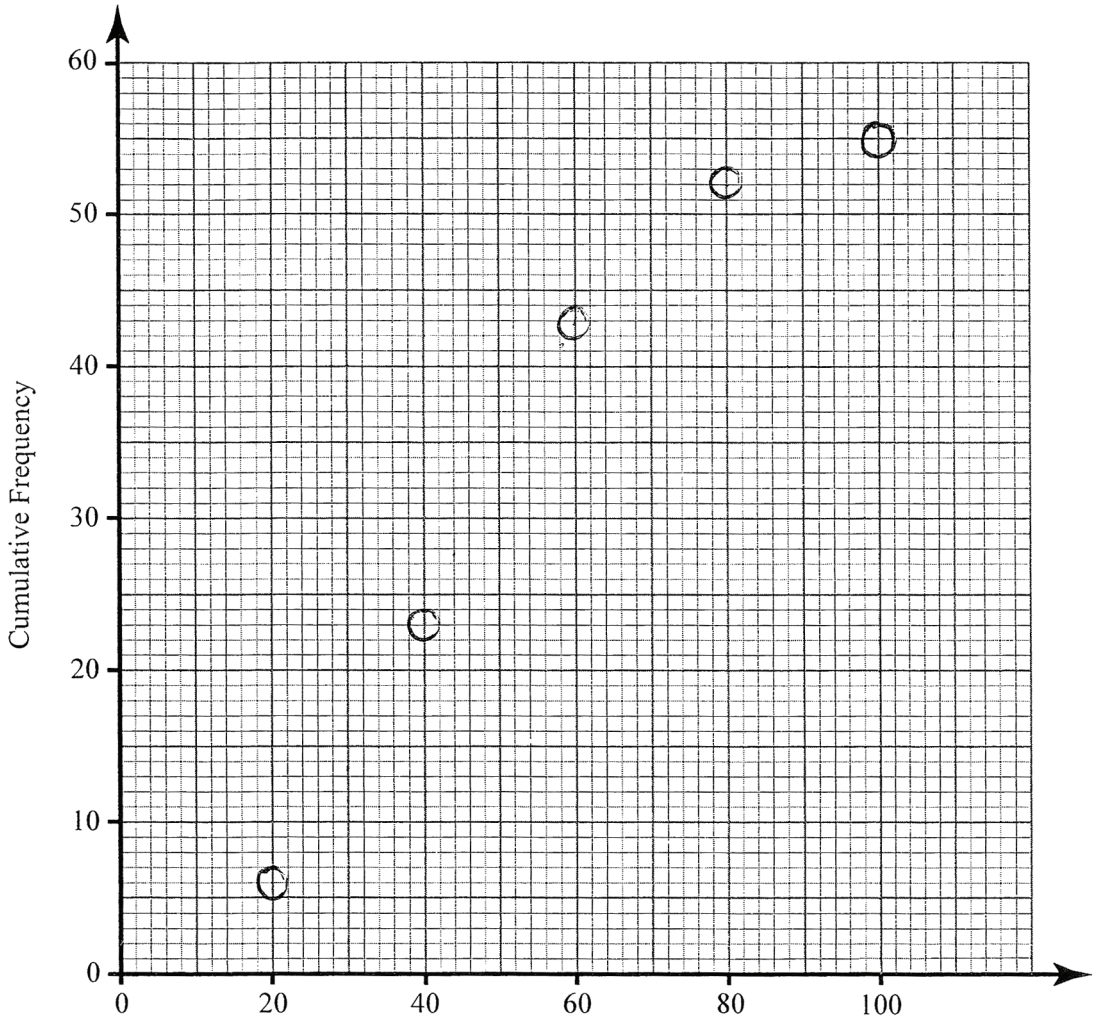
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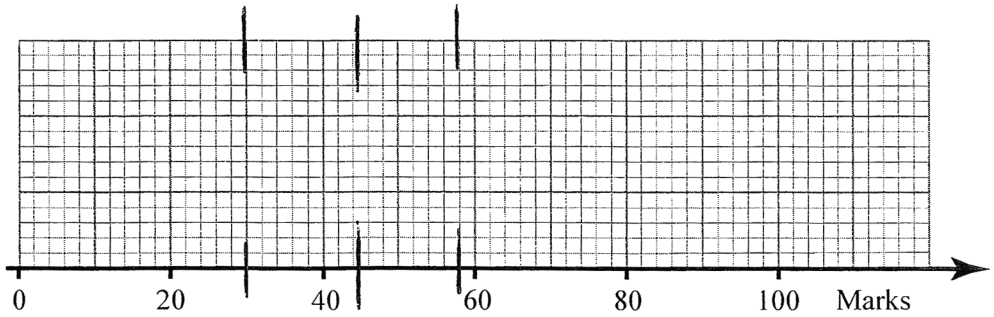
			AVAILABLE MARKS
10	**(a)** $y = \frac{k}{x^2}$		
	$4 = \frac{k}{9}$		
	$k = 36$	MA1	
	$y = \frac{36}{x^2}$	A1	
	(b) $y = \frac{36}{144}$	MA1	
	$= \frac{1}{4}$		
	(c) When x is doubled the denominator becomes 4 times bigger therefore y becomes 4 times smaller	A2	5
11	**(a)** Area $= \frac{1}{2}80 \times 264 \sin 44$	MA1	
	$= 7335.6\ \text{m}^2$	A1, A1 units	
	(b) Let M = midpoint		
	$\text{AM}^2 = 80^2 + 132^2 - 2 \times 80 \times 132 \cos 44$	MA1	
	$\text{AM} = \sqrt{8631.543417}$	MA1	
	$\text{AM} = 92.9$	A1	6
12	**(a)** $x^2 + (x-5)^2 = 144$	MA1	
	$x^2 + x^2 - 10x + 25 = 144$	A1	
	$2x^2 - 10x - 119 = 0$	MA1	
	(b) $x = \frac{10 \pm \sqrt{1052}}{4}$	MA2	
	$x = 10.6$	MA1	6
13	**(a)** 70 and 20	A1, A1	
	(b) Two bars drawn to correct heights (6.8 and 9.6)	A1, A1	
	(c) 7.5 + 52.5	MA1	
	60	A1	
	(d) $\frac{x}{60} \times 20$ **or** $\frac{144}{40} = 3.6, 3.6 \times 20 = 72$	MA1	
	$\frac{x}{3}$ $h = \frac{x}{60} \times 20 = \frac{x}{3}$	A1	8

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			AVAILABLE MARKS
14	$\left(\frac{8}{27}\right)^{-\frac{4}{3}} = \left(\frac{27}{8}\right)^{\frac{4}{3}} = \left(\sqrt[3]{\frac{27}{8}}\right)^4 = \left(\frac{3}{2}\right)^4 = \frac{81}{16}$	MA2	
	$0.25^{-2} = \left(\frac{1}{4}\right)^{-2} = 4^2 = 16$	MA1	
	$\frac{81}{\cancel{16}} \times \cancel{16} = 81$	A1	4
15	**(a)** Since triangle ANB is isosceles $(180 - 120)/2 = 30$	A1	
	(b) $\frac{AN}{\sin 30} = \frac{25}{\sin 120}$ **or** $\cos 30° = \frac{12.5}{AN}$	MA1	
	$AN = \frac{25 \sin 30}{\sin 120}$ $AN = \frac{12.5}{\cos 30°}$	MA1	
	$AN = 14.4$ (14.43376) $AN = 14.4$ (14.43376)	A1	
	(c) Let x = length of OA and OB		
	$2x^2 = 25^2$	MA1	
	$x = \sqrt{(25^2/2)} = 17.68$	MA1	6
16	$x^2 + 2qx + q^2$	MA1	
	$2q = -8 \quad q = -4$	MA1	
	$p = (-4)^2 = 16$	MA1	3
17	$\frac{2(3x-2) + 6(x+1)}{(x+1)(3x-2)} = 1$	M1, A1	
	$6x - 4 + 6x + 6 = 3x^2 - 2x + 3x - 2$	MA1	
	$3x^2 - 11x - 4 = 0$	MA1	
	$(3x + 1)(x - 4) = 0$	MA2	
	$x = -\frac{1}{3}$ **or** 4	MA1	7
18			
	CGD = 180 – $(x + y)$		
	$x + y + y + z = 180$ (cyclic quad)		
	$y + z = 180 - (x + y)$		
	CGD = FED	A3	3
		Total	**100**

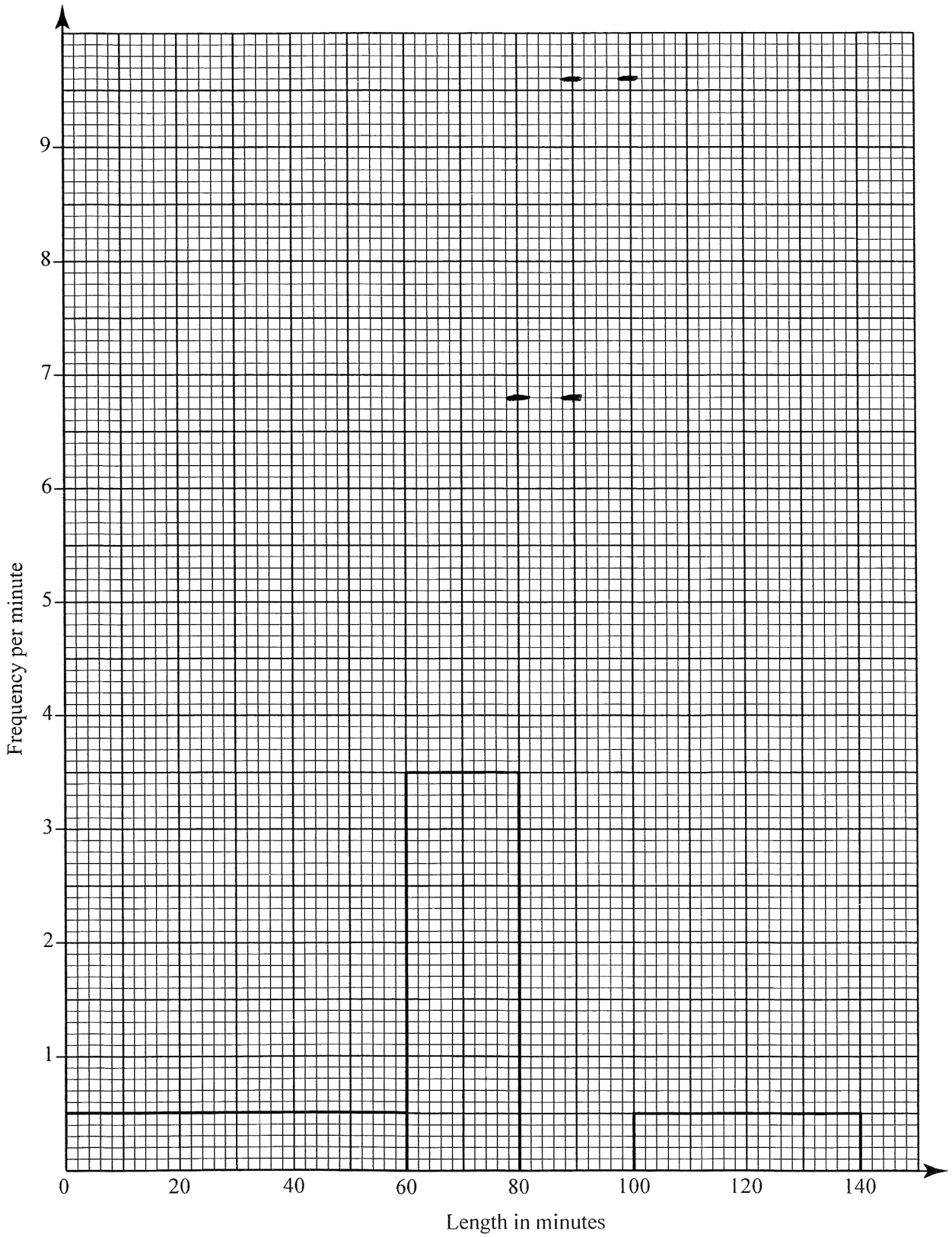
GCSE NEW SPEC MATHEMATICS JANUARY 2012
UNIT T4
OVERLAYS QUESTION 2





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GCSE NEW SPEC MATHEMATICS JANUARY 2012
UNIT T4
OVERLAYS QUESTION 13



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New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011

Mathematics



Unit T4
(With calculator)
Higher Tier

[GMT41]

GMT41

TUESDAY 31 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.
Write your answers in the spaces provided in this question paper.
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

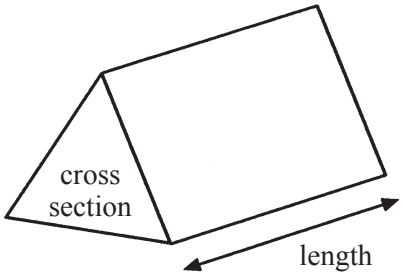
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **question 11**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is overleaf.

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	
Total Marks	

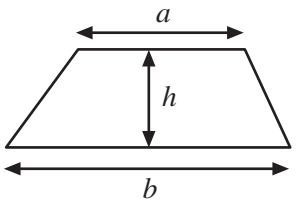
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Formula Sheet

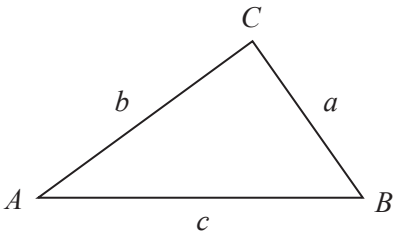
Volume of prism = area of cross section × length



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



In any triangle *ABC*



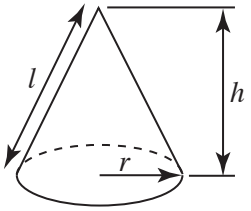
Sine Rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

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

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

Curved surface area of cone $= \pi rl$



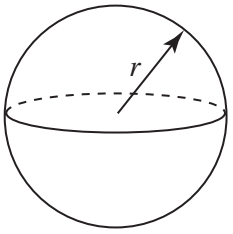
Quadratic Equation

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 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]

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Examiner Only	
Marks	Remark

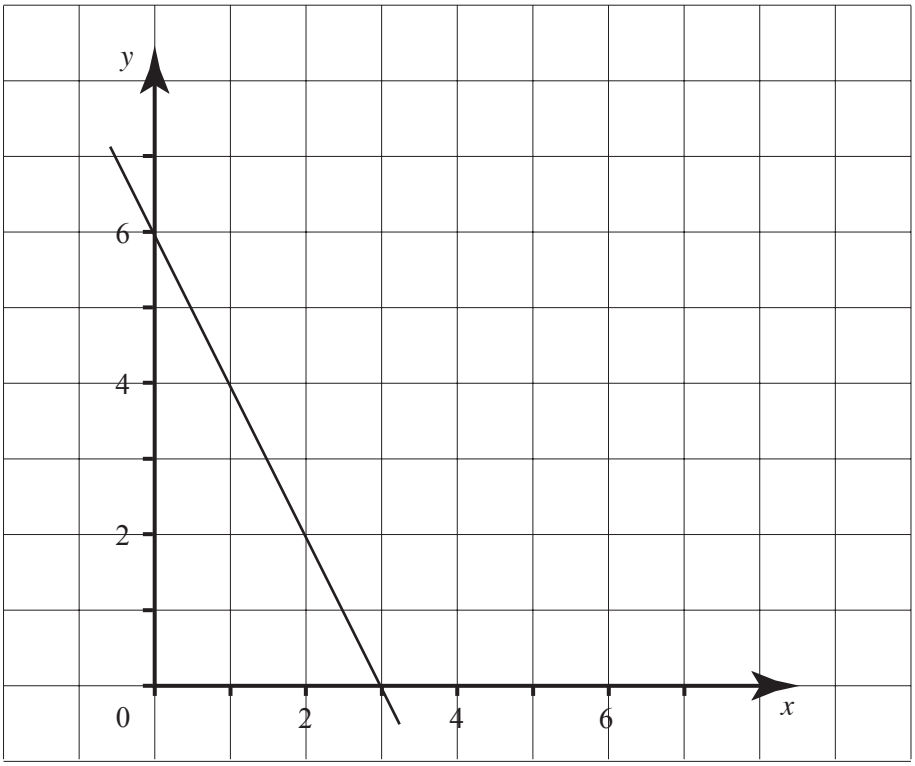
2 **(a)** Solve the equation $\frac{2x-4}{5}+\frac{x+11}{2}=2$

Show your working.

A solution by trial and improvement will not be accepted.

Answer $x =$ _____ [4]

(b)



Write down the equation of this line in the form $y = mx + c$.

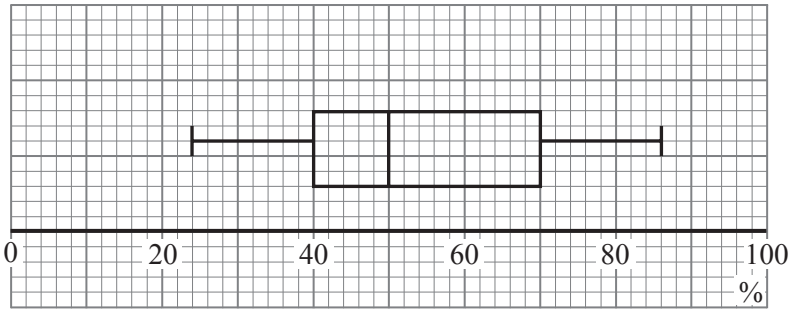
Answer _____ [3]

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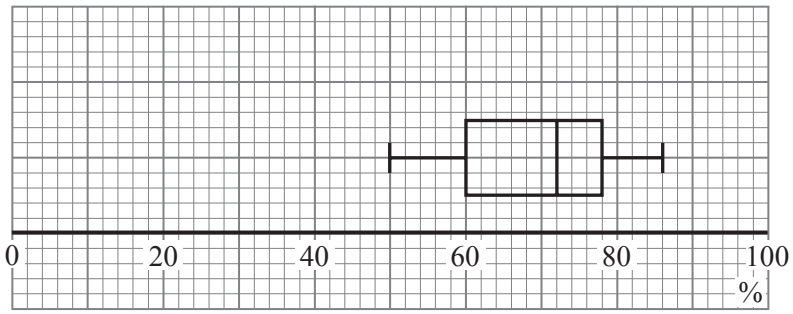
3 The box plots show the distribution of test results for two different classes.

Examiner Only	
Marks	Remark

Class P



Class Q



Comment on **two** differences between the classes.

1. _____

_____ [1]

2. _____

_____ [1]

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Examiner Only	
Marks	Remark

4 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]

---

5 **(a)** In the diagram O is the centre of the circle.

SOQ is a straight line.

Angle ORQ = 41° and angle PQS = 24°

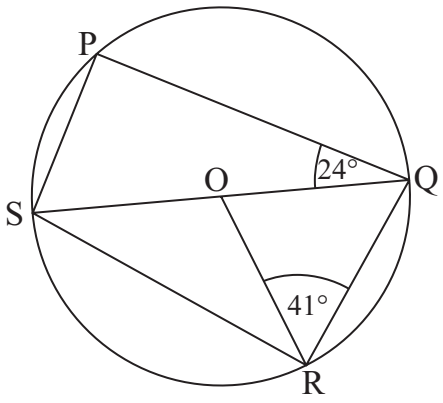


diagram not drawn accurately

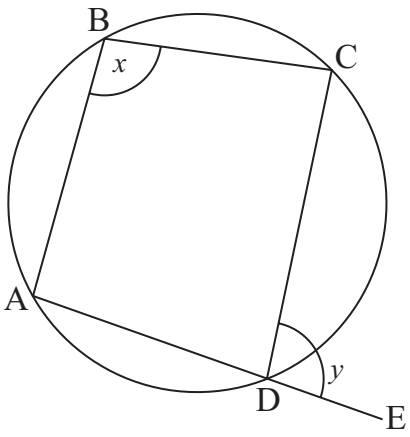
Find the size of the following angles:

(i) OQR = _____° [1]

(ii) PSQ = _____° [1]

(iii) PSR = _____° [1]

(b) Show that the exterior angle of the cyclic quadrilateral equals the interior opposite angle (i.e. $x = y$).



[3]

Examiner Only	
Marks	Remark

---

6 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]

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7 The graph opposite shows the cumulative frequency of scores obtained in a darts tournament.

Examiner Only	
Marks	Remark

(a) Use the graph to estimate

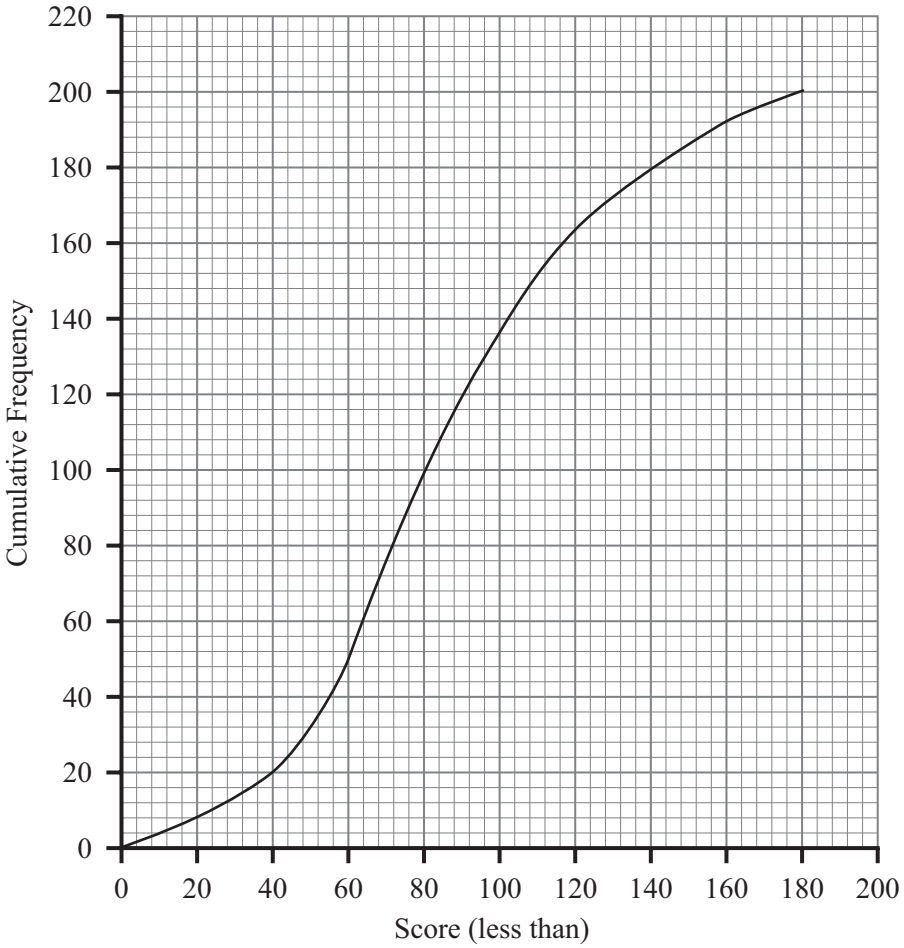
(i) the median,

Answer _____ [1]

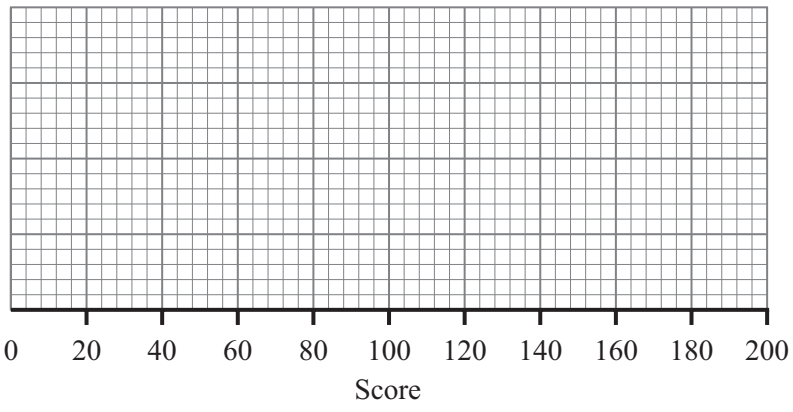
(ii) how many scores were more than 150

Answer _____ [2]

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(b) From the graph draw a box plot.



[3]

Examiner Only

Marks	Remark

8 **(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]

(c) 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]

Examiner Only	
Marks	Remark

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9 Each year a car lost 20% of its value at the beginning of the year. After how many whole years was it worth less than half of its original value?

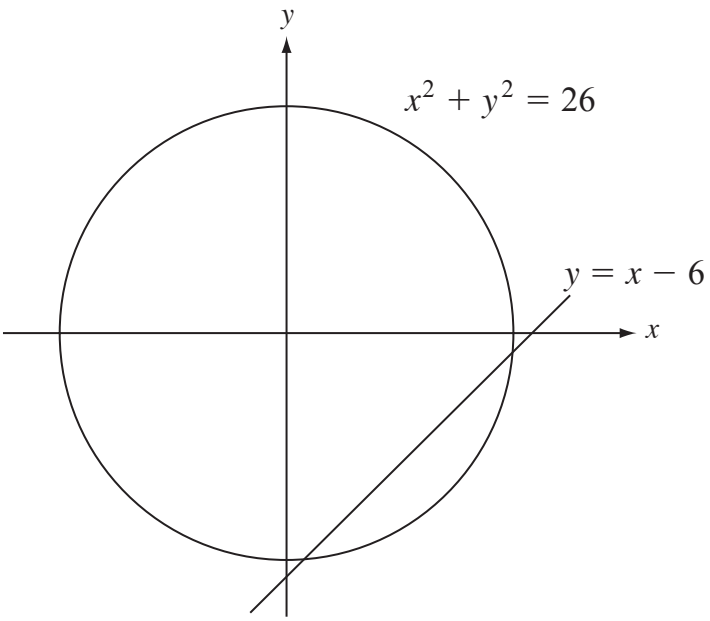
Show your working.

Answer _____ years [3]

Examiner Only	
Marks	Remark

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10 The diagram shows the intersection of the line $y = x - 6$ with the circle with equation $x^2 + y^2 = 26$



(a) Show that the x co-ordinates of the points of intersection of the line with the circle can be found from the solutions to the equation $x^2 - 6x + 5 = 0$

[3]

(b) Hence find the co-ordinates of the points of intersection of the line and the circle.

Answer (____,____) (____,____) [3]

Examiner Only	
Marks	Remark

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Quality of written communication will be assessed in this question.

Examiner Only

Marks	Remark

11 The table shows information about 600 workers in a factory.

Age, a years	Number of Males	Number of Females
$20 \leq a < 30$	99	26
$30 \leq a < 40$	142	48
$40 \leq a < 50$	124	64
$50 \leq a < 60$	55	22
$60 \leq a < 70$	20	0

The manager wants to carry out a survey of the workers' views on the workplace. He decides to choose a sample of 80 workers to take part in the survey.

(a) From an alphabetical list of workers' names, he selects every 5th name until he has 80 names.

Explain why this may not produce a fair sample.

Answer _____

_____ [2]

(b) Explain how to take a stratified sample of 80 workers for this data.

[2]

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Examiner Only	
Marks	Remark

12 **(a)** y is inversely proportional to the square of x and $y = 10$ when $x = 2$

Express y in terms of x.

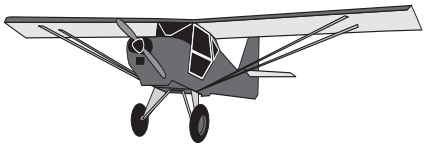
Answer _____ [3]

(b) Calculate the value of y when $x = 5$

Answer _____ [1]

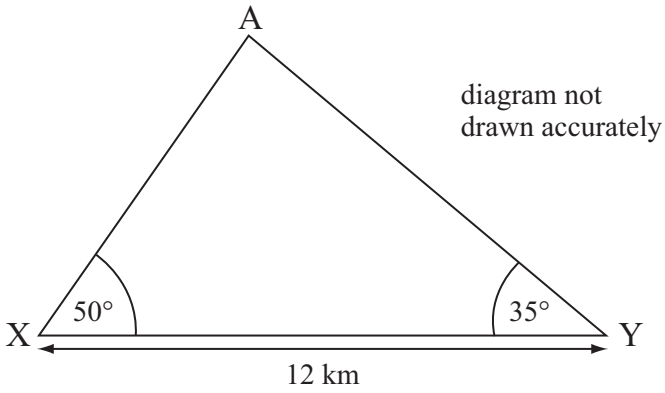
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13 A small aircraft, located at position A in the sketch diagram, develops an engine fault while flying between two landing strips located at positions X and Y in the diagram.



The angles from X and Y to the aircraft are 50° and 35° respectively. The aircraft must land as quickly as possible. How much closer is X than Y from A?

Show all working.



Answer _____ km [4]

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14 **(a)** Simplify

$$\frac{x^2+3xy-5x-15y}{2x^2-10x}$$

Answer _____ [4]

(b) Hence write down a negative value of x and the corresponding positive value of y for which

$$\frac{x^2+3xy-5x-15y}{2x^2-10x}=0$$

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

Examiner Only	
Marks	Remark

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15 The table gives information about the weights of 100 children.

Weight, w kg	Number of children
$20 \leq w < 30$	16
$30 \leq w < 35$	28
$35 \leq w < 40$	36
$40 \leq w < 60$	18
$60 \leq w < 65$	2

(a) Illustrate the data by drawing a histogram, **A**, on the graph paper opposite. [3]

(b) A stratified sample of 20 children was taken from those whose weight was less than 40 kg.

How many of the sample were taken from the interval $35 \leq w < 40$?

Answer _____ [2]

(c) The histogram **B**, already drawn, illustrates the weights of a different group of 100 children. Compare this histogram with the one you have drawn. Give **two** comparisons.

1. _____

_____ [1]

2. _____

_____ [1]

(d) Suggest a reason for the difference in the two histograms.

Answer _____

_____ [1]

(e) Calculate an estimate for the mean weight of the children in histogram **B**.

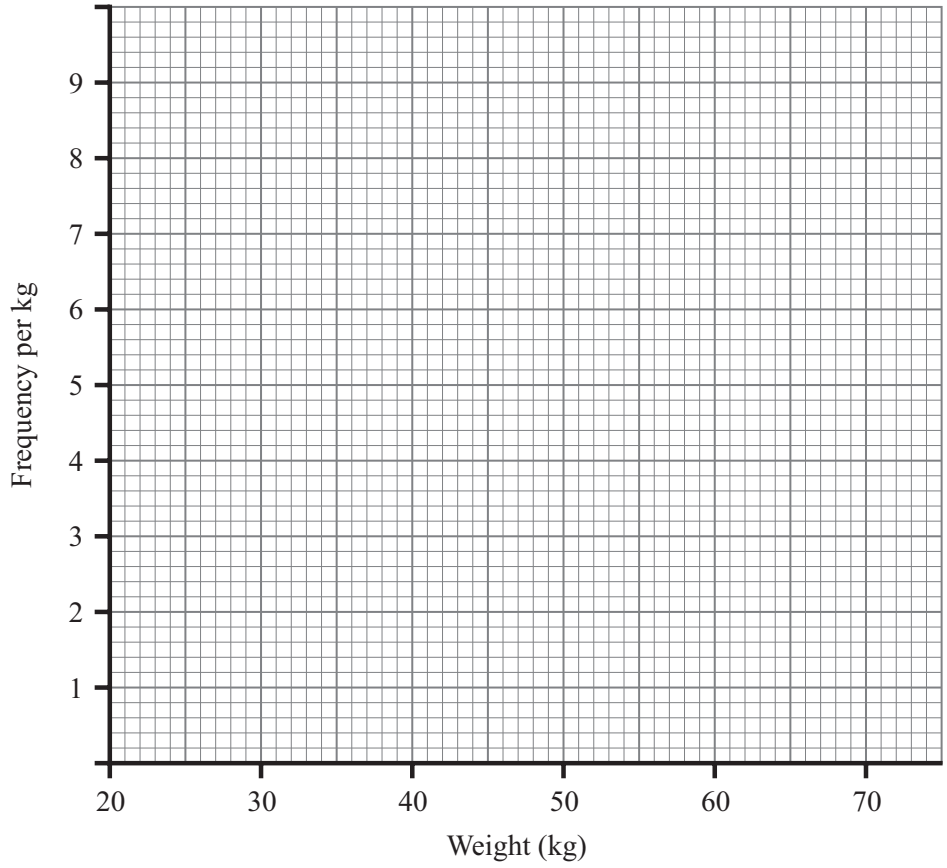
Answer _____ kg [4]

Examiner Only

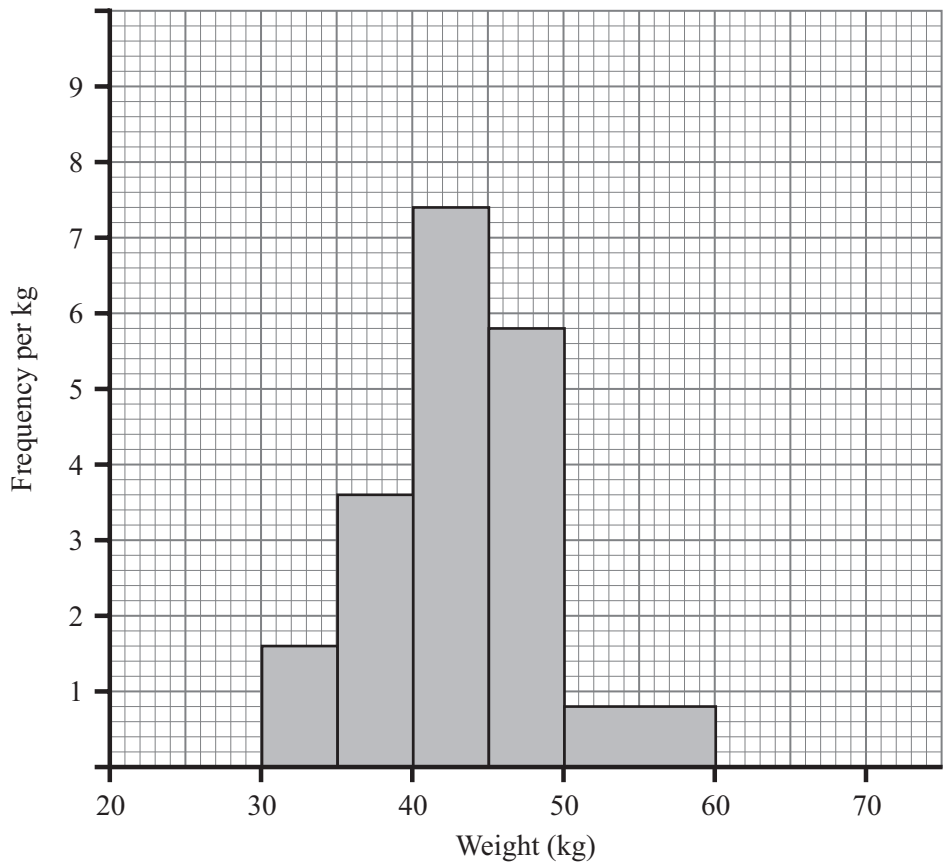
Marks	Remark

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A



B



Examiner Only	
Marks	Remark

16 (a) Evaluate $289^{\frac{1}{2}}$

Answer _____ [1]

(b) (i) m, n are integers and $2^m = \dfrac{1}{4^n}$

Write m in terms of n

Answer $m =$_____ [2]

(ii) m, n are integers and $2^m = \dfrac{1}{2}\left(\dfrac{1}{4^n}\right)$

Write m in terms of n

Answer $m =$_____ [2]

17 Solve $\dfrac{10}{2x-5} + \dfrac{7}{x+2} = 3$

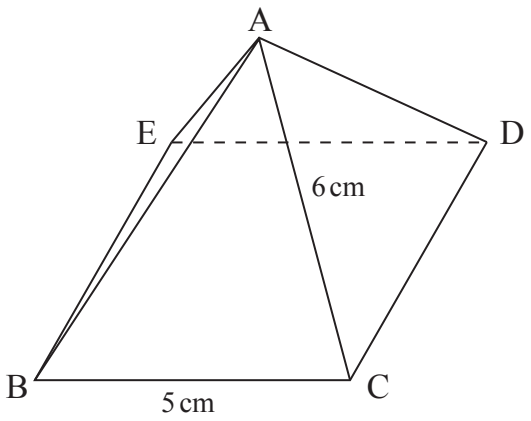
Answer _____ [6]

Examiner Only

Marks	Remark

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18



The square-based pyramid has four faces which are isosceles triangles.

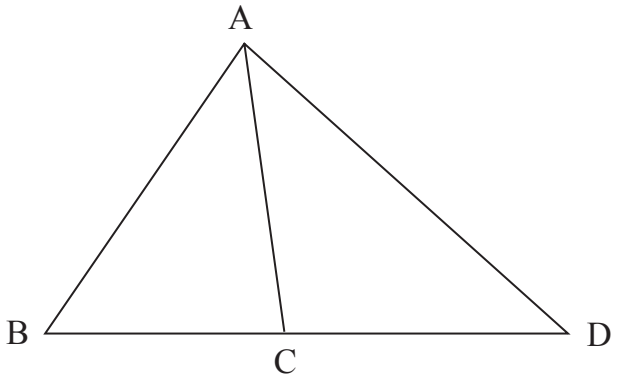
Calculate the angle between AB and the base.

Answer _____° [4]

Examiner Only	
Marks	Remark

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19



AB = 6.2 cm, angle BAC = 35° and the area of triangle ABC is 9.2 cm^2.

AD = 10.5 cm and CD = 6.4 cm.

Calculate the area of the triangle ACD.

Answer _____ cm^2 [8]

Examiner Only

Marks	Remark

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THIS IS THE END OF THE QUESTION PAPER

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New Specification

Rewarding Learning

General Certificate of Secondary Education
2011

Mathematics

Unit T4
Higher Tier

[GMT41]

TUESDAY 31 MAY
9.15 am–11.15 am

MARK SCHEME

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GCSE MATHEMATICS 2011

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 **M0 A1** 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);

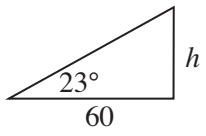
(ii) select and use a form and style of writing appropriate to their purpose and to complex subject matter (i.e. reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning);

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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		diagram A1	
	$\tan 23° = \frac{h}{60}$	MA1	
	$h = 60 \tan 23°$	MA1	
	$= 25\ (.468)$	A1	4
2	**(a)** $2(2x - 4) + 5(x + 11) = 20$	MA1	
	$4x - 8 + 5x + 55 = 20$	MA1	
	$9x + 47 = 20$	MA1	
	$9x = -27$		
	$x = -3$	MA1	
	(b) grad $= -2$ $\quad y = -2x + 6$	MA1, A1, A1	7
3	suitable comments e.g.		
	median and/or quartiles higher for class Q	A1	
	range or IQR or spread is greater for class P	A1	2
4	103.5	A1	
	112.5	A1	2
5	**(a)** **(i)** 41	A1	
	(ii) 66	A1	
	(iii) 115	A1	
	(b) ADC $+ x = 180$ reason	A1	
	$y +$ ADC $= 180$ reason	A1	
	so $x = y$	A1	6
6	88% = £63.36	MA1	
	$= \frac{63.36}{0.88}$ *OR* $\frac{63.36}{88} \times 100$	MA1	
	$= 72$	A1	3

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					AVAILABLE MARKS
7	**(a)**	**(i)**	80	MA1	
		(ii)	$200 - 186$	MA1	
			14	A1	
	(b)		median at 80	A1	
			quartiles at 60 and 110	A1	
			range	A1	6
8	**(a)**		$3a(3a - y)$	A2	
			$3(3a^2 - ay)$ or $a(9a - 3y)$ allow A1		
	(b)	**(i)**	$(x + 3)(x - 2)$	A2	
		(ii)	-3 and 2	A1	
	(c)		$4x + 3y = 1$ *OR* $4x + 3y = 1$		
			$4x - 2y = -4$ $4x - 3y = -6$	MA1	
			$y = 1$ *OR* $x = -\frac{1}{2}$	MA1	
			$x = -\frac{1}{2}$ *OR* $y = 1$	MA1	8
9			0.8, 0.64, 0.512, 0.4096	M1, A1	
			Ans 4	A1	3
10	**(a)**		$x^2 + (x - 6)^2 = 26$	MA1	
			$x^2 + x^2 - 12x + 36 = 26$		
			$2x^2 - 12x + 10 = 0$	MA1	
			$(\div 2)\ x^2 - 6x + 5 = 0$	MA1	
	(b)		$(x - 5)(x - 1) = 0$	MA1	
			$x = 5, x = 1$	MA1	
			$(5, -1)$ and $(1, -5)$	MA1	6
11	**(a)**		suitable explanation e.g. workers with names at the end of the alphabet have no chance of being in the sample	A2	
			e.g. some of the groups in the table may not be fairly represented	A1	
			it is not a random sample	A1	
			all workers do not have an equal chance of being in sample	A1	
				(QWC)	
	(b)		explanation	A2	4
			using $\frac{80}{600}$; of each category	(QWC)	

			AVAILABLE MARKS
12	**(a)** $y = \frac{k}{x^2}$		
	$10 = \frac{k}{4}$	M1, A1	
	$y = \frac{40}{x^2}$	A1	
	(b) $y = \frac{40}{25}$ or 1.6	A1	4
13	$\frac{12}{\sin 95} = \frac{AX}{\sin 35} = \frac{AY}{\sin 50}$	MA1	
	$AX = \frac{12 \sin 35}{\sin 95}$ $\quad$ $AY = \frac{12 \sin 50}{\sin 95}$	MA1	
	$= 6.9$ km $\quad$ $= 9.2$ km	MA1	
	Answer 2.3	A1	4
14	**(a)** $x(x+3y)-5(x+3y)$	MA1	
	$\frac{(x-5)(x+3y)}{2x(x-5)}$	MA1	
		MA1	
	$\frac{x+3y}{2x}$	A1	
	(b) $\frac{x+3y}{2x} = 0 \rightarrow x + 3y = 0$		
	choose $-$ve x and corresponding y e.g. -3, 1 -6, 2 etc.	M1, A1	6

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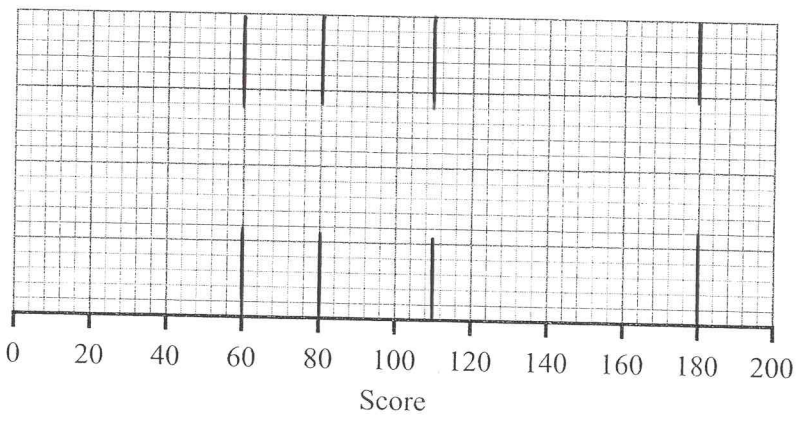
			AVAILABLE MARKS
15	**(a)** 1.6, 5.6, 7.2, 0.9, 0.4	M1, A1	
	graph	A1	
	(b) $36 \times \frac{20}{80}$	M1	
	9	A1	
	(c) **(i)** weights of second group are on average higher	A1	
	(ii) weights of first group are more spread out	A1	
	(d) suitable reason e.g. first group could be girls and second group boys or second group could be older children	A1	
	(e) f x fx 8 32.5 260 18 37.5 675 37 42.5 1572.5 29 47.5 1377.5 8 55 440 4325 mean = 43.25	f M1, A1 fx MA1 A1	12
16	**(a)** 17	A1	
	(b) **(i)** $-2n$ allow 1 for $2n$ or $-n$	M1, A1	
	(ii) $-2n - 1$	A2	5
17	$10(x + 2) + 7(2x - 5) = 3(2x - 5)(x + 2)$	M1	
	$10x + 20 + 14x - 35 = 3(2x^2 - 5x + 4x - 10)$	MA1	
	$24x - 15 = 6x^2 - 3x - 30$	MA1	
	$6x^2 - 27x - 15 = 0$	MA1	
	$3(2x^2 - 9x - 5) = 0$		
	$(2x + 1)(x - 5) = 0$	MA1	
	$x = -\frac{1}{2}$ or 5	MA1	6

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			AVAILABLE MARKS
18	angle ABD recognised	MA1	
	$\frac{1}{2}BD = \frac{1}{2}\sqrt{5^2+5^2} = 3.5355$	MA1	
	$\cos^{-1}\frac{3.5355}{6}$	MA1	
	angle = 53.9	A1	4
19	Area $ABC = \frac{1}{2} \times 6.2 \times AC \times \sin 35°$	M1	
	$9.2 = \frac{1}{2} \times 6.2 \times AC \times (0.57357)$	A1	
	$AC = 5.1741$	A1	
	cos rule for angle in ACD or cos rule for angle ADC	M1	
	e.g. $\cos CAD = \frac{AC^2 + AD^2 - CD^2}{2 \times AC \times AD}$		
	$= \frac{5.1741^2 + 10.5^2 - 6.4^2}{2 \times 5.1741 \times 10.5}$		
	$= 0.884$	A1	
	angle $CAD = 27.86°$ angle $ADC = 22.1969°$	A1	
	Area $ACD = \frac{1}{2} \times 5.1741 \times 10.5 \times \sin 27.86°$	M1	
	$= 12.69$	A1	8
	Area $ACD = \frac{1}{2} \times 10.5 \times 6.4 \times \sin 22.1969°$		
	$= 12.69$		
	Total		**100**

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GCSE NEW SPEC MATHEMATICS SUMMER 2011
UNIT T4
OVERLAYS QUESTION 7B



GCSE NEW SPEC MATHEMATICS SUMMER 2011
UNIT T4
OVERLAYS QUESTION 15A

A

