OCR
RECOGNISING ACHIEVEMENT

GCSE

Mathematics A

General Certificate of Secondary Education

Unit **A501/02:** Mathematics A (Higher Tier)

Mark Scheme for January 2013

Oxford Cambridge and RSA Examinations

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Annotation	Meaning
	Correct
	Incorrect
	Benefit of doubt
	Follow through
	Ignore subsequent working (after correct answer obtained), provided method has been completed
	Method mark awarded 0
	Method mark awarded 1
	Method mark awarded 2
	Accuracy mark awarded 1
	Independent mark awarded 1
	Independent mark awarded 2
	Misread
	Special case
	Omission sign

These should be used whenever appropriate during your marking.

The **M**, **A, B**, etc annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks.
It is vital that you annotate these scripts to show how the marks have been awarded.
It is not mandatory to use annotations for any other marking, though you may wish to use them in some circumstances.

Subject-Specific Marking Instructions

1. **M** marks are for using a correct method and are not lost for purely numerical errors.
   A marks are for an accurate answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
   B marks are independent of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
   SC marks are for special cases that are worthy of some credit.

2. Unless the answer and marks columns of the mark scheme specify **M** and **A** marks etc, or the mark scheme is 'banded', then if the correct answer is clearly given and is not from wrong working **full marks** should be awarded.

   Do not award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen and the correct answer clearly follows from it.

3. Where follow through (**FT**) is indicated in the mark scheme, marks can be awarded where the candidate's work follows correctly from a previous answer whether or not it was correct.

   Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, eg FT 180 × (*their* '37' + 16), or FT 300 – $\sqrt{}$(*their* '$5^2 + 7^2$'). Answers to part questions which are being followed through are indicated by eg FT 3 × *their* (a).

   For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.

4. Where dependent (**dep**) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.

5. The following abbreviations are commonly found in GCSE Mathematics mark schemes.

   - **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point eg 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
   - **isw** means **ignore subsequent working** after correct answer obtained and applies as a default.
   - **nfww** means **not from wrong working**.
   - **oe** means **or equivalent**.
   - **rot** means **rounded or truncated**.
   - **seen** means that you should award the mark if that number/expression is seen anywhere in the answer space, including the answer line, even if it is not in the method leading to the final answer.
   - **soi** means **seen or implied**.

6. In questions with no final answer line, make no deductions for wrong work after an acceptable answer (ie **isw**) unless the mark scheme says otherwise, indicated for example by the instruction 'mark final answer'.

7. In questions with a final answer line following working space,

   (i) if the correct answer is seen in the body of working and the answer given on the answer line is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.

   (ii) if the correct answer is seen in the body of working but the answer line is blank, allow full marks. Place the annotation ✓ next to the correct answer.

   (iii) if the correct answer is seen in the body of working but a completely different answer is seen on the answer line, then accuracy marks for the answer are lost. Method marks could still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation × next to the wrong answer.

8. As a general principle, 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, mark the poorer (poorest).

9. When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the MR annotation. **M** marks are not deducted for misreads.

10. Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.

11. Ranges of answers given in the mark scheme are always inclusive.

12. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.

13. Anything in the mark scheme which is in square brackets […] is not required for the mark to be earned, but if present it must be correct.

Question			Answer	Marks	Part Marks and Guidance	
1			Angle 77° correct	1	Tolerance ± 2°	
			12.2 cm drawn accurately, FT *their* angle	1	Tolerance ± 2 mm	
			Remaining vertex in correct position FT, with compass arcs drawn correctly	2	**B1FT** if no compass arcs Or **M1FT** if correct arcs with error in one of the lengths If they ignore line given and start again, mark accordingly, but for the first mark their line must be 8.5 to 8.9 cm	Use deviation of top left hand vertex from ideal, if in tolerance, to help judge acceptable position for final vertex If in doubt of tolerance, check with the protractor and/or ruler instead of the multi-line overlay
2	(a)		33.6, $\frac{168}{5}$ or $33\frac{3}{5}$	2	**B1** for other answers rounding to 33.6 or for both 282.24 and 8.4 seen oe as fractions	**B0** for correct answer seen then spoilt since obtainable from 3.6 × 2 + 13.2 × 2
	(b)		$4 + (5 \times 6)^2$	1	Condone extra pairs of superfluous brackets	
	(c)	(i)	$2^3 \times 3 \times 5$	2	Product required but indices need not be used **M1** for 2, 3, 5 and no others or for factor tree or division with at least two of 2, 3 and 5 found as factors	

Question			Answer	Marks	Part Marks and Guidance	
		(ii)	840	3	**M2** for 120×7 or $2^3 \times 3 \times 5 \times 7$ oe or for correct Venn diagram or for lists of multiples of each of 120 and 42 where both lists go past 400 (condoning one error) Or **M1** for $42 = 2 \times 3 \times 7$ oe (eg seen in Venn diagram or factor tree or division; product not required) or for lists of at least 4 multiples of each of 120 and 42 (condoning one error)	Lists may start with 120 and 42 or eg 240 and 84 or higher
3	**(a)**		$18y + 30$ as final answer	1		
	(b)		$5(y - 3)$ as final answer	1	oe Condone omission of final bracket; allow inclusion of multiplication sign	
	(c)		$\frac{13}{2}$ as final answer	3	oe ignore subequent conversion **M2** for $2x = 13$ Or **M1** for one side of this correct or for x terms or constant term collected correctly AND **M1** for *their* answer correct FT (rot to at least one dp if needed), after at least **M1** earned	eg **M1** for $2x - 2 = 11$ eg allow final **M1** for 1.08 after $12x = 13$
4	**(a)**	**(i)**	45	2	**M1** for $\frac{5}{8} \times 72$ oe or $\frac{5}{\textit{their}(1+2+5)} \times 72$ oe or for [1 share =] 9 or for 9 : 18 : 45 as answer	

Question			Answer	Marks	Part Marks and Guidance	
		(ii)	1440	2	**M1** for $\frac{8}{2}\times 360$ oe or for [1 share =] £180	
	(b)		59.33 to 59.34 or 59.3(0)	4	**M1** for midpoints 10, 30, 50 etc seen or used **M1** for *their* midpoints × freq (20, 150, 350, 770, 270, 220; total 1780) **M1** for (*their* sum of midpoints × freq) ÷ 30 Allow **A1** for 59 if **M3** earned	At least three of them seen; may be implied by products Allow 9.99, 29.99, 49.99 etc At least 3 correct or total seen Accept 19.98, 149.95, 349.93, 769.89, 269.97, 219.98; total 1779.7 Allow first two **M1**s if seen even if another method used for answer on answer line Second and third **M**s are available for '*their* midpoints' being an attempt using other points in interval, or endpoints (at least 3 seen) Allow **M0M0M1** for 600/30 following consistent use of class-width 20 instead of midpoints Answers of 69.33 to 69.34 or 69.3(0) (or 49.33 to 49.34 or 49.3(0)) imply second and third **M1**s
5	**(a)**		C = 30 + 25n oe	2	**M1** for 25n oe	Must have C = for **2** marks Ignore £ signs; accept 25 × n; condone n25 and N used for n

Question			Answer	Marks	Part Marks and Guidance	
	(b)		2.5 oe	2	**M1** for 62.5(0) = 25*n* or for 62.5(0)/25 Allow **SC2** for answer 2 < *n* < 2.5 with justification that Dave's Plumbing may round times up to next half hour	Allow **2** for 2h 30m Allow **M1** for 25 × 2.5 + 30 = 92.50 or similar as answer
6			998 and 200 correctly on answer lines	3	**SC2** for 5 × 200 – 2 = 998 seen with answer lines not completed correctly (eg final answer wrong or they may not realise 200th term) Or **B1** for 998 on an answer line And **M1** for 200 on an answer line or for 5*n* – 2 = 998 or 5*n* = 1000 or for at least two correct trials of 5*n* – 2 with outcomes between 900 and 1100 for clear values of *n*, with *n* an integer If **0** in question, then **SC1** for 3, 8 and 13 found (first three terms) or for any three trials of 5*n* – 2 with correct outcomes for clear values of *n*, with *n* an integer	**SC2** for eg *n* = 200→998 oe

Question			Answer	Marks	Part Marks and Guidance	
7	(a)		± 3	3	Both required **B2** for one solution or for $x = \pm \sqrt{9}$ or for $2x = \pm 6$ Or **B1** for $x^2 = 9$ oe or $x = \sqrt{\frac{36}{4}}$ or for $2x = 6$ OR **SC1** for $3^2 = 9$ or $4 \times 3^2 = 36$ **SC1** for $(^-3)^2 = 9$ or $4 \times (^-3)^2 = 36$	ie **2** marks if one step away from full marks, **1** mark if two steps away
	(b)		$[A =] 6c^2$	2	nfww Accept unsimplified eg **2** for $A = 6 \times c^2$ **M1** for $c^2 = \frac{A}{6}$ or for $A = kc^2$ with $k \neq 6$ or for correct unsimplified expression for A eg $[A =](c\sqrt{6})^2$	Condone a instead of A
8			9.5(...)	4	nfww **M1** for $42^2 = 20.4^2 + w^2$ or other correct Pythagoras statement **M1** for $\sqrt{42^2 \pm 20.4^2}$ If at least **M1** earned, allow **B1** for final answer FT *their* width – 27.2 Allow **B3** for 36.7(...)	**0** for scale drawing

Question			Answer	Marks	Part Marks and Guidance	
9	(a)		4.240(2...)	3	**M2** for 5 × cos *their*(90 – 58) or for 5 × sin 58 Or **M1** for $\cos \textit{their}(90-58)=\frac{AD}{5}$ or for $\sin 58=\frac{AD}{5}$	Allow **M2** for complete correct method of sin followed by Pythagoras, and allow **A1** for answer to at least 4sf in range 4.239... to 4.2404... Condone poor notation such as $58\sin=\frac{AD}{5}$, but **M1** only for worse notation such as 58sin5 unless 4.240(2...) seen NB answer to 3 sf given – must have at least 4 figures shown for **3** marks

Question	Answer	Marks	Part Marks and Guidance	
(b)	108 to 109	6	Obtained from correct calculations	**M0** for scale drawing
			M1 for [BD =] 5 × sin *their*(90 – 58) or 5 × cos 58 or $\sqrt{5^2 - 4.24^2}$ (= 2.65 or to more sf) or for [BD^2 =] 7.02(...)	Or **M1** for $BC^2 = 5^2 + 12^2 - 2 \times 5 \times 12 \times \cos$ *their*(90 – 58) oe (eg BC^2 = 68.89...**or** BC = 8.3(0...))
			B1 for [DC =] 7.76 or to more sf	Or (instead of **B1M1**) **M1** for $\frac{\sin C}{5} = \frac{\sin(\textit{their}(90-58))}{\textit{their BC}}$ oe (accept inverted) And **M1FT** for $\sin C = \frac{\sin(\textit{their}(90-58))}{\textit{their BC}} \times 5$
			M1 for attempt at using tan with *their* BD and DC (or attempt at using cos with *their* BC and DC, following cos rule attempt)	
			M1 for inverse trig function seen or used	Allow last **M1** for inverse with any trig function
			A1 or B5 for BCD = 18.8 to 18.9° or DBC = 71.1 to 71.2°, with angle clearly identified; accept 71 for **A1** if method seen	If part marks are earned, a tick where each mark is earned will aid awarding the marks
			Allow **B4** for 18.8 to 18.9° or 71.1 to 71.2°, with angle **not** clearly identified; accept 71 with method seen	NB some relevant working for part (b) may have been done in part (a) or on the diagram.
			0 for eg 109° with no working and no scale drawing	Angle on diagram measures about 109°, so they will probably have measured this

Question			Answer	Marks	Part Marks and Guidance	
10	(a)		Longest time at 28.7 UQ at 16.7 Shortest time (7.7), LQ (12.7) and median (14.4) plotted correctly A complete box plot	1 1 1 1	Calculations seen or correct plots, for first two marks; ignore subsequent plots if calculations seen Plots must be in correct squares, condoning on their gridlines With box, whiskers and median line	 Use overlay Accept median line solid or dashed; condone lack of vertical lines on ends of whiskers if ends are clear
	(b)	(i)	Yes/True: median for 2009 = 13 to 13.5	1	Allow times for 2010 not quoted since given in (a), but if quoted, must be correct (14.4) Accept 'Yes they took 0.9 to 1.4 hours longer in 2010'	See exemplar comments Accept median further to right in 2010 Comments must make the year plain, but bod where correct values implies which year

Question			Answer	Marks	Part Marks and Guidance	
		(ii)	No/False: range for 2009 = 12.5 to 13.5 or IQR for 2009 = 2.6 to 3.2	1	Allow times for 2010 not quoted since given in (a), but if quoted, must be correct (range = 21.0, IQR = 4.0) May refer to length of box instead of IQR or to length of box plot instead of range **0** for just 'false since range is larger in 2010' oe; evidence in figures or in referring to size of box plot is needed	See exemplar comments Accept eg 'No, box for 2010 is longer' For box plot accept 'wider/longer' but not 'spread out' or 'varied' without values Comments must make the year plain, but bod where correct values implies which year
		(iii)	Can't tell oe or box plots give no information about numbers of swimmers	1		See exemplar comments Condone 'no we don't know' etc
11			a = 15/2 oe f(4) = 24	2 1	**M1** for 9 = 2a – 6 oe Or FT 4 × *their* a – 6, only if **M1** has been earned	

APPENDIX 1

Exemplar responses for question 10(b)(i)

(median for 2009 = 13 to 13.5, [and for 2010 = 14.4])

Response	**Mark awarded**
Yes. 2010 14.4 and 2009 13.2	1 both medians identified
True. The median is further along in 2010 than 2009. This shows that the average is higher	1 bod that further along means further to the right
Yes. The median in 2009 was 13.2	1
True because in 2009 their shortest time was 8 hrs	0
Yes because on the box plot it is longer	0
True. In 2009 the median was 13.3 and in 2010 it was 12.7	0 2010 figure wrong
No. The median in 2009 was 13.2	0 for no
Yes. The box plot shows us they started and finished earlier in 2009	0
Yes. In 2009 it was 13.2	0 no figure for 2010 and could be range not median
Yes because 50% of people in 2009 took less than just over 13 minutes whereas in 2010 50% of people took less than 14.4 minutes	0 minutes not hours
Yes because median in 2010 is larger	0

Exemplar responses for question 10(b)(ii)

(range for 2009 = 12.5 to 13.5 or IQR for 2009 = 2.6 to 3.2 [for 2010 range = 21.0, IQR = 4.0])

Response	Mark awarded
No. The 2009 IQR is between 2.9 and 3.0	1
False; the box is shorter in 2009	1 accept 'shorter' / smaller
False, 4 compared with 2.7	1 bod years and IQR from the figures
Incorrect. 2010 had a range of 21 hours and 2009 was only 12.5 hours	1
False. The times were more varied in 2010 as they had a larger range (7.7 to 28.7) than in 2009 (7.2 to 20.2) [bod since correct figures support their answer though actual range not calculated]	1 bod
The swimmers times were more varied in 2010, since the range was only 13.0 in 2009	1 since have 'more' instead of 'less'
False. Both years had about the same shortest time, but the slowest swimmer took much longer in 2010 than 2009	1
False; the box plot is much longer in 2010	1
False; the box plot is much more spread out in 2010	0 no value and 'spread out' not sufficient
There was a larger range in 2010	0 needs evidence
There was a larger range in 2010 so the results were more varied than 2009	0 needs 2009 value and is wrong way round
Not true. The ranges are both equal	0
No, because both swims still start at the same time	0
No, the time was more varied in 2009	0
False. The times were more varied in 2010 from 7.7 to 21.0 [have used range as highest time; and need 2009 figures]	0
Yes, less varied in 2009 as IQR was 4 in 2010 and 3 in 2009	0 should be No/False

Exemplar responses for question 10(b)(iii)

Response	Mark awarded
There is no way to tell this as only times are shown	1
Could be true or false but the data does not give this information	1
The data does not show how many swimmers there were	1
False. It only shows how long they took	1
There is no evidence to say there were more in 2010	1
I disagree with this statement as there is no proof. From the graph we cannot see whether there is more swimmers or not	1
I cannot tell	1
It may suggest this but there is no evidence to support this statement	1 bod
Only gives details of times not competitors	1
False as you can't get this information from the graph	1
The higher numbers suggest more people swam in 2010	0
There was more because we can see the box is longer	0
No this info cannot be shown from the box plot since it only shows averages	0 no idea that box plot not about nos. of swimmers

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