

Mathematics A

General Certificate of Secondary Education

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

Mark Scheme for June 2011

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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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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 $180 \times (\textit{their} '37' + 16)$, or FT $300 - \sqrt{(\textit{their} '5^2 + 7^2')}$. Answers to part questions which are being followed through are indicated by eg FT $3 \times \textit{their} (a)$.

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.
 - **cao** means **correct answer only**.
 - **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).
 - **nfw** 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. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise, indicated for example by the instruction 'mark final answer'.
 7. 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).
 8. 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.
 9. 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.
 10. If the correct answer is seen in the body and the answer given in the answer space is a clear transcription error allow full marks unless the mark scheme says 'mark final answer' or 'cao'. Place the annotation ✓ next to the correct answer.

If the answer space is blank but the correct answer is seen in the body allow full marks. Place the annotation ✓ next to the correct answer.

If the correct answer is seen in the working but a completely different answer is seen in the answer space, then accuracy marks for the answer are lost. Method marks would still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.
 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.

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MARK SCHEME

♣ = common with A501/01

Question			Answer	Marks	Part marks and guidance
1	(a) ♣	(i)	6.75 or 6.7 or 6.8	1	
		(ii)	614.125	1	Condone rot to 3sf or more
	(b)		$2 + 3 \times (2 + 7) = 29$	1	ignore superfluous pairs of extra brackets eg $2 + (3 \times (2 + 7)) = 29$ but 0 for extra single brackets or for extra brackets giving wrong result eg $(2 + 3) \times (2 + 7) = 29$
	(c)		231	2	M1 for 3.85×60 or for 0.85 minutes = 51s soi
2	(a) ♣		Arcs drawn with radii 9.5 and 4.8 cm centres A and C resp. Quadrilateral completed with ruled lines, with D in tolerance	1 1	Tolerance 2mm [This mark available even if no arcs seen] condone dashed lines, if 0, allow SC1 for one correct arc the arcs should be inside circles on overlay but condone outside and very nearly touching circles when screen is set to width; one of the arcs should extend through at least three circles, including D NB spurious arcs put in afterwards do not gain credit; ignore other arcs on the diagram condone wrong / no label for D; tolerance – the vertex should be inside circle on overlay but condone outside and very nearly touching circle when screen is set to width allow SC1 for quadrilateral completed, with arcs, using CD = 9.5 cm and AD = 4.8 cm

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Question		Answer	Marks	Part marks and guidance	
	(b) ♣	Correct construction arcs Correct ruled bisector drawn	1 1	Check by eye; use marking tool if in doubt Within tolerance on overlay	NB spurious arcs put in afterwards do not gain credit; ignore other arcs on the diagram to extend at least to the circles on overlay, going through or touching these
3	(a) ♣	$70n + 150$ oe	2	M1 for $70n$ oe or for e.g. $70x + 150$ oe	Accept $70 \times n$, $n70$, etc; or capital N ignore £ or p;
	(b) ♣	$70n + 150 = 3300$ or $3300 - 150 = 70n$ 45	1 2	or FT from <i>their</i> (a); must see equation to gain this mark M1 for one correct step in solving <i>their</i> equation eg $70n = 3150$ but M0 for just $3300 - 150 = 70n$ – not sufficient SC1 for embedded answer on answer line or in body of script	Allow other letters allow M1 for $n = \frac{C - 150}{70}$ seen and then 3300 substituted for C even if no equation with n then seen ignore £ or p allow M1 for correct step in solving inequality and then A1 for $n \leq 45$

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Question		Answer	Marks	Part marks and guidance	
4		<p>70/42 or 1.66 – 1.67 or 1.7 [gallons used]</p> <p>FT <i>Their</i> gallons × 4.5 or 7.47 to 7.65 [litres used]</p> <p>FT <i>Their</i> litres for 70 miles used × 121.9 or × 1.219</p> <p>9.09 to 9.17 or 9.32 to 9.34</p> <p><u>Or</u> for 42/4.5 or 9.3(3...) [miles per litre]</p> <p>70 ÷ <i>their</i> mpl or 7.5 [litres used]</p> <p><i>their</i> litres for 70 miles used × 121.9 or × 1.219</p> <p>9.09 to 9.17 or 9.32 to 9.34</p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>or</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>in principle: M1 for dealing correctly with any two elements of $\frac{70}{42} \times 4.5 \times 121.9$,</p> <p>M1 for correctly combining the result with a third, M1 for correctly combining the result with the fourth. For A1 accept unrounded answers as well as answers to nearest penny.</p> <p>or B4; B3 for 909 to 917</p> <p>or B4 for 9.09 to 9.17</p>	<p><u>Or</u> M1 for 121.9 × 4.5 or 548.(55) [cost of one gallon, in pence] or 70/42 or 1.66 – 1.67 or 1.7 [gallons used] then M2 for 70/42 or 1.66 – 1.67 or 1.7 [gallons used] and <i>their</i> (1.66 – 1.67) × <i>their</i> 548.(55)</p> <p>proportion methods: 7.5 litres used in 70 miles earns M2– then 7.5 × 121.9 earns last M1</p> <p>42 miles costs 548.(55)[p] earns M2 then [×] 70/42 or informal proportion used correctly earns last M1</p> <p>M0 for just 70 × 121.9</p> <p>allow B3 for 8.7768 rot to 2 dp or more, [from premature approxn to 1.6 gallons used]</p>
5	(a) ♠	$1 \leq g < 1.5$	1	<p>Condone poor notation such as '1 to 1.5' or '<' used instead of '≤'</p>	<p>0 for single value within correct interval or for 13</p> <p>0 for '1 ≤ g < 1.5 13' but allow '1 ≤ g < 1.5 <u>because</u> 13' oe</p>

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Question		Answer	Marks	Part marks and guidance	
	(b) ♣	Plots at midpoints of intervals at least four heights correct: 5, 7, 13, 5, 2 Plots joined with straight line segments	1 1 1	tolerance 1mm (eg accept ht of 5 on nearest gridlines) Within 1 mm of points	Use overlay as well as correct, allow heights mark for bars or for plots not at midpoints but elsewhere in correct interval; Ignore joins to axes from endpoints, but last mark not earned if endpoints are joined ignore bars if a frequency polygon also seen; otherwise bars can earn the mark for heights correct
6	(a) ♣	(i)	0	1	0/2 not sufficient
	♣	(ii)	45	1	
	(b) ♣		$4n - 2$ oe	2 Mark final answer M1 for $4n$ oe SC1 for $4n^{\text{th}} - 2$	Condone $4 \times n$, $n4$, use of other letters instead of n , or $4n + - 2$; ignore ' $n =$ ' or ' $n^{\text{th}} =$ '
7	(a)		$6x^2 - 10x$	2 1 for each term; mark final answer If 0, allow SC1 for $6x^2 - 10x$ seen then spoilt by further 'simplification' or SC1 for $6x - 10$ [possible MR of multiplication sign instead of x]	eg 1 mark for $6x^2 + -10x$

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Question		Answer	Marks	Part marks and guidance	
	(b)	$5y(2x + 3y)$	2	Mark final answer M1 for $5y$ (....) or for $5(2xy + 3y^2)$ or for $y(10x + 15y)$ SC1 for $10y(x + 1.5y)$	condone missing final bracket
8	(a)	(3, 6.5) oe	2	1 each; accept 13/2 oe isw	
	(b)	9.8 or 9.84 to 9.85	4	NB 0 for scale drawing M1 for 4 and 9 seen or used on diagram or in this part; M1 for <i>Their</i> $4^2 + 9^2$ M1 for $\sqrt{\textit{Their}9^2 \pm \textit{their}4^2}$ A1 for 9.8 or 9.84 to 9.85	Allow M1 for $a^2 + b^2$ attempted with any numbers ft their numbers used
9	(a)	(i)	12	1	
		(ii)	68 to 74	2	M1 for [UQ] 210 to 216 or [LQ] 138 to 144
	(b)	(i)	Delta + [larger] median Values: Delta 190 (± 2) compared with median for Pellow 178 to 184	1 1	condone Delta + [larger] average only if correct figures for at least one median shown condone 'medium' but not 'mean' instead of 'median' for this first mark eg Delta's median is 10g more is not sufficient for this second mark without values shown

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Question			Answer	Marks	Part marks and guidance	
		(ii)	Pellow + smaller IQR oe Values: Delta IQR 98 (± 2) compared with Pellow FT	1 1FT	cao FT (a)(ii) If 0 in this part, allow SC1 for 'Either + ranges same'	condone Pellow + lower IQR; no FT for this first mark 0 for just 'Pellow does not vary as much' oe since Pellow IQR already stated in (a)(ii) we do not require it to be restated here
10	(a)		$[11a + 5c =] 6d + 2cd$ $5c - 2cd = 6d - 11a$ $c(5 - 2d) = 6d - 11a$ $[c =] \frac{6d - 11a}{5 - 2d}$ oe	M1 M1 M1 M1	Expanding brackets Collecting c terms on one side, remaining terms on other, dep on having a cd term Factorising c terms (may be implied by correct division); dep on having an nc term and a cd term Final division by factor allow B4 for $[c =] \frac{6d - 11a}{5 - 2d}$ oe	condone $d6$ etc Each M1 is for a correct constructive step, FT previous error if of equivalent difficulty for M4, answer must be fully correct
	(b)	(i)	8	1	mark final answer	
		(ii)	$5x - 7$	2	mark final answer M1 for $5(x + 1) - 12$ soi	

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11		Freq densities: 0.7, 1.6, 2, 1, 0.3, 0.2	1	Seen or used as heights; condone two errors	may be by table
		Bars all correct height	1		
		Bars all correct width	1		

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12		<p>$180 \div 10$</p> <p>Angles 36, 54, 90</p> <p>6 used as hypotenuse of right-angled triangle (may be implied by sketch or attempt at trig with 6 as hyp)</p> <p>Use of sine <i>their</i> 36 (attempt at right-angled trig or sine rule) or of cos <i>their</i> 54</p> <p>$6 \times \sin 36$ or $6 \times \cos 54$ oe</p> <p>3.5(267...) rot to 2 sf or more</p> <p>Showing <i>their</i> answer : $6 \neq 2 : 5$ or obtaining for sides to be in same ratio, shortest side should be 2.4</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>B1</p>	<p>or eg $\frac{2}{10} \times 180$ seen oe for at least one angle</p> <p>or B2</p> <p>if this and subsequent M marks not earned, allow SC1 for the strategy of any attempt at using trig</p> <p>For this last M1, must work with correct angles After marks for angles; Allow B4 for 3.5(267...) rot to 3 sf or more (need not be identified as shortest side). If 3.5(267...) not found, allow SC2 for 4.8(541...) rot to 3 sf or more</p> <p>accept using 3.5 to 3.53 from correct answer but not approximation to 4 (oe FT <i>their</i> shortest side found)</p> <p>B0 for just '3.5 : 4.9 : 6 is not the same as 2 : 3 : 5'</p>	<p>allow this second M1 for accurate drawing</p> <p>or equivalent methods to find other side and then correct use of Pythagoras</p> <p>Condone poor notation e.g. $\sin (36 \times 6)$ for this last M1</p> <p>or SC2 for 4.8 or 4.9 after correct use of trig</p> <p>using 3.5, 4.9 and 6 may eg work out perimeter and divide 14.4 in ratio 2:3:5 as 2.88: 4.32 :7.2;</p> <p>allow B1 for 2.4 : 3.6 : 6 seen</p> <p>NB in the absence of clear evidence of trigonometry used, the max mark is M1A1M1M0M0A0B1</p>

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