

Mathematics A

General Certificate of Secondary Education

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

Mark Scheme for November 2011

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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 used in the detailed Mark Scheme.

Annotation	Meaning
✓	Correct
×	Incorrect
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working (after correct answer obtained), provided method has been completed
M0	Method mark awarded 0
M1	Method mark awarded 1
M2	Method mark awarded 2
A1	Accuracy mark awarded 1
B1	Independent mark awarded 1
B2	Independent mark awarded 2
MR	Misread
SC	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

- 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 awarded for a correct final 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
- i mark scheme says 'mark final answer' or 'cao'. Place the annotation ✓ next to the correct answer.
 - ii 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.
 - iii 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.

1	(a)	(i) 280	2	M1 for 140 or for $420 \div 3$	
		(ii) 540	2	M1 for 180 or for $360 \div 2$	
	(b)	13 : 8 or $13/8 : 1$ oe or $1 : 8/13$ as final answer	2	M1 for 26 : 16 or 130 : 80 or 13g : 8g or other correct partial simplification or for 13 and 8 seen	Allow 2 marks for 1.625 : 1 or 1 : 0.615(...) Allow M1 for 1.62 : 1 or 1.63 : 1 or 1 : 0.61 or 1 : 0.62
2	(a)	$6a - 15$	2	1 for each term allow SC1 for $6a - 15$ seen and spoilt	
	(b)	$b(b + 7)$ as final answer	1		Condone missing final bracket
3	(a)	2.2 oe	1	Allow 11/5	
	(b)	(i) $2^2 \times 3^3 \times 5$ oe	3	Must have product; M2 for fully correct factor tree or division Or M1 for at least two of 2, 3 and 5 found / given as prime factors	Allow this M1 even if errors in factor tree or division oe; may be obtained independently by divisibility tests
		(ii) 2700	2	M1 for 540×5 or for $50 = 2 \times 5^2$ or for list of first 5 multiples of 540: [540], 1080, 1620, 2160, 2700 (condone one error in multiples, FT)	Allow M1 for fully correct factor tree or division for 50

4		<p>Circle or arc centre A that crosses the position of a line through AB</p> <p>Radius 6 cm and compass-drawn, at least the part of the arc bounded by the correct perp bisector)</p> <p>Attempt at perpendicular bisector of AB</p> <p>Accurate attempt with correct compass arcs</p> <p>Shading of minor segment of circle centre A cut off by perp bisector</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>B1</p>	<p>Condone hand-drawn since interpretation required for this M1</p> <p>Tolerance 2 mm</p> <p>Passing within 5mm of centre of AB and making an angle of 80° to 100° with AB</p> <p>Must pass between parallel lines on overlay</p> <p>FT <i>their</i> circle/arc centre A and line</p>	<p>Use overlay</p> <p>scoris tip: find out how the tolerance relates to the size of the overlay circles on your screen setting</p> <p>2nd M not earned for just two sets of arcs or two circles with no line</p> <p>NB be alert for spurious arcs added after drawing line – A0</p> <p>B0 for overlap of two circles</p>
5	(a)	<p>Plots at midpoints of intervals</p> <p>All seven heights correct (7, 10, 14, 9, 5, 3, 2)</p> <p>All plots joined with ruled straight line segments</p>	<p>1</p> <p>1</p> <p>1FT</p>	<p>Condone one error/omission</p> <p>Tolerance 1 mm</p> <p>Within 1 mm of points; FT for at least six points plotted</p>	<p>Use overlay</p> <p>As well as correct, allow heights mark for bars or for plots not at midpoints but elsewhere in correct interval</p> <p>Ignore joins to axes from endpoints, but last mark not earned if endpoints are joined; bod if only one segment not clearly ruled</p> <p>Ignore bars if a frequency polygon also seen; otherwise bars can earn the mark for heights correct</p>

	<p>(b) Midpts 25, 75, 125... seen or implied</p> <p>$f \times x$ attempted</p> <p>(<i>Their</i> sum of $f \times x$) \div 50 soi</p> <p>137</p>	<p>M1 For 3 or more correct; need not be used</p> <p>M1 Sum seen or at least 3 products seen FT <i>their</i> 'midpts'; their 'midpoints' need to be in the correct class; Eg 175, 750, 1750, 1575, 1125, 825, 650</p> <p>M1 If correct: $6850 \div 50$</p> <p>A1 Allow B4 for 137</p> <p>SC2 for 162 or 112</p>	<p>Eg may be seen by table</p> <p>Eg allow 2nd M1 for use of endpts not midpts; 6850 implies first two Ms; working for 2nd M1 may be by table</p> <p>First two M1s may be earned for correct work seen even if not then used in the final answer</p> <p>May be earned even if their 'midpoints' are not in the correct class. Eg Midpt used as 50 throughout earns MOMOM1 (their $fx = 350, 500, 700$ etc then $2500 \div 50$)</p>
6	<p>(a) $\frac{10}{8}$ or 1.25 oe as final answer</p>	<p>3 M2 for $8x = 10$, Or M1 for x terms or number terms collected correctly and M1 for their final answer correct FT <i>their</i> $ax = b$, with a and $b \neq 1$ or 0</p>	
	<p>(b) $\frac{5}{2}$ or $\frac{35}{14}$ or 2.5 oe as final answer</p>	<p>3 M2 for $35 = 14x$ or $5 = 2x$ oe Or M1 for $35 - 14x$ soi</p> <p>If M0, allow SC1 for their final answer correct FT <i>their</i> $ax - b = 0$ or <i>their</i> $ax = b$, with a and $b \neq 1$ or 0</p>	<p>Eg SC1 for 17.5 oe following $35 - 2x = 0$</p>

7		<p>Height of triangle = 765 or 1067 – 302</p> <p>$\sin x = \text{their } 765 / 1200$</p> <p>Inverse trig fn seen or used</p> <p>39.6(...)</p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>soi; may be on diagram or used in working</p> <p>Or use of Pythagoras + other trig fn; Condone poor notation</p> <p>Condone poor notation</p> <p>Allow B4 for 39.6(...) www Allow A1 for 40 if correct method seen</p>	<p>Eg allow 2nd M1 for $\sin x = 1067 / 1200$</p> <p>Eg \cos^{-1} seen earns third M1</p> <p>NB 0 for scale drawing, except first M1 may be earned</p>
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<p>8</p>	<p><i>Trig method (using lh diagram):</i> Use of rt angled triangle with 22.5° or 67.5 and trig</p> <p>Correct trig statement with <i>h</i> as subject [<i>h</i> =] $6 \times \tan 67.5$ or $6 / \tan 22.5$</p> <p>[<i>h</i> =] 14.4 to 14.64</p> <p>Height needed = $4 \times \textit{their } h$ oe soi Or $2 \times \textit{their } h$ for one tile [or 28.8 to 29.3 or FT];</p> <p>Ans 57.6 to 58.6</p> <p>OR <i>Pythag method (using rh diagram):</i> $a^2 + a^2 = 12^2$ oe</p> <p>$a^2 = 72$ soi</p> <p>[<i>a</i> =] $\sqrt{72}$ soi or FT if first M1 earned</p> <p>[<i>a</i> =] 8.4 to 8.52</p> <p>Height needed for one tile = $2 \times \textit{their } a + 12$ oe soi [28.8 to 29.3 or FT] Or for two tiles: $4 \times \textit{their } a + 24$ oe</p> <p>Ans 57.6 to 58.6</p>	<p>M1</p> <p>M2 M1 if one of length / angle is wrong or for $\tan 22.5 = 6/h$ or $\tan 67.5 = h / 6$</p> <p>A1 If not explicit, may be implied by correct final answer</p> <p>M1 Dependent on at least one other M mark earned; may be earned earlier</p> <p>A1 Accept greater heights allowing for grouting, if justified</p> <p>OR <i>or trig method to find a (rh diagram)</i></p> <p>M1 Use of rt angled triangle with 45° and trig</p> <p>M1 correct trig statement with 12, <i>a</i>, 45</p> <p>M1 $a = 12 \cos 45$ or $12 \sin 45$</p> <p>A1 If not explicit, may be implied by correct final answer or height for one tile [28.8 to 29.3]</p> <p>M1 Dependent on at least one other M mark earned; may be earned earlier;</p> <p>A1 Accept greater heights allowing for grouting, if justified; allow B6 nfw for 57.6 to 58.6; B4 nfw for 8.4 to 8.52 or 16.8 to 17.1</p>	<p>Beware multiple attempts – if choice, mark only method leading to answer</p> <p>M0 for just [<i>h</i> =] 12 or 18 used with no trig/Pythag attempt earning credit</p> <p><i>or Pythag using diagonal b of 12 by 12 square or rt-angled triangle:</i> $b^2 = 12^2 + 12^2$</p> <p>$b^2 = 288$ soi</p> <p>[<i>b</i> =] $\sqrt{288}$ or FT if first M1 earned</p> <p>[<i>b</i> =] 16.8 to 17.1 [this method may also lead to finding <i>a</i> since $a = b / 2$, or <i>b</i> from $2 \times a$]</p> <p>height for one tile = $\textit{their } b + 12$ oe or for two tiles = $2 \times \textit{their } b + 24$ oe</p> <p>M0 for just [<i>a</i> =] 12 or 6 used with no trig/Pythag attempt earning credit</p> <p>reminder: B marks are nfw</p>
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9	(a)	-5	1		
	(b)	7/2 oe	1		
	(c)	1 - 2x or 1 + -2x oe as final answer or a = 1 and b = -2	2	M1 for $7 - 2(3 + x)$ Or SC1 for $1 + 2x$	NB not 1 mark for each term
10	(a)	Freq densities: 0.1, 0.3, 0.2, 0.28, 0.01 Bars all correct height Bars all correct width	1 1 1	Seen or plotted; condone one error No FT from wrong freq density	May be by table Use overlay Condone unruled and without vertical lines to bars
	(b)	(i) It is in the 200-250 group	1	Condone poor notation, as here	Both 200 and 250 must be mentioned; Ignore reference to number of recipes
		(ii) 9	1		
11		$C + 5p = aC - ap$ $5p + ap = aC - C$ oe $p(5 + a) = aC - C$ oe $[p =] \frac{aC - C}{5 + a}$ or $\frac{C(a - 1)}{5 + a}$ oe	M1 M1 M1 M1	Expanding brackets Collecting p terms on one side, remaining terms on other, dep on having an ap term Factorising p terms (may be implied by FT correct division); dep on having an np term and an ap term Final division by factor Allow B4 for $[p =] \frac{aC - C}{5 + a}$ or $\frac{C(a - 1)}{5 + a}$ oe	Each M1 is for a correct constructive step, FT previous error if of equivalent difficulty For M4 , answer must be fully correct Making C the subject instead of p can earn at most M1M1M0M1

Exemplar responses for Q.12(a)

Response	Mark
by adding all the lengths up they are less than 13 cm so it cannot be right	0
because Jay added all the lengths individually instead of using Pythagoras	0
he is calculating the perimeter	0
because adding up the length, width and height is greater than the diagonal	1
because the diagonal cannot be any longer than the sides all added up	1
Jay has added base width and height together	0
the perimeter is not 13 cm so therefore anywhere in the box can't be 13 cm	0
the diagonal length cannot be greater than $b + w + h$ otherwise it would come out of the cuboid	1
because the three sides will add up to more than the diagonal will be	1
because Jay added the length, width and height together	0
he's finding the perimeter, confused with 3D Pythagoras	0
because when you add the sides up it would be longer than the diagonal	1
because he added up the lengths of the three sides and it comes to 12.4 which is less than 13	0 no mention of diagonal
because if each side of the room adds to 12.4 then the diagonal has to be less	1
he has added the length, width and height to find the diagonal	0 no comparison
because $5.1 + 4.7 + 2.6$ is clearly bigger than the diagonal	0 no mention of sides

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