

GCSE

Mathematics A

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

General Certificate of Secondary Education

Mark Scheme for November 2016

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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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

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.
 - **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 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. In questions with a final answer line:
 - (i) If one answer is provided on the answer line, mark the method that leads to that answer.
 - (ii) If more than one answer is provided on the answer line and there is a single method provided, award method marks only.
 - (iii) If more than one answer is provided on the answer line and there is more than one method provided, award zero marks for the question unless the candidate has clearly indicated which method is to be marked.
9. In questions with no final answer line:
 - (i) If a single response is provided, mark as usual.
 - (ii) If more than one response is provided, award zero marks for the question unless the candidate has clearly indicated which response is to be marked.
10. 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.

11. 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.
12. Ranges of answers given in the mark scheme are always inclusive.
13. 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.
14. 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	(a)	$\frac{5}{11}$	2	M1 for $\frac{250}{550}$ seen, or implied by a correct partial simplification or M1 for 5 : 11	Common
	(b)	153 nfww	3	M2 for $85 \times \frac{9}{5}$ oe or M1 for $85 \div 5$ or 17	Common allow SC1 for 68 allow M1 for $17 \times 5 = 85$
2		7.0 with correct method	2	B1 for figs 697(...) to 698 or M1 for $600 [000\ 000\ 000] \div 86$,	may have 600 billion $\div 86$
3	(a)	$2^2 \times 3 \times 7$ oe	2	must be product but need not use indices M1 for factor tree with at most one error or omission, or successive division of 84 by primes, with at most one error or B1 for 2, 2, 3, 7 found but not written as product	Common M0 if only get as far as 2, 2, 21 oe
	(b)	420	3	M1 for $30 = 2 \times 3 \times 5$ or for 'Venn diagram' showing all the correct prime factors of 30 and 84 (need not be in correct regions) and M1 for $LCM = 2^2 \times 3 \times 5 \times 7$ oe or M2 for lists of common multiples up to and including 420; M1 if one error ft so misses 420	Common
4	(a)	29.7	1		Common

Question		Answer	Marks	Part Marks and Guidance			
	(b)			$4(3f+4c-1)$	2	M1 if one error with 4 as common factor or for $2(6f+8c-2)$	allow superfluous pairs of brackets
5				correct region indicated with correct constructions	4	M1 for relevant part of circle rad 5 cm centre C (tol 2 mm) and M2 for perp bisector of AB constructed with correct arcs, or B1 for perpendicular bisector without correct arcs and M1 for region inside circle on correct side of their perp bisector drawn, dep on attempts at circle and perp bisector	must extend so that there would be at least one intersection with a correct circle
6	(a)	(i)		336 to 342	1		Common tolerances to be checked from final map
		(ii)		1.9 to 2.1 nfw	2	M1 for 7.7 to 8.1 [may be on map] or for their distance FT from their stated measurement	Common tolerances to be checked from final map
	(b)	(i)		87.3(...)	3	M2 for $\sqrt{80^2+35^2}$ or M1 for 80^2+35^2 allow A1 for 87 if correct method seen	0 for scale drawing

Question		Answer	Marks	Part Marks and Guidance	
	(ii)	23.6(...)	3	M1 for $\tan \theta = \frac{35}{80}$ oe and M1 indep for use of inv trig fn allow A1 for 24 if correct method seen	or use of other trig fns FT from (b)(i) 0 for scale drawing
7		plots at midpoint of intervals heights correct joins with ruled straight lines	1 1 1	condone one error condone one error ignore join to origin or join back of (12, 3) to (2, 10) or other joins of endpoints to axes	if just a histogram is drawn, can gain heights mark only; if a histogram and frequency polygon, ignore histogram
8	(a)	$3x + 12$ seen $4x = 17$ or FT $[x =]\frac{17}{4}$ oe or FT; mark final answer	M1 M2 M1dep	for expanding brackets correctly for collecting x terms on one side and non- x terms on the other, FT; M1 if one side correct FT FT their $ax = b$ with a and $b \neq 0$ or 1; dependent on at least two M marks gained	
	(b)	± 12	3	B2 for one correct or M1 for $x^2 = 144$ or for $x/3 = 4$ if 0, allow SC1 for $12^2/9 = 16$ oe	

Question	Answer	Marks	Part Marks and Guidance	
9	$OX = 60 \cos 52 \text{ or } \cos 52 = \frac{OX}{60}$ <p>angle turned = $360 \div 30$ or 12° in one minute or 24° in two</p> <p>use of angle TOB = 76°</p> <p>distance lower = $OX - OY$</p> <p>art 22.4</p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>M1 dep</p> <p>A2</p>	<p>or equiv statement for OY, FT their angle</p> <p>dep on trig attempted; may be longer method using TY – TX and TO = 60</p> <p>A1 for OX = 36.939... or OY = 14.515... to 3 or more sf (dependent on relevant Ms)</p>	<p>[if correct, OX = 36.9..., OY = 14.5...]</p>
10	$[a =][\pm]\sqrt{\frac{R}{5} - b} \text{ or } [a =][\pm]\sqrt{\frac{R - 5b}{5}}$ <p>as final answer</p>	<p>3</p>	<p>nfww</p> <p>M1 for coping correctly with 5, either by correct division at first, or by correct expansion and correct division later</p> <p>M1 FT for coping correctly with b (or $5b$)</p> <p>M1 FT for coping correctly with square root</p>	<p>note acceptance of possible \pm</p> <p>subtraction may be the last step Eg those who end up with</p> $[a =][\pm]\sqrt{\frac{R}{5} - b}$ <p>get M1 for dealing with div by 5, M0 for sq rt, M1ft for subt 5 if that working is seen, but must see stages of working to award Ms</p>

Question		Answer	Marks	Part Marks and Guidance	
11	(a)	<p>freq density soi: 0.2, 0.55, 1.35, 0.7, 0.2</p> <p>vert axis scaled appropriately</p> <p>heights of bars correct</p> <p>widths of bars correct</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p>	<p>at least 4 correct</p> <p>no ft from wrong 'freq dens'</p> <p>no ft from wrong freq dens</p>	<p>eg seen by table or implied by plots</p>

Question	Answer	Marks	Part Marks and Guidance																								
(b)	two comparisons, with supporting evidence, which refer to whole distributions, and at least one in context	4	<p>(B1 comparison + B1 evidence) × 2</p> <p>eg boys took longer on average since hist further to right (allow reference to modal group for boys being longer time, but need to refer to the greatest no of people or the modal group/mode rather than just the times)</p> <p>boys range [probably] greater/ less consistent since they had people over 100 mins [and both G and B had some finishing in 0-10 group]</p> <p>there were more boys than girls, with evidence re numbers or area of boys histogram greater</p> <p>if 0 for spread comparison, allow SC1 for boys' range 0 –120 min, girls 0 –100 min or for comment about longest times 'The boys longest times were 100-120 but the girls were 70-100'</p> <p>no FT from wrong 'histogram' in (a) – can use given table</p> <p>condone boys' range 120 min, girls 100 min as evidence for acceptable comment about range; not condone boys' range 0 –120 min, girls 0 –100 min as evidence, but see possible SC</p> <table border="1" data-bbox="1630 756 2011 1129"> <thead> <tr> <th>Time (<i>t</i> mins)</th> <th>Girl</th> <th>Boy</th> </tr> </thead> <tbody> <tr> <td>$0 < t \leq 10$</td> <td>2</td> <td>2</td> </tr> <tr> <td>$10 < t \leq 30$</td> <td>11</td> <td>9</td> </tr> <tr> <td>$30 < t \leq 50$</td> <td>27</td> <td>18</td> </tr> <tr> <td>$50 < t \leq 70$</td> <td>14</td> <td>23</td> </tr> <tr> <td>$70 < t \leq 100$</td> <td>6</td> <td>6</td> </tr> <tr> <td>$100 < t \leq 120$</td> <td>0</td> <td>2</td> </tr> <tr> <td>Total</td> <td>50</td> <td>60</td> </tr> </tbody> </table> <p>see appendix for exemplar comments</p>	Time (<i>t</i> mins)	Girl	Boy	$0 < t \leq 10$	2	2	$10 < t \leq 30$	11	9	$30 < t \leq 50$	27	18	$50 < t \leq 70$	14	23	$70 < t \leq 100$	6	6	$100 < t \leq 120$	0	2	Total	50	60
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$100 < t \leq 120$	0	2																									
Total	50	60																									

Question		Answer	Marks	Part Marks and Guidance	
12	(a)	$d = 5$ $c(2x + 1) + d = 2cx + 3$ $c + d = 3$ $c = -2$	B1 M1 M1 A1	 may have subst their d may have subst their d	
12	(b)	-11	B1	correct answer only	

APPENDIXExemplar responses for Q11(b)

Response	Mark
The boys times have a greater spread. Boys 120 min, girls 100 min	1 + 1
The boys longest times were 100-120 but the girls were 70-100	0, SC1
Two boys took up to 20 min longer than the girls	0, SC1
The boys took longer to complete the puzzle	1 bod average + 0 evidence
The most girls finished in 30-50 mins, but the most boys took 50-70 mins	0 no comment about which is faster + 1 evidence

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