OCR
Oxford Cambridge and RSA

GCSE

Mathematics A

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

General Certificate of Secondary Education

Mark Scheme for June 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.

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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 × (*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 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)		241.6 to 241.7 or 240, 241 or 242	2	**M1** for $\frac{100}{60}\times 145$ oe or for [1g =] 2.4(16...) or 10g = 24. (16...) or **B1** for answer with digits 2416(...) or 2417 with wrong dp	
	(b)		165 to 167 or 170	2	**M1** for $\frac{400}{145}\times 60$ oe or $\frac{400}{\textit{their}\ (a)}\times 100$ oe If 0 , allow SC1 for $\frac{145}{60}\times$ acceptable answer = result in range 398 to 411	
	(c)		$[1:]\frac{29}{12}$	2	allow $[1:]2\frac{5}{12}$ **M1** for 12 : 29 or $\frac{12}{29}:1$ or for $[1:]\frac{145}{60}$ or for $[1:]2\frac{25}{60}$	
2	(a)		2000 nfww	2	**B1** for 1752. ... rot to 3 or more sf or for 2000.0 or more decimal zeros nfww	Common 0 for just 1800
	(b)		8.04	2	**B1** for other rot versions of 8.03571… or for their unrounded ans with more than 2 dp correctly rounded to 2dp	eg B1 for 0.723… rounded to 0.72
3	(a)		348	2	**M1** for 48 + 12 × 25	Common
	(b)		C = 20 + 16n as final answer	2	**M1** for 16n isw condone P instead of C	Condone poor notation such as n16 etc ; condone inclusion of £ Common

Question			Answer	Marks	Part Marks and Guidance	
	(c)		48 + 12*n* = *their* (20 + 16*n*)	**M1 FT**	must see this equation or simultaneous equations in *C* or *P* and *n* and subtracting	Common
			7 cao	**2**	**M1** for 28 = 4*n* or FT provided their (b) is of form *a* + *bn* with both *a* and *b* non-zero allow **M0 SC1** for 328 = 16*n* or FT after 348 or *their* (a) = *their* (20 + 16*n*)	the correct answer without an equation can earn 2 marks only (eg from trials); ignore inclusion of £ anywhere
			or, for those attempting simultaneous equations in *C* or *P* and *n* and eliminating *n*:	**or**		
			multiplying to eliminate *n* and subtracting, with at most one error	**M1**	eg 16*P* = 768 + 192*n* and 12*P* = 240 + 192*n* then 4*P* = 528 or, eg 4*C* = 192 + 48*n* and 3*C* = 60 + 48*n* then *C* = 132, with at most one error	bod **M1** if using both *P* and *C* but treating as same in multiplying etc
			7 cao	**2**	**M1** FT for obtaining cost [132 if correct] **and** reaching *their* cost – 20 = 16*n* or *their* cost – 48 =12*n*	
4	**(a)**		angle BCD = 103 to 107°	**1**		Common
			AD = 11.5 to 11.9 with arc and quadrilateral completed	**2**	**B1** for AD = 11.5 to 11.9 and quadrilateral completed with no arc	NB two possible quadrilaterals use angle measurer and ruler to mark this qn

Question			Answer	Marks	Part Marks and Guidance	
	(b)		Bisector of angle ABC drawn with correct compass arcs or perp bisector of AC drawn with correct compass arcs	**2**	tol 1°; must be ruled; condone bisector dashed one pair of arcs centres A and C crossing once then joined to B is sufficient; **B1** for acceptable bisector without correct compass arcs;	Common since AB = BC, allow arcs on AB and BC drawn from B or from A and C use angle measurer set at 50°
5	**(a)**		7, 12, 17	**2**	**B1** for 2 of these in correct position or for 2, 7, 12	
	(b)		$20 - 3n$ as final answer	**2**	oe; need not be simplified **M1** for $-3n$ or $3n$ oe	condone $n3$ etc for $3n$
6	**(a)**		21.81 to 21.82 or 21.8(0)	**3**	nfww; **M1 for** attempt at multiplying 43 × 417 etc (at least two correct of 17 931, 136 188, 30 450, 6510) or total 191 079 **M1** for their 191 079 ÷ 8760 (may be implied by answer) allow **A1** for 22 if correct working seen	 FT attempt at their (sum of fx) ÷ 8760
	(b)	**(i)**	90 to 95	**1**		
		(ii)	South-West	**1**		
		(iii)	3.5 to 4	**1**		

Question			Answer	Marks	Part Marks and Guidance	
7	(a)		Vertical bar = 1.2 m	**2**	**M1** for $\frac{2}{3}\times 1.8$ oe	NB may be on diagram
			Diagonal bar = 2.16(3...) or 2.2 nfww	**3**	**and M2** for $\sqrt{1.8^2 + their 1.2^2}$ or **M1** for $1.8^2 + their 1.2^2$ or 4.68	allow their FT length of diagonal to imply the square root of $1.8^2 + their 1.2^2$ seen evaluated; eg allow M2 for 1.9(386) after $1.8^2 + 0.72^2 = 3.7584$
			Total 13.5 to 13.6 nfww	**1**		
	(b)		$\cos\theta = \frac{0.3}{1.8}$	**M1**	or for complete method correct using Pythag (adj = 1.7748..) and another trig ratio	**0** for scale drawing
			Inv trig fn seen or used	**M1**	Not dep on first M1	may be implied by answer
			80.2 to 80.8	**A1**	accept 80 or 81 after correct trig seen; allow **B3** for 80.2 to 80.8 nfww	

Question			Answer	Marks	Part Marks and Guidance	
8			$L^2 = 5^2 + a^2 + a^2$	**M2**	may be in root form; for clear correct 3D Pythagoras statement – may be in two stages; or allow **M1** for $L^2 = 5^2 + d^2$ oe, and **M1** for $d^2 = a^2 + a^2$, where d is the diagonal of the base (accept the square roots of these statements) allow **only M1** for $L^2 = 5^2 + 2a^2$ with no prior stage or for a correct 3D Pythag statement such as 'when $a = 3$, $L^2 = 5^2 + 3^2 + 3^2$'	or similarly may use the diagonal of a vertical face working backwards: allow M1 for rearranging given answer to $2a^2 = L^2 - 25$ with at least one intermediate step and M1 for reaching $L^2 = 5^2 + 2a^2$ or $L^2 = 25 + 2a^2$ and M2 for full justification of why $L^2 = 25 + 2a^2$ oe using Pythagoras
			$2a^2 = L^2 - 25$	**M1**	no FT from wrong statements or with a number subst for a	
			showing $a = \sqrt{\frac{L^2 - 25}{2}}$	**M1**	for rearrangement to $2a^2$ as subject for completion to given answer showing at least one correct intermediate stage; NB square root symbol must extend below fraction line ; LHS may be in words	ignore extra work (may have errors) outside their main argument
9	**(a)**	**(i)**	14, 27, 44, 49, 50	**1**		
		(ii)	plots at rh end of intervals	**1**	0 for plots of frequencies etc.	attempts at frequency graphs score 0 in this part
			plots of correct heights	**1**	tol 1 mm; ft one error in table eg cfs 2, 6, 12, 25, 42, 47, 48	0 for bars at correct heights since must miss off one end; if cf graph as well as bars, ignore bars
			join with smooth curve or straight line segments	**1**	ft their ascending plots only; tol 2mm	

Question			Answer	Marks	Part Marks and Guidance	
		(iii)	FT their cf graph with correct evidence	2	oe in hours and minutes throughout (condone poor notation); allow FT from plots at midpoints correct down lines for LQ and UQ on graph without values then correct answer is enough for full marks **M1** for LQ or UQ FT their ascending diagram tol 1mm of our reading to 1 d.p. at the correct horizontal positions	eg condone 7.12 for 7h12min = 7.2 h non-cumulative frequency graphs and lines of best fit score 0 in this part (no FT if they have horizontal reading-off lines not within correct grid squares)
	(b)		13 nfww	2	**M1** for 7 and 6 (may be seen on diagram; may be split into 3.5s and 1.5s); condone one error but both bars must be attempted	NB not from 7h or 6h eg 13 – 7 = 6
10	(a)		$4m - 8 = 5mt + 3t$ $4m - 5mt = 8 + 3t$ $m(4 - 5t) = 8 + 3t$ $[m =]\frac{8+3t}{4-5t}$ oe as final answer	M1 M1 M1 M1	for correctly expanding brackets on both sides for correctly collecting m terms on one side, non-m terms on other FT(may be earned after factorising) for correctly factorising m terms; FT their two m terms dividing by their 2-term factor FT	condone $t3$ etc not allow after other collecting/simplifying errors multiple attempts: mark the attempt that leads to the ans on the ans line
	(b)		$a = -10$ $b = 4$	2 1	**M1** for $-6 = a + b$ (need not be simplified)	

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