

GCSE

Applications of Mathematics (Pilot)

Unit **A381/02**: Application of Mathematics 1 (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

- 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.
- 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.
- **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. 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 \checkmark 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.

MARK SCHEME

Question		Answer	Marks	Part marks and guidance	
1	(a)	136 – 140	1		
	(b)	Point marked correctly (use overlay)	3	M1 for line drawn at bearing of 283-287° at B. AND M1 for line drawn at bearing of 203-207° at A.	Point must be marked unambiguously (labelled “C” or at least marked with a clear cross or dot at the intersection point) Use overlay
	(c)	[0]63	2	M1 for 243 – 180 soi	Look on diagram at A for 63
2	(a)	187	2	M1 for $192 - (0.007 \times 28^2)$ or 5.488 oe seen or 186.5(...) or 784 If B0 then SC1 for $206 - (28 \times 0.88)$ seen and answer 182	
	(b)	$184 = 206 - 0.88a$ oe 25	1 AND 2	M1 for $22 = 0.88a$ oe If 0 and M0 then SC1 for $192 - 0.007a^2 = 184$ or better and answer 33[.8..] or 34	Equation must be stated

Question		Answer	Marks	Part marks and guidance																							
	(c) (i)	Straight line ruled between (10, 197.2) and (90, 126.8)	3	<p>M2 for two correct points plotted with no incorrect points.</p> <p>M1 for one correct point plotted or calculated (condone other errors)</p>	<table border="1"> <thead> <tr> <th><i>a</i></th> <th><i>h</i></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>206</td> </tr> <tr> <td>10</td> <td>197.2</td> </tr> <tr> <td>20</td> <td>188.4</td> </tr> <tr> <td>30</td> <td>179.6</td> </tr> <tr> <td>40</td> <td>170.8</td> </tr> <tr> <td>50</td> <td>162</td> </tr> <tr> <td>60</td> <td>153.2</td> </tr> <tr> <td>70</td> <td>144.4</td> </tr> <tr> <td>80</td> <td>135.6</td> </tr> <tr> <td>90</td> <td>126.8</td> </tr> </tbody> </table>	<i>a</i>	<i>h</i>	0	206	10	197.2	20	188.4	30	179.6	40	170.8	50	162	60	153.2	70	144.4	80	135.6	90	126.8
<i>a</i>	<i>h</i>																										
0	206																										
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90	126.8																										
	(ii)	17 – 21	1 FT	Strict FT from <i>their</i> straight line (c)(i)																							

Question			Answer	Marks	Part marks and guidance	
	(d)		She burns up 235.(32) kcals not enough from the ice cream o.e.	4	<p>B3 for 235.(32) Or B2 for 385.32 or 7.844 Or B1 for $(0.1 \times 138 - 0.006 \times 66 - 0.02 \times 28 - 5) \times 30$ or better</p> <p>If B0 then SC1 for -137.56</p> <p><u>Alternative</u> B1 each to maximum of 2 for 13.8 (-) 0.396 (-) 0.56</p> <p>And 1 for correct observation made based on “their” positive figure compared with 300 kcal for the ice cream. But does not necessarily require specific reference to the 300 kcals.</p>	<p>Omitting the “-5” or “$\times 30$”</p> <p>Mark to candidates’ advantage</p> <p>Order of operations on calculator must have negative attached</p> <p>$0.1 \times 138 = 13.8$ $0.006 \times 66 = 0.396$ $0.02 \times 28 = 0.56$</p> <p>Do not accept “almost” oe unless same to 2 sf B3 does not guarantee this mark.</p> <p>(Think of question given verbally and getting a verbal response.)</p>
3	(a)	(i)	31.25 or 31.3	3	<p>M2 for $0.75 \div 24 \times 1000$ oe or M1 for $0.75 \div 24$ or 0.75×1000</p>	0.03125 or 750
		(ii)	awrt 0.46 to 0.47	2 FT	<p>Strict FT <i>their</i> (a)(i) $\times 0.015$ M1 for <i>their</i> (a)(i) $\times 0.015$ oe</p>	
	(b)	(i)	3.9	3	<p>M1 for $650 \div 16500$ [$\times 100$] And A1 for 3.93[9...] or 3.94</p>	0.039[3...] [$\times 100$]

Question		Answer	Marks	Part marks and guidance	
		(ii)	82.71 or 82.72 Allow 8271 pence or 8272 pence provided pence seen & £ deleted	3	<p>M2 for $650 - (0.189 \times 365 + 0.151 \times 3300)$ Or $65000 - (18.9 \times 365 + 15.1 \times 3300)$</p> <p>Or</p> <p>M1 for 18.9×365 and 15.1×3300 Or 0.189×365 and 0.151×3300</p> <p>For both M marks follow through their consistent calculations in £ or p(ence)</p> <p>$18.9 \times 365 = 6898.5$ $15.1 \times 3300 = 49830$ $6898.5 + 49830 = 56728.5$</p> <p>$0.189 \times 365 = 68.985$ $0.151 \times 3300 = 498.3[0]$ $68.985 + 498.30 = 567.285$</p>
4	(a)	(i)	1 87 is a multiple of 3	1 AND 1 dep	<p>Or 3 is a factor of 87 oe Or 3 goes into 88 with remainder 1 oe</p> <p>May be given in words</p>
		(ii)	$2.25w + 2.5d + 13 = 86$ Or $2.25w + 2.5d = 86 - 13$ leading to $9w + 10d = 292$	2	<p>M1 for $2.25w + 2.5d$ seen</p> <p>As given</p> <p>Allow $86 - 13$ given as 73</p>

Question		Answer	Marks	Part marks and guidance	
	(iii)	<p>[...matches won] 28 [...matches drawn] 4</p> <p>Allow $w = 28$ and $d = 4$ in working provided no contradictory solutions</p>	3	<p>M1 for $9w + 3d = 264$ (or $30w + 10d = 880$)</p> <p>And M1 for $7d = 28$ (or $21w = 588$)</p>	<p>Allow equivalent multiples of the equations. Condone 1 error.</p> <p>For eliminating 1 variable.</p> <p>Substitution method: M1 $d = 88 - 3w$ oe</p> <p>M1 $9w + 10(88 - 3w) = 292$ or better oe</p>

Question	Answer	Marks	Part marks and guidance	
(b)	<p>No supported by clear correct complete working; for example [KU =] 2.30[7692...] or 2.31 [gpm] [QC =] 2.81[8181...] or 2.82 [gpm]</p> <p>And $(1 - 2.82/2.31) \times 100$ oe = 22.07% to 22.1% [more goals] Or $KU + 30\% = 3$ or 2.99[9...] Or $QC / 1.3$ oe = 2.1 to 2.2</p> <p>[KU] $30/13 \times 1.3$ oe [gpm] Or [QC] $(31/11) / 1.3$ oe Or <i>their</i> 2.82 / <i>their</i> 2.31 [x100] Or both 2.31 and 2.82 and correct conclusion</p> <p>[KU =] 30/13 [gpm] Or [QC =] 31/11 [gpm] Or [KU] 30×1.3 [goals] Or [QC] $31/1.3$ [goals]</p>	<p>5-4</p> <p>3-2</p> <p>1</p>	<p>4 for complete correct working with no errors with an incorrect conclusion or no conclusion Or correct working with at most one error and a “correct” conclusion from their working.</p> <p>2 for [KU =] 30/13 [gpm] And [QC =] 31/11 [gpm]</p> <p>Or Conclusion consistent with some correct working</p> <p>1</p>	<p>gpm = goals per match</p> <p>Allow fully correct alternative methods</p> <p>[KU + 30% =] 3 or 2.99[9...gpm] Or $(31/11) / 1.3 = 2.16[78..]$ or 2.2 [gpm]</p> <p>[KU =] 2.30[7692...] or 2.31 [gpm] [QC =] 2.81[8181...] or 2.82 [KU + 30%] oe= 39 QC /1.3 oe = 23.846</p>
(c)	33 or 32.9[64...]	4	<p>M3 for $114 \div \sqrt{10} \times 0.9144$ oe Or M2 for $114 \div \sqrt{10}$ oe or 114×0.9144 oe or $0.9144 \div \sqrt{10}$ oe Or B1 for $\sqrt{10}$ seen</p> <p>If B0 or M0 then SC1 for 10.4[24...] as final answer</p>	36.0[4996...] or 104.[2416] or 0.289[...]

Question		Answer	Marks	Part marks and guidance	
	(d)	60 000 nfw	5	<p>M4 for 59770[.1...] or 59000 or 59700 or 59800 Or M3 for $7800 \div (1/4 \times 3/5) \div 0.87$ Or M2 for $7800 \div (1/4 \times 3/5)$ or $7800 \div 1/4 \div 0.87$ or $7800 \div 3/5 \div 0.87$ Or M1 for $7800 \div 3/5$ or $7800 \div 1/4$ or $7800 \div 0.87$</p>	<p>52000 or 35862 or 14942.5...</p> <p>13000 or 31200 or 8965.5...</p>
	(e)	10.8	4	<p>M3 for $(1.2 \div 0.5^2) \times 1.5^2$ Or M2 for $1.2 \div 0.5^2$ or 4.8 Or M1 for $d=kt^2$ or $1.2 = 0.5^2k$ oe</p> <p>If M0 then SC1 for <i>their</i> 4.8×1.5^2</p>	<p>May be given in equality $d = 4.8t^2$</p> <p><i>their</i> 4.8 from calc using 1.2 and 0.5</p>
	(f)	86.6[4 m ²] isw	5	<p>B1 for 1.9 seen</p> <p>And M3 for $(2 \times (3.8 + \textit{their } 1.9))^2 - 4 \times (0.5 \times 3.8^2) - 8 \times (0.5 \times \textit{their } 1.9^2)$ oe Or M2 for two of</p> <ul style="list-style-type: none"> • $(2 \times (3.8 + \textit{their } 1.9))^2$ • $[4 \times] (0.5 \times 3.8^2)$ • $[8 \times] (0.5 \times \textit{their } 1.9^2)$ <p>Or M1 for one of the above</p> <p>If B1 M2 then also SC1 for final answer 173.28 [m²]</p>	<p>Small triangle side</p> <p>129[.96] or 130 28.88 or 7.22 14.44 or 1.805</p> <p>Allow for alternative methods eg: M4 for $(3.8 \times 3)^2 - 3 \times 3.8^2$</p>

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