OCR
Oxford Cambridge and RSA

GCSE

Applications of Mathematics (Pilot)

Unit **A381/02:** 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.

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

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 – √(*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.

MARK SCHEME

Question			Answer	Marks	Part marks and guidance	
1	(a)		60 ÷ 200 = 0.3 Or 200 × 0.3 = 60 Or 60 ÷ 0.3 = 200	1		
	(b)*		44 times supported by clear working: 105 ÷ 2.4 = 43.75	3	**2** for (60 +45) ÷ 2.4 oe or 44 with incomplete working or 43.75 supported by correct working or 43 with incomplete or inaccurate working Or **1** for 2.4 clearly identified as common multiple or (60 + 45) ÷ figs 24 or better, may be implied by first 4 or 5 multiples of 24 followed by answer of 4 or 5 or (1.75 ÷ figs 24) x 60 or 437 given as final answer	(1.75 ÷ 2.4) x 60 Condone (for clear working) listing multiples of 0.3 and 0.8 For clearly identified as a minimum must see lists of multiples for both 0.3 & 0.8 & at least one stops at 2.4 or 2.4 circled in both Do not award 1 for just answer of 4 or 5 without working
2	(a)		[Iron:] 61 to 62 **and** [Zirconium:] 81 to 82 nfww Zirconium Or *their* choice of harder metal FT *their* calculated figures seen & clearly related to the metals	3 **And** **1**	**B2** for 61 to 62 **or** 81 to 82 nfww Or **B1** for $\frac{1.85\times100}{1.73^2}$ **and** $\frac{1.85\times150}{1.84^2}$ or 185 or 2.9929 or 277.5 .. or 3.3(856 ...) seen If **B0** then **SC1** for 33… and 44… Or 106 to 107 and 150 to 151	Both values nfww Allow Iron is the softer metal Zirconium with no working scores 0

Question			Answer	Marks	Part marks and guidance	
	(b)		49 to 49.2	4	**B3** for [*Z* =] 10.16 to 10.2 Or **B2** for [*W* =] 0.64 to 0.65 Or **M1** for 87.4 to 87.5 or 9.3 to 9.4 or $10-\sqrt{10^2-3.54^2}$ oe seen If **B2** or **M1** then **also** **M1** for 1.57 x 10 x *their* 0.647 ... or 500 ÷ *their Z* (10.1664...) seen If **0** scored then **SC3** for $\frac{500}{1.57\times10\times(10-\sqrt{10^2-3.54^2})}$ Or **SC2** for $\frac{P}{1.57\times D\times(D-\sqrt{D^2-d^2})}$	Answer 49 to 49.2 with no working shown scores full marks *Their Z* could be, as an example: (*Z*=) 1.57 + *their D* + *their W* but would still gain for 500 ÷ *their W*
3	(a)		0.988449 cao	2	**B1** for any of 209.3 or 159.56 or 281 or 44836.36 or 211.7… or 0.988…	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Part marks and guidance</th><th></th></tr>
<tr><td></td><td>(b)</td><td></td><td>Single ruled line, passing through (10, 8.8) and (60, 74.3) correct to within ½ small square</td><td>2</td><td>M1 for 1 correct point plotted or calculated
or correct part line
or line with correct gradient</td><td>If single correct line ignore extra incorrect points & award 2 marks

If more than one line M1 max for correct points

Points may include:
<table>
<tr><th>x</th><th>y</th></tr>
<tr><td>5</td><td>2.3</td></tr>
<tr><td>10</td><td>8.8</td></tr>
<tr><td>15</td><td>15.4</td></tr>
<tr><td>20</td><td>21.9</td></tr>
<tr><td>25</td><td>28.5</td></tr>
<tr><td>30</td><td>35</td></tr>
<tr><td>35</td><td>41.6</td></tr>
</table>
<table>
<tr><th>x</th><th>y</th></tr>
<tr><td>40</td><td>48.1</td></tr>
<tr><td>45</td><td>54.7</td></tr>
<tr><td>50</td><td>61.2</td></tr>
<tr><td>55</td><td>67.8</td></tr>
<tr><td>60</td><td>74.3</td></tr>
<tr><td>65</td><td>80.9</td></tr>
<tr><td>70</td><td>87.4</td></tr>
</table></td></tr>
<tr><td>4</td><td>(a)*</td><td></td><td>Correct appropriate calculation(s) with solution(s) to 4 sig figs or better linked to clear explanation with reference to rounding as appropriate

Eg 38% of 2340 = 889.2 which can be rounded to 890
Eg (890/2340) x 100 = 38.03% which rounds to 38%
Eg (890 ÷ 38) x 100 = 2342 so one of the numbers must be rounded
Eg
(890/2340) x 100 = 38.03% ≈ 38%</td><td>3</td><td>2 for correct calculation(s) with solution to accuracy below or better Eg 38% of 2340 = 889.2
Eg (890/2340) x 100 = 38.03% = 38%
Eg 890 ÷ 38 = 23.4[2..] & 23.4[2..] x100 = 2340

Or
1 for one correct calculation shown
Eg 2340 x 38% = 889 or =890
Eg (890/2340) x 100 = 38%
Eg 890/2340 = 0.38…
Eg 890 ÷ 38 = 23.4[2..]</td><td>For all 3 marks explanation must mention rounding or approximately oe
Accept clear ≈ for their explanation

Accept alternatives with clear explanations
Eg 0.38 x 2340 = 889.2
& 0.381 x 2340 = 891.5
so 38% must be rounded

Do not accept ‘so it’s the same’ for an explanation

If correct & incorrect calculations assume contradictory unless explanation clearly follows from one</td></tr>
</table>

Question			Answer	Marks	Part marks and guidance	
	(b)		1080 Or 1078, 1079, or 1081 with correct supporting working	4	**M2** for $1-\left(\frac{2}{5}+\frac{1}{6}\right)$ oe soi by $\frac{13}{30}$ Or **M1** for $\frac{2}{5}+\frac{1}{6}$ oe soi by $\frac{17}{30}$ **And** **M1** for 468 ÷ *their* $\frac{13}{30}$ or 468 ÷ *their* $\frac{17}{30}$ or 468 × *their* $\frac{30}{13}$ or 468 x *their* $\frac{30}{17}$ If **M0** then **SC1** for 468 ÷ 8/11 oe or 468 ÷ 3/11	For method marks follow their working, may be seen embedded or in stages Allow working with equivalent fractions or decimal or % rot to 2 sig figs or better, ie **M2** for 1 – (0.4 + 0.16 to 0.17) soi by 0.43 to 0.44 Or **M1** for 0.4 + 0.16 to 0.17 soi by 0.56 to 0.57 **And** **M1** for 468 ÷ *their* 0.43 oe or 468 ÷ *their* 0.57 *their* 13/30 or 17/30 must come from attempt at adding fractions 2/5 and 1/6 seen 643 to 644 1716
	(c)	(i)	87.5	2	**M1** for figs 175 ÷ 0.2 oe If **M0** allow **SC1** for figs 875	figs 175 x 5 May be done in stages Allow full marks for 87 500 000 if “million” crossed out.
		(ii)	51.49 or 51.5	2	**M1** for figs 38 × 1.355 oe If **M0** allow **SC1** for figs 5149 or figs 515 or 13.49 or 13.5 seen	May be done in stages Condone full marks for 51 490 000 or 51 500 000 without ‘million’ crossed out if penalised in part (c)(ii)
		(iii)	41.5 Allow 42 supported by correct method shown	2	**M1** for (99.9 – 70.6) ÷ 70.6 oe or (99.9 ÷ 70.6) oe	29.3 ÷ 70.6

Question			Answer	Marks	Part marks and guidance	
		(iv)	1.4[2][%] decrease	4	**M3** for [1 –](1.06 × 0.93) oe Or **M2** for 1.06 **and** 0.93 oe soi Or **M1** for 1.06 or 0.93 oe soi If **M0** then **SC1** for 106 or 93	0.9858 or 98.58 or 98.6 or 0.014[2] M2 can be implied by 9858 Follow through all method marks where values given as percentages 106% or 93% If using assumed value for 2012 follow method & award M marks as appropriate where working seen
	(d)		$600t + 210\frac{t}{2} = 33840$ oe 48	1 And 2	**M1** for [*t* =] 33840 ÷ (600 + 210/2) or better If **0** and **M0** then **SC1** for $600t + 210\frac{t}{2}$ oe seen	705*t* = 33840 Condone inclusion of £ sign
	(e)		x + 10 **and** 3x seen or implied by correct equation or answer of 18 26 + (x + 10) + (180 – 3x) = 180 oe 18	1 And 2 And 1	**M1** for using sum angles in triangle correctly to form an equation in x for *their* angles PQB and PRQ, must follow from diagram	Allow 3 *x* x for 3x May be seen on diagram, in correct or incorrect place, or in working 3x = x + 10 +26 or better 18 with no or incorrect working scores 2 marks

Question			Answer	Marks	Part marks and guidance	
5	(a)		38.5 Or 39 from correct working	3	**M2** for $46.2 \times \frac{40}{48}$ or $46.2 \div \frac{48}{40}$ oe Or **M1** for [h/40 =] 46.2/48 or [h/46.2 =] 40/48	$40 \div 48 = \frac{5}{6}$ or 0.83[33…] 48 ÷ 40 = 1.2 46.2 ÷ 48 = 0.9625
	(b)		66.39 to 66.4 Or awrt 66 provided full correct method shown	4	**M3** for $58 \times \sqrt[5]{(\frac{7.5}{5})}$ oe Or **M2** for $\sqrt[5]{(\frac{7.5}{5})}$ soi by 1.14 to 1.15 oe Or **M1** for 1.5 or $0.\dot{6}$ or $\sqrt[5]{7.5}$ or $\sqrt[5]{5}$ seen If **M0** then **SC1** for final answer 87	$58 \div \sqrt[5]{0.\dot{6}}$ May be done in stages $\sqrt[5]{0.\dot{6}}$ = 0.87 to 0.88 1.957 to 1.96 or 1.7099… to 1.71 for $0.\dot{6}$ allow 0.66 to 0.67
	(c)		(£)2925	4	**M2** for $L = (1 + \frac{2}{3})S$ oe And $S + 2L = 2S + L + 1950$ oe Or **M1** for $L = (1 + \frac{2}{3})S$ oe or $S + 2L = 2S + L + 1950$ oe **And** **M1** for $S + \frac{10}{3}S = 2S + \frac{5}{3}S + 1950$ oe Or $\frac{3}{5}L + 2L = \frac{6}{5}L + L + 1950$ oe If **first M1** then **also SC1** for correctly combining their two equations for a single variable	Allow M marks for using decimal equivalents with at least 3 decimal places, rot. For M1 if not L and S their equations must follow their defined variables if given Award **M3** for $\frac{2}{3}S = 1950$ or 1950 ÷ $\frac{2}{3}$ oe or $\frac{2}{5}L = 1950$

Question			Answer	Marks	Part marks and guidance	
	(d)	(i)	[0]32	2	**M1** for 212 − 180 oe seen	180 – (360 – 212)
		(ii)	Point marked correctly (use overlay)	3	**M1** for line drawn at bearing of 312 to 314° at Jinan's crane And **M1** for line drawn at bearing of 30 to 32° at Heather's crane.	May not be labelled "Carmella's crane", but must be unambiguous for full marks Full marks may be awarded for correct positioning but with missing or incomplete construction lines.

Question			Answer	Marks	Part marks and guidance	
6			$\frac{29}{98}$ or an equivalent proper fraction Or 0.2959 to 0.296 if given as a decimal	4	Using AC & BC consistently in correct proportions as integers, fractions decimals, decimals to 2dp rot or better Using AB as 2, BC as 5: **M2** for area one or both white triangles Or **M1** for area one or two or four grey triangles And **M1** for area white triangle ÷ area large square oe <u>Alternative approach</u> using Pythagoras: **M3** for $\frac{1}{2}\times\left(\left(\frac{2}{7}\right)^2+\left(\frac{5}{7}\right)^2\right)$ [= ½ x($\frac{\sqrt{29}}{7}$)^2] oe or $\frac{\frac{1}{2}\times(2^2+5^2)}{7\times7}$ [= $\frac{14.5}{49}$] oe Or **M2** for $\sqrt{\left(\frac{2}{7}\right)^2+\left(\frac{5}{7}\right)^2}$ [= $\frac{\sqrt{29}}{7}$] oe or ½ x (2^2+5^2) [= 14.5] oe Or **M1** for $\left(\left(\frac{2}{7}\right)^2+\left(\frac{5}{7}\right)^2\right)$ [= $\frac{29}{49}$] oe or $\sqrt{2^2+5^2}$ oe	M marks may be embedded & may be done in stages Possibilities include: One white triangle: ½ (49 – 4 × 5) [= 14.5] oe $\frac{1}{2}\times\left(1-4\times\frac{1}{2}\times\left(\frac{2}{7}\times\frac{5}{7}\right)\right)$ oe One Grey triangle: 0.5 × 2 × 5 [= 5] Or $\frac{1}{2}\text{x}\left(\frac{2}{7}\times\frac{5}{7}\right)$ [= $\frac{5}{49}$] oe nb **M3** for $\frac{1}{2}\times\left(1-4\times\frac{1}{2}\times\left(\frac{2}{7}\times\frac{5}{7}\right)\right)$ or $\frac{\frac{1}{2}\times\left(7\times7-4\times\frac{1}{2}\times(2\times5)\right)}{7\times7}$ or $\frac{\left(\frac{1}{2}\times7\times7-2\times\frac{1}{2}\times(2\times5)\right)}{7\times7}$ For misread must indicate lengths clearly on diagram or in working, most obvious is AB is 2/7 of BC, follow their calculations for area triangles etc & award M marks as appropriate 2/7 = 0.2857... 5/7 = 0.714...

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553