

GCSE

Applications of Mathematics (Pilot)

Unit **A381/02**: Higher Tier

General Certificate of Secondary Education

Mark Scheme for June 2015

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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 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 $180 \times (\textit{their} \text{'37'} + 16)$, or FT $300 - \sqrt{(\textit{their} \text{'5}^2 + 7^2)}$. 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.

MARK SCHEME

Question		Answer	Marks	Part marks and guidance	
1		412 500 Or 411 184 to 416 666 if conversion £'s to \$'s seen	4	<p>M3 for $625000 \times (66000 \div 0.1 \times 1000000)$ or $625000 \div (0.1 \times 1000000 \div 66000)$</p> <p>Or</p> <p>M2 for $\\$1 = \pounds 0.66$ oe or $\pounds 1 = \\$1.5$ to 1.52 oe</p> <p>Or</p> <p>M1 for [10%] [of 1 000 000] [=] [\$]100 000 Or $66\,000 \times 10 = 100\%$</p> <p>If M0 then SC2 for figs 412 or figs 411 to 416 as final answer</p> <p>Or</p> <p>SC1 for $625\,000 \times$ <i>their</i> 0.66 Or $625\,000 \div$ <i>their</i> 1.5 to 1.52</p>	<p>625 000 x 0.66 oe 625 000 ÷ 1.5 to 1.52 For all M marks FT <i>their</i> rounding</p> <p>Incl: \$100 000 = £66 000</p>
2	(a)	21 to 23 cm	3	<p>B1 for 63 to 69 [metres] seen</p> <p>And</p> <p>M1 for [<i>h=</i>] <i>their</i> distance ÷ 3 where <i>their</i> distance is from 60 to 70</p>	<p>May be seen on graph</p> <p>Allow M mark if <i>their</i> distance first 'converted' to cm</p>

Question			Answer	Marks	Part marks and guidance
	(b)*		<p>A clearly structured complete solution that includes method shown to find 9 [billboards] & $9 \times 30 \times 140 = \text{£}37\,800$; may be done in stages</p> <p>Two relevant correct calculations soi or $\text{£}37\,800$ seen with no supporting correct working shown Or final answer 9 [billboards] & either $\text{£}32\,850$ or $\text{£}37850$ with no working shown</p>	<p>4-3</p> <p>Lower mark for 9 [billboards] & $\text{£}37\,800$ as final answer with incomplete or no relevant working Or some working shown for billboards & income & final answer 9 [billboards] & either $\text{£}32\,850$ or $\text{£}37850$ or 9 [billboard] & $\text{£}37\,800$ seen in working</p> <p>2-1</p> <p>Lower mark for one relevant correct calculation soi eg 9 [billboards] stated</p>	<p>$5000 \div 550 = 9[.09\dots]$ $550 \times 9 = 4950$</p> <p>$30 \times 140 = 4200$ $30 \times 9 = 270$ $9 \times 140 = 1260$</p> <p>$30 \times 140 - 550 = 3650$ $9 \times (30 \times 140 - 550) = 32\,850$</p>
3	(a)	(i)	<p>104 is not divisible by 12 oe Or 12 is not a factor of 104 Or 104 is not a multiple of 12</p>	<p>1</p> <p>If $104 \div 12 = 8.6[6\dots]$ or 8.7 shown, must be explained eg 'not an integer' oe</p>	<p>See List Check 'factor' or 'mutiple' have been used correctly</p>
		(ii)	<p>Two of: 6 [£2 coins and] 4 [50p coins] 4 [£2 coins and] 7 [50p coins] 2 [£2 coins and] 10 [50p coins]</p>	<p>2</p> <p>B1 mark for one correct combination</p> <p>If B0 then SC1 for two 'correct' solutions inverted</p>	<p>Condone 0 [£2 coins and] 13 [50p coins] eg 4 [£2] & 6 [50p] and 7[£2] & 4 [50p]</p>

Question		Answer	Marks	Part marks and guidance	
	(b)	255	6	<p>B2 for $\frac{4}{15}$ or $0.2\dot{6}$ or $26.\dot{6}$ % soi</p> <p>Or</p> <p>M1 for $(\frac{1}{3} + \frac{2}{5})$ oe decimal or %</p> <p>And</p> <p>B2 for 68</p> <p>Or</p> <p>M1 for $13.60 \div 0.20$ oe</p> <p>And</p> <p>M1 for <i>their</i> $68 \div \text{their } \frac{4}{15}$ oe</p> <p>Or [68], 85 and 102 seen</p>	<p>Allow decimal & % rot to 2 sig figs</p> <p>B2 may be implied by [68], 85 & 102 seen</p> <p>$\frac{11}{15}$ or $(\frac{5}{15} + \frac{6}{15})$</p> <p>May be seen in stages</p> <p>Not for $\div \text{their } \frac{11}{15}$ oe</p>
	(c) (i)	6.65	1		
	(ii)	$\frac{49}{200}$	2	B1 for equivalent fraction including $\frac{24.5}{100}$	
	(d) (i)	1.25	2	M1 for $\pi \times 1.125^2 \times 0.315$ soi by 1.252[...]	
	(ii)	awrt 7.6	2FT	M1 for $9.5 \div \text{their (d)(i)}$	For FT check their answer rounded to 2 sig figs or better
	(e) (i)	64.28 to 64.3 Or awrt 64 with complete correct method shown	3	<p>M2 for $(180 - (360 \div 7)) \div 2$ or $\frac{1}{2} \times (180 \times (7 - 2) \div 7)$</p> <p>Or</p> <p>M1 for $360 \div 7$ soi by 51.4[2857...] or $180 \times (7 - 2)$ soi by 900</p> <p>Or SC2 for final answer 64 or 64.5 with incomplete or no working</p>	May be seen on diagram

Question			Answer	Marks	Part marks and guidance	
		(ii)	85 5/9 oe Allow 85 to 86 with some correct working shown If integer answer must see some correct working leading to answer	4	<p>B1 for $\frac{11}{12}$ oe or $\frac{12}{11}$ oe soi or for $\frac{12}{144}$ oe or $\frac{11}{144}$ oe soi</p> <p>AND</p> <p>M1 for $200 \times 2 \div 30$ And M1 for [7 x] <i>their</i> $(200 \times 2 \div 30) \times \text{their } \frac{11}{12}$ or [7 x] <i>their</i> $(200 \times 2 \div 30) \div \text{their } \frac{12}{11}$</p> <p>Or Alt:</p> <p>M1 for $200 \times (\text{their } \frac{11}{12})^2$ or $200 \div (\text{their } \frac{12}{11})^2$ And M1 for [7 x] <i>their</i> $(200 \times (\text{their } \frac{11}{12})^2) \times 2 \div 27.5$ or [7 x] <i>their</i> $(200 \div (\text{their } \frac{12}{11})^2) \times 2 \div 27.5$</p>	<p>Look for unsimplified eg $\frac{27.5}{30}$ or $\frac{30}{27.5}$ or decimal 0.916 to 0.917 or 1.09[...] or ratio 12:11 oe or 11:12 oe or area SF 0.84[027..] or 1.19[008..]</p> <p>13.3[33...] or 40/3 oe</p> <p>[7 x] $12 \frac{2}{9}$ or [7 x] $12. \dot{2}$</p> <p>$168 \frac{1}{18}$ or 168.05[55...] or 168.06</p> <p>[7 x] $12 \frac{2}{9}$ or [7 x] $12. \dot{2}$</p> <p>Take care if circumference used $\pi \times 27.5 = 86.39...$ rounds to 86 & scores 0 marks. Could score B1 for SF seen.</p>
4	(a)	(i)	North British [Railway]	2	<p>M1 for one conversion to same form to allow for comparison, eg. $\frac{7}{20} = 35\%$ or $30\% = \frac{6}{20}$</p>	Accept NB[R] for North British Railway
		(ii)	3 000 000	2	<p>M1 for correct use of 30% oe = 900 000 in first correct step of method eg $900\,000 \div 3$ or $900\,000 \div 30$ or $1/20 = 150\,000$</p>	Accept final answer of 3 million

Question	Answer	Marks	Part marks and guidance
(b)	<p>64 with complete, clear & correct method with geometric reasoning for each stage of their method Each stated angle should be described using 3 letters or clearly identified or seen on diagram & accompanied by correct geometric reasoning The sum $x + (x + 8) + (x - 20) = 180$ must be seen explicitly & accompanied by angles in a triangle [= 180] or [angles in a] triangle = 180 or angles on a straight line [= 180] as appropriate</p> <p>64 & at least $x + (x + 8) + (x - 20) = 180$ seen or better or clearly implied by working</p> <p>64 with no relevant method or geometric reason Or $x + (x + 8) + (x - 20)$ or better (eg $3x - 12$) Or one relevant correct angle & geometric reason (accept if given on diagram)</p>	<p>5-4</p> <p>3-2</p> <p>1</p>	<p>Lower mark for complete, clear & correct method with geometric reasoning with no or incorrect final answer Eg up to $x + (x + 8) + (x - 20) = 180$ or better seen with all correct geometric reasoning Or 64 with complete, clear & correct method & at least one correct geometric reasoning attributed to angle or angle sum Or 64 with complete, clear & correct method with at most one error or one missing angle or one missing reason</p> <p>Lower mark for 64 and one relevant correct angle & associated geometric reason (accept if given on diagram) Or $x + (x + 8) + (x - 20) = 180$ or better seen</p> <p>For full marks, angles must be identified clearly in written method & correct geometric terminology used Condone opposite for vertically opposite & alt, alternating, alternative for alternate</p> <p>If using 'Z angles' for 'alternate' & / or 'F angles' for 'corresponding' treat as one error ie max 4 marks</p> <p>Most direct method: angle BMC = x (corresponding)</p> <p>Some other methods include: angle JCG = x (alternate) & angle JCD = x + 8 (corresponding) Or angle KBH = x ([opposite angles in] parallelogram) & angle ABK = x - 20 (corresponding) Or angle ABL = x + 20 (ABL & BCM similar triangles or corresponding) & angle KBH = x ([opposite angles in] parallelogram)</p> <p>Ignore irrelevant method that will not lead to correct answer</p>

Question		Answer	Marks	Part marks and guidance	
5	(a)	12 x 9 – 4x or 108 – 4x or 12 x (9 – x) + 8x or 4 x (9 – x) + 9 x 8 or 14 x 12 x 9 or 14 x 4x	M1		Check & award marks for area calculated in stages
		14 x <i>their area expression</i> or 14 x 12 x 9 and 14 x 4x explicitly seen as products	M1		<i>their area expression</i> must involve numerical term and term in x only M marks independent
		leading to 1512 – 56x as given	A1		A mark dep on both M marks
	(b)	Sandstone	2	M1 for 179.52[x] ÷ 4[x] soi by 44.88 or 44.88 x 4 [= 179.52] or 4x seen or 179.52 ÷ 44.88 = 4	Allow M mark if more than one material price evaluated but no conclusion
	(c)	1512 – 56x + 179.52x = 2300 or 1512 + 123.52x = 2300 or 123.52x = 788	1		Condone ≤ or < in place of = Must see an equation or inequality Allow 14(108-4x)+179.52x=2300
		6.3 to 6.4 6 with correct method shown	2	M1 for 123.52x [=] 788 If M0 then SC2 for 6.3 to 6.4 Or SC1 for answer 3.3 to 3.35	T&I method does not score M mark Award full marks for final answer in range 6.3 to 6.4 from T&I not for answer 6 from T&I
6	(a)	[0]44 ± 2°	1		

Question		Answer	Marks	Part marks and guidance	
	(b)	bearing $105^\circ \pm 2^\circ$ from Ancient Tomb shown bearing $135^\circ \pm 2^\circ$ from Base Camp shown Correct position within tolerance shown - see overlay	B1 B1 B1	May be implied by final B1 May be implied by final B1	If no or one construction lines visible allow all 3 marks if one correct position labelled Lost Palace or very clearly indicated 'blob' If multiple positions shown, allow all 3 if correct position clearly labelled, otherwise max 2 marks if only two lines seen
	(c)	67.5 [minutes] oe with units shown 1 hour 7.5 minutes or 1 hour, 7 minutes, 30 seconds or 1.125 hours or 4050 seconds	2	M1 for $45 \times \frac{3}{2}$ oe soi by 1.125	Allow M marks where time 0.75 Look for embedded method eg $their\ d \div (2/3 (their\ d \div 45))$
7	(a)	10.5[11...]	2	M1 for $[200 \times] 0.5^{34/8}$	0.052556... $34/8 = 4.25$ oe
	(b)	200	1		Check for blank pages

Q3a Response	Decision	Justification
$104 \div 12 = 8.6$ not a whole number	1	
$12 \times 9 = 108$ too much & $12 \times 8 = 96$ too little	1	
When you divide 104 by 12 it is not an integer	1	
Cannot have 8.6 coins	BOD	
104 doesn't divide by 12 equally / exactly / evenly	BOD	
12 doesn't go into / divide into 104	BOD	
$104 \div 12 = 8.6$	0	No explanation
$12 \times 9 = 108$ which is too much	0	
No because then she'd have 8.6 coins 8.666 coins 8.6 recurring coins	0	Part of coin not explained

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