

GCSE

Applications of Mathematics (Pilot)

Unit **A382/02**: Applications of Mathematics 2 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for November 2014

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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 ✓ 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/Indicative Content	Marks	Guidance	
				Content	Levels of response
1	a	34	1		
	b	5.5 – 6	1		Condone 9.5 – 10
	c	No or does not stay same AND valid example from graph	1		MUST see example from graph
2	a	No trend or fluctuates oe	1		
	b	24000 – 26500 provided full correct working shown	4	B1 for bar chart reading 60500 – 63500 AND B1 for pie chart angle 145 – 150 or if percentage 39 – 43 AND M1 for <i>their</i> bar chart reading \times <i>their</i> pie chart angle /360 Or <i>their</i> bar chart reading \times <i>their</i> pie chart percentage	May be done in stages For M mark at least one reading in correct range ie M1 dep on at least B1 scored
3	a	$13.2 \div 6.78$	1		
	b	4.96	2	M1 for $18.5[0] \div 3.73$	Allow if in table
	c	i		B1 B1	
		ii	M1 A1	If M0 then SC1 for $\frac{6.5[0]}{4.07} \approx \frac{5.95}{3.73}$	Condone 'changed' for 'increase'

Question		Answer/Indicative Content	Marks	Guidance	
4	a	Watch or clock or stopwatch oe	1		Any timepiece incl [mobile] phone
	b	(1) (3) (1) (5) (6) 0 3 4 4 5 6 7 9 2 2 2 6 7 7 (0) (1) (3) (3) 5 7 8 (9)	3	M2 for up to 3 errors or omissions Or M1 for correct values on branches but unordered or ordered with at most 5 or 6 errors or omissions	
	c	44 52 57 47 67 20	1 1 1 1FT 1FT 1FT		
	d	i	Fully correct	2FT	M1 for at least 3 'correct' values FT <i>their</i> values for LQ, M UQ from (c)
		ii	Same range or IQR or median or both [times] generally underestimates Silent estimates skewed or talking estimates not skewed oe	2FT	M1 for one correct on FT & not contradicted MUST be comparing measure of average or measure of dispersion or skewness For both marks FT their graph / table
	e	No, with correct counter example given from top left quadrant or No, many results bottom left corner of graph, but results in top left quadrant	2	M1 for no with attempt at reason or correct counter example given, but no definite decision or lines drawn at x=60 and y=60 or x=60 or y=60 drawn with attempt at reason	No with no correlation M1 only Comments in context Correct counter examples are: (34, 68) (42, 63) (49, 81) (57, 64) (57, 76) & (44, 60)

Question		Answer/Indicative Content	Marks	Guidance	
5	a	$49.72 \div (241 \times 0.124 \times 0.104) = 16$	4 ag	<p>M3 for figs $4972 \div (241 \times \text{figs } 124 \times \text{figs } 104)$ Or M2 for $241 \times \text{figs } 124 \times \text{figs } 104$ or $\text{figs } 124 \times \text{figs } 104 \ \& \ \text{figs } 4972 \div 241$ Or M1 for $\text{figs } 124 \times \text{figs } 104$ or $\text{figs } 4972 \div 241$</p> <p>If M0 then SC2 for $49.72 \div (29.88 \times 0.104)$ Or SC1 for $49.72 \div (29.88 \times \text{figs } 104)$</p>	<p>May be done in stages Do not accept figs 16 followed by 16 unless clearly specified change of units</p>
	b	i	1 1		<p>$416 \div 4 [=104]$ $116 \div 2 [=58]$</p>
		ii	6	<p>M5 for $\pi \times [104] \times (58^2 - 24^2) \div ([104] \times 29880)$ or figs 29(3...) as final answer with some working shown Or M4 for $\pi \times [104] \times (58^2 - 24^2) = [104] \times 29880 \times t$ or $\pi \times [104] \times (58^2 - 48^2) \div ([104] \times 29880)$ Or M3 for equating two volumes but units not correct or $\pi \times [104] \times (58^2 - 48^2) = [104] \times 29880 \times t$ Or M2 for any two of figs $2988 \times [104] \times t$ or $\pi \times [104] \times 58^2$ or $\pi \times [104] \times 24^2$ Or M1 for any one of figs $2988 \times [104] \times t$ or $\pi \times [104] \times 58^2$ or $\pi \times [104] \times 24^2$</p>	<p>Full correct method & correct units with early rounding shown scores 6 marks if final answer correct</p> <p>Full correct method with early rounding & answer out of range scores 5 marks</p> <p>Allow all M marks for missing or incorrect units</p> <p>If 104 not used throughout award marks provided consistently not used</p> <p>Look for & FT if 241×124 used for 29880</p> <p>Look for answers doubled or halved (surface area)</p> <p>Figs 310752 x t or 349856 or 59904</p>

Question		Answer/Indicative Content	Marks	Guidance
6	a	00:10 or 12:10	3	B2 for 12: m where m = 00 – 14 or n:10 where n =11, 23, 1, 13, 2 or 14 Or B1 for n:10 or 12:m le 'ten past (...)' scores B1
	b	i	3	M2 for full method shown with at most one arithmetical error Or M1 for full method shown with two arithmetical errors one correct relevant time calculation NB Answer Given on paper If use of 5 ½ hours to find time in another country MUST state where that country is
		ii	3	M2 for 15 minutes or 5 hours 45 minutes or 5 hours 45 minutes behind or (15:25 – 13:35) – 1 hour 35 minutes Or M1 for 15:25 – 13:35 or 1 hour 50 minutes 5:45 ahead or + 5:45 scores all 3 marks Allow 1:50 – 1:35 Allow 1:50
	c	i	2 FT	M1 for 12:15 pm or 5:15 pm or time difference between either 6pm or 11pm and their (b) (ii) Or correct line and additional line Correct or FT for both marks
		ii	1 FT	Correct or FT provided their (c) (i) not 6pm – 11pm ie attempt made to convert to London times

Question		Answer/Indicative Content	Marks	Guidance	
	d	i	29000 - 29990	2	B1 for 30000
		ii	9:01 – 9:04 and 9:16 - 919	1	Both values
		*iii	1100 – 1400 supported by evidence of finding area under graph with working Complete area under graph using kt figures then x 0.031 or kt converted to km then area calculated One relevant area calculation & attempt to use 0.031 correctly	5 4 – 3 2 – 1	Area under graph split into trapezia / rectangles / triangles Eg $\frac{1}{2} \times 20 \times (180 + 500)$ + 15×500 + $\frac{1}{2} \times 55 \times (500 + 350)$ + $\frac{1}{2} \times 5 \times (350 + 190)$ + $\frac{1}{2} \times 5 \times (190 + 180)$ Or Eg Area whole rectangle – smaller areas If feet scale used instead of knots scale treat as MR If no working and answer within range award SC3
	e		Fully correct & labelled	4	B1 for C AND B1 for D correct AND B1 for E correct on <i>their</i> line BD AND B1 for line FG in correct place Max 3 marks for correct diagram, but not all points labelled

Question		Answer/Indicative Content	Marks	Guidance
7	a	0.886	1	
	b	$0.886^{5.72} = 0.5[004\dots]$	2	M1 for $0.886^{\text{figs } 5.72}$
	c	4220	5	<p>B1 for any substitution of t in 0.866^t & its calculation & comparison or implied comparison with 0.6 AND M1 for a correct trial & solution for t where $1 < t < 5.72$ AND M1 for a correct improved trial for t where $4 < t < 5$ AND M1 for further correct improved trial and solution for t where $4.2 < t \leq 4.25$ and t given to at least 2dp</p>
	d	Yes, evaluated values same correct to 3dp and supported (justified) with evaluated values	3	<p>M2 for 0.886^t and 1.129^{-t} evaluated for the same value of t Or M1 for 0.886^t or 1.129^{-t} evaluated for a value of t, other than $t = 0$</p> <p><u>Alternative</u> M3 for $1/1.129 = 0.885(\dots)$ or 0.886 to 3dp or $1/0.886 = 1.1286(\dots)$ or 1.129 to 3dp</p> <p>Or M2 for $1/1.129 = 0.886$ or $1/0.886 = 1.129$</p> <p>Or M1 for $0.886^t = 1.129^{-t}$</p> <p><u>Alternative</u> M2 for $1.129^{-5.72} = 0.499(5\dots)$ or 0.500 to 3 dp</p>

Question			Answer/Indicative Content	Marks	Guidance
8	a	i	200 280 250 125 45 15	3	M2 for 4 or 5 correct Or M1 for 2 or 3 correct
		ii	Fully correct	3	M2 for at most 3 errors in bar height or width Or M1 for at least 2 correct bars or all bars correct width
	b		Lower	1	Accept qualifications eg generally lower
	c		Correct representation	1	Line from between 44.5 and 44.75 to between 49.25 and 49.5 Condone open circles or just small vertical lines drawn at both ends provided same notation used
	d		64 or 65	4	M3 for sum of at least 3 of (0.7 x 25) 25 18 (27/40 x 6) Or M2 for (0.7 x 25) oe or (27/40 x 6) oe Or M1 for 46.53 or 47.47 used

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