

Applications of Mathematics (Pilot)

General Certificate of Secondary Education

Unit **A382/02**: Higher Tier

Mark Scheme for January 2013

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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

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.

M (method) marks are not lost for purely numerical errors.

A (accuracy) marks depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.

B marks are independent of **M** (method) marks and are awarded for a correct final answer or a correct intermediate stage.

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.

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 $180 \times (\textit{their} '37' + 16)$, 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 for example 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. As a general principle, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered, mark the poorer (poorest).
9. 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.
10. 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.
11. Ranges of answers given in the mark scheme are always inclusive.
12. 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.
13. 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)	(i)	Straight [line]	1		Condone $y = x + 2.5$ oe in words Allow gradient stays the same or gradient is constant or gradient is 1 Do not allow gradient is positive or gradient goes up or line is constant or it's a line or consistent scales
		(ii)	[UK size] + 2.5 [= American shoe size] oe	1		Condone $y = x + 2.5$ oe in words For 2.5 allow oe eg +3 – 0.5
	(b)		9	2	M1 for $(43 - 32) \times 0.8$ or 8.8 If M0 scored allow SC1 for 8.5 or 17.4 or 17.5	May be done in stages
2*			Full correct relevant consistent calculations seen with correct conclusion Julie is incorrect or hot air balloon [4 – 5 times] more risky oe Two consistently evaluated calculations (may not be evaluated correctly) with no or incorrect conclusion	4–3 2–1	For lower mark a pair of correct calculations correctly evaluated, with incorrect conclusion Or a pair of correct calculations with one or more wrong answers with correct conclusion Or three consistent calculations with at least two evaluated correctly & no or incorrect conclusion Or a pair of correctly evaluated calculations and a comparison with no or incorrect conclusion For lower mark at least one relevant calculation (answer may be incorrect or may not be evaluated)	Answers rot to 1 sig fig if working shown, 2 sig figs if no calculations $3760 \div 50345000 = 0.00007468..$ $39 \div 116700 = 0.00033(419..)$ $0.00007468.. \div 2 \neq 0.00034..$ oe $0.00033.. \div 0.000074... = 4.47...$ $3760 \div 39 = 96.4...$ $50345000 \div 116700 = 431.4...$ $431.405.. \div 96.4.. = 4.47...$ $39 \times 431.4.. = 16824.8..$ $16824.8.. \div 3760 = 4.47...$ $50345000 \div 3760 = 13389.6...$ $116700 \div 39 = 2992.3...$ $13389.6 .. \div 2992.3 = 4.47..$

Question		Answer	Marks	Part Marks and Guidance	
3	(a)	Circles centre Huddersfield radius 2.5cm \pm 2mm and 5cm \pm 2mm and Perpendicular bisector of line joining Liverpool and Birmingham and Correct area shaded or clearly indicated	5	<p>M2 for circles centred Huddersfield radius 2.5cm \pm 2mm and 5cm \pm 2mm or M1 for one correct or two freehand concentric circles</p> <p>AND M2 for Perpendicular bisector of line joining Liverpool and Birmingham or M1 for clear attempt at perpendicular bisector or correct arcs, but no line</p> <p>If M3 scored then award A1 for <i>their</i> correct area shaded</p> <p>SC3 for <i>their</i> correct area shaded based on two freehand concentric circles and clear attempt at perpendicular bisector</p>	<p>For circles allow correctly placed major arcs for both marks</p> <p>Clear attempt means a line that would cross a line between Birmingham and Liverpool</p>
	(b)	3575	2	<p>M1 for 0.65×5500 seen or 3575 used in further working</p> <p>If M0 scored allow SC1 for 2843.75 or 4988.75</p>	

Question		Answer	Marks	Part Marks and Guidance	
	(c)	1766.62 or 1766.63	5	<p>M4 for $(7 + (7 \times 7.3 / 60)) \times 6.25 \times \textit{their}$ 36 or 1766.625</p> <p>or</p> <p>M3 for $(7 + (7 \times 7.3 / 60)) \times 6.25$ or $(7 + (7 \times 7.3 / 60)) \times \textit{their}$ 36</p> <p>or</p> <p>M3 for $(\textit{their}$ 7 + $(\textit{their}$ 7 \times 7.3 / 60)) \times 6.25 \times \textit{their} 36</p> <p>or</p> <p>M2 for one correct calculation involving any three of \textit{their} number of hours per day, \textit{their} number of days, rate of pay, holiday time</p> <p>or</p> <p>M1 for one correct calculation involving any two of \textit{their} number of hours per day, \textit{their} number of days, rate of pay, holiday time</p> <p>OR</p> <p>M2 for $36 \times 7 \times 6.25$ or 1575 seen and</p> <p>M2 for $(7 \times 7.3 / 60) \times 6.25 \times 36$ or 191.625 or 191.62 or 191.63 seen</p>	<p>May be done in stages</p> <p>If done in stages FT their rounded values for all M marks</p> <p>eg allow if 30.66.. rounded or truncated</p> <p>If 8 hours per day used throughout treat as misread MR-1</p> <p>eg 2019 gets 4 marks</p> <p>ie calculations involving \textit{their} 36, \textit{their} 7, 6.25, 7.3/60</p>
	(d) (i)	5	1		
	(ii)	<p>- - - 7 6</p> <p>6 7 8 8 7</p> <p>5 6 6 6 5</p>	4	<p>B3 for 11 – 14 correct entries</p> <p>or</p> <p>B2 for 7 – 10 correct entries</p> <p>or</p> <p>B1 for 3 – 6 correct entries</p>	<p>Correct entries includes first 3 days</p> <p>Allow 0 or blank or - for first 3 days</p> <p>Allow entries given as tallies oe</p>

Question		Answer	Marks	Part Marks and Guidance		
4	(a)*	7 or 8 eggs with full detailed correct calculations in justification of conclusion	4		$(5 \times \text{value } 60 - 67) \div \text{value } 43 - 49$	
		Use of representative values of both appropriate ranges, calculations correct but no or an incorrect conclusion Or answer 7 or 8 with full supporting calculations, but some errors in calculations or evaluations	3–2	For lower mark two relevant calculations with some errors with incorrect or no conclusion or answer 7 or 8 with one correct calculation	For all calculations allow end points of range $\pm \frac{1}{2}$	
		Answer 7 or 8 with no or incorrect working or one relevant calculation	1		If Australia large or USA extra large or USA medium or peewee treat as misread MR-1	
	(b)	(i)	< 70.5[g] < 77.5 – 80[g] (55) (150) 384 550 625 (640)	1 1	If 0 scored allow SC1 for 3 correct entries	
		(ii)	Fully correct	3	M1 for 5 plots at $ucb \pm \frac{1}{2}$ small square (FT <i>their</i> values providing all increasing) and M1 for 5 plots at correct height within correct class (FT <i>their</i> values providing all increasing & non linear) If M1 or M0 scored allow SC1 for increasing non-linear graph through 5 plotted points	Ignore final plot at (x, 640) Ignore (35, 0) Allow points joined by curve or straight lines

Question		Answer	Marks	Part Marks and Guidance	
	(b)	360 - 400 inclusive	2	M1 for 16 or 40 or 9 - 10 or 25 or $((1.8 - 2) \times 5) \times (8 \times 5)$ oe	
	(c) (i)	20.28 - 20.3 or 20 provided working shown nfw	3	M2 for $\sin^{-1}(52/150)$ or awrt 20.2 or M1 for $\sin(x) = 52/150$ or SC2 for answer 0.35 - 0.354 or 22.53 - 22.54	
	(ii)	$\tan^{-1}(0.78) = 37.9$ or 38	1		Allow $\tan 38 = 0.78(12\dots) = 78\%$ or $\tan x = 0.78$ and $x = 37.9$ or 38
	(d)	2.29... or 2.3 provided working shown nfw	3	M2 for $(590-588)^2 + (107-106)^2 + (2.5-2)^2$ or 5.25 or $2^2 + 1^2 + 0.5^2$ or M1 for 2 and 1 and 0.5 or $\sqrt{2^2 + 1^2}$ or $\sqrt{1^2 + 0.5^2}$ or $\sqrt{2^2 + 0.5^2}$ or $[\sqrt{2^2 + 1^2 + 0.5^2}]$ where one of 2, 1 or 0.5 is incorrect	
7	(a) (i)	Charts show % not number oe	1		Different number of schools in X and Y must be qualified to award the mark. Just the numbers are different is not enough.
	(ii)	4	1		
	(b)	4.47 - 4.48 or $2\sqrt{5}$ Allow 4.5 provided $\sqrt{\sqrt{4^2} \times (5/4)}$ or better seen	3	M2 for $\sqrt{4^2} \times (5/4)$ or $\sqrt{20}$ or M1 for ratio 4:5 oe or 5:4 oe soi	

Question		Answer	Marks	Part Marks and Guidance	
8	(a)	$T + 1.5B \leq 8$ or $60T + 90B \leq 480$ oe except $2T + 3B \leq 16$	1		
	(b)	$T + 2.5B \leq 10$ oe	1		
	(c)	Correct line & shading	3	<p>M2 for correct line from (0, 4) to (10, 0) or M1 for one point identified on line marked or written as coordinate</p> <p>If M0 scored then SC2 for <i>their</i> line & shading provided line not horizontal or vertical or SC1 for <i>their</i> line provided line not horizontal or vertical</p>	Allow if line dotted
	(d)	T = 5 and B = 2 and Profit £29	3	<p>B1 for T = 5 and B = 2 and M1 for $(5 \times 3) + (2 \times 7)$</p> <p>If B0 M0 scored allow SC2 for (0, 4) & £28 or (2, 3) & £27 or (4, 2) & £26 or (6, 1) & £25 or (8, 0) & £24 or SC1 for profit = $(\text{their } T \times 3) + (\text{their } B \times 7)$ except (0,0)</p>	

Question		Answer	Marks	Part Marks and Guidance	
9	(a)	4	1		
	(b)	Fully correct histogram & fd (1) 14.6 11.6 7.2 1.2	4	M3 for 4 correct bars on graph or all correct fd seen with at most one error on graph or M2 for all correct fd in table & no / incorrect graph or at least 3 correct bars on graph or M1 for 5 bars correct widths, no gaps or further 2 correct fd	Condone fd values missing from table if graph fully correct Correct fd may be implied by bars or crosses at correct height on graph
	(c)	Greater detail oe or smaller time intervals oe	1		If more accurate this must be qualified
	(d)	Wanda, (most) class sizes are smaller oe	1	<u>Must</u> have reason	
10	(a)	Judy 72 and Dave 1458	3	M2 for Judy 72 or Dave 1458 or M1 for $2^2 \times 18$ or $9^2 \times 18$ If M0 scored allow SC1 for Judy 36 & Dave 162	Award 2 marks for Judy 1458 and Dave 72
	(b)	Increases oe	1		
	(c)	(i)	2	M1 for one correct with none incorrect or both correct and extras	Allow $1^2 \times 6$ or $s = 1$ $d = 6$ Allow $2^2 \times 1.5$ or $s = 2$ $d = 1.5$
		(ii)	2	M1 for working with any values of S & D that give a BF of 75 or for $75 + n^2$ where n is an integer 1 – 8 inclusive	eg $1^2 \times 75$ or $5^2 \times 3$ or $10^2 \times 0.75$ or $2^2 \times 18.75$ etc

Question			Answer	Marks	Part Marks and Guidance	
	(d)	(i)	3	1		
		(ii)	(cell J7) 06/05/2012 and (cell K7) 3 (cell L7) 4 (cell M7) 7 (cell N7) 112	1 1 1 1	Correct or FT <i>their</i> L7 & M7	Condone correct date given in any format
		(iii)	2 M7	1 1		If ^ replaced with * and L7 allow mark

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