

Methods in Mathematics (Pilot)

General Certificate of Secondary Education

Unit **B391/02**: Higher Tier

Mark Scheme for June 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.

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1 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.

2 Subject-specific Marking Instructions

- i) **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.

- ii) 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.

- iii) 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 $3 \times \textit{their} (a)$.

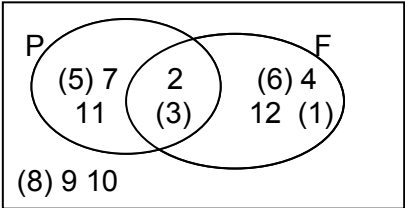
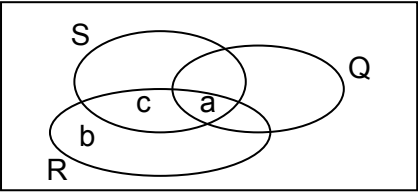
For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.

- iv) 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.
- v) The following abbreviations are commonly found in GCSE Mathematics mark schemes.
- **cao** means **correct answer only**.
 - **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).
 - **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**.
- vi) Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise, indicated for example by the instruction 'mark final answer'.
- vii) 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).
- viii) 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.
- ix) 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.
- x) If the correct answer is seen in the body and the answer given in the answer space is a clear transcription error allow full marks unless the mark scheme says 'mark final answer' or 'cao'. Place the annotation ✓ next to the correct answer.
- If the answer space is blank but the correct answer is seen in the body allow full marks. Place the annotation ✓ next to the correct answer.
- If the correct answer is seen in the working but a completely different answer is seen in the answer space, then accuracy marks for the answer are lost. Method marks would still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.
- xi) Ranges of answers given in the mark scheme are always inclusive.
- xii) 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.
- xiii) 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)	(0) 0 0 (0) 0 1 2 (3) 4 5 2 4 6 (8) 10 3 6 9 12 15	2	B1 for up to 4 errors	
	(b) (i)	$\frac{2}{20}$ oe isw attempts to change form	1	FT $\frac{\textit{their } n(6)}{20}$ oe	Ratios, 'in', 'to' etc –1 once in question But eg 0.1, 10% is full marks
	(ii)	$\frac{6}{20}$ oe isw attempts to change form	1	FT $\frac{\textit{their } n(\textit{odds})}{\textit{their } 20}$ oe	No FT if $P \geq 1$ eg 0.3, 30%
2	(a)	Rotational	1	Ignore extras eg order or angles Condone rotated, rotary, etc	
	(b) (i)	6 (cm ²)	2	M1 for $\frac{1}{2} \times 4 \times 3$	
	(ii)	52 (cm ²)	2	FT $40 + 2 \times \textit{their } (b)(i)$ M1 for $8 \times 5 + 2 \times \textit{their } (b)(i)$	
3		7.5, 2.5 oe	3	M1 for evidence of 3 trials or $x = 3y$ or $x - y = 5$ or $2y = 5$ or $y = 3y - 5$ oe B1 for pair with first $3 \times$ second B1 for pair differing by 5 either way round Or SC2 for reversed 'correct' answers	

Question			Answer	Marks	Part marks and guidance
4	(a)	(i)	4.5, $4\frac{1}{2}$, $\frac{9}{2}$ isw attempts to change form	2	M1 for $-2x = 3 - 12$ oe or M1 for FT ans from <i>their</i> $ax = b$ $a \neq 1$ Or SC1 for clearly embedded answer Condone if $x = 4.5$ oe clearly stated and eg $12 - 9 = 3$ written in ans space
		(ii)	-3 cao	2	M1 for $7x - 3x = -11 - 1$ or M1 for FT ans from <i>their</i> $ax = b$, $a \neq 1$ Or SC1 for clearly embedded answer
	(b)		$3x(2x - 5y)$	2	B1 for $3(2x^2 - 5xy)$ or $x(6x - 15y)$ or $3x$ extracted with 1 error inside bracket Eg $6x(x - 2.5y)$ scores 0
5*			£3210 with working for 2100 and 480 and no wrong statements	5	4 for correct answer with one error Or incorrect answer with £ sign but with 2100 or 480 wrongly worked but not both or error in final addition 3 for 3210 or wrong answer but correct apart from 1 arithmetical error Or for £2664 with working for 2100 and 20% off 3330 2 for correct calculation with working of 2100 or 480 1 for 2100 or 480 with no working Or correct addition of $130 + 500 +$ their insurance + their petrol Eg $480 + 500 = 980 + 130 = 1110$ 1 error means: no working for either 2100 or 480 (but not both) or no £ sign in answer Do not give if 2100 or 480 wrongly worked out and no working for other ie incorrect calculation of petrol cost or insurance or in final addition.

Question			Answer	Marks	Part marks and guidance	
6	(a)	(i)	Reflect(ion) In $y = 1$	1 1	Indep	Not mirror, flip etc Any indication of second transformation scores 0
		(ii)	Rotation 90° clockwise (5, 3)	1 1 1	Indep, accept -90 Indep, accept $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$ but not $\frac{5}{3}$	Not turn but accept quarter turn for 2nd mark if first mark not scored Any indication of second transformation scores 0 Sight of word vector or a column vector not containing digits 5 and 3 implies 2 transformations.
	(b)		Δ at $(-3, 6), (-3, 7), (-1, 6)$	2	B1 for x movement or y movement correct	
7	(a)	(i)		3	B2 for just 1 or 2 wrong or omitted or B1 for just 3 or 4 wrong or omitted or SC1 for correct list for P or F	Condone 1, 3, 5, 6, 8 repeated in correct region but otherwise penalise as 1 error an element repeated
		(ii)	2 3	1	FT their diagram	
		(iii)	8 9 10	1	FT their diagram	
	(b)			1 1 1	1 for each correctly positioned	

Question		Answer	Marks	Part marks and guidance	
8		15	3	B1 for 12 000 M1 for their $12\,000 \div (40 \times 20)$ oe	Eg $12\,000 \div 20\,000 \times 25$
9	(a)	2×3^2	1		In all parts accept eg 3×3 In parts a, b, d condone eg 2^1 In all parts look back from evaluated answers for correct answer and isw
	(b)	$2 \times 3 \times 5$	1		
	(c)	$2^2 \times 3^2$	1		
	(d)	$2^3 \times 3^5 \times 5 \times 7$	2	B1 for 3 of these 4 factors correct SC1 for 68040	
10	(a)	$180 - \frac{1}{2}x$ oe final ans	2	B1 for reflex angle $\underline{AOD} = 360 - x$ or for $\underline{APD} = \frac{1}{2}x$ (possibly on diagram)	Must be $f(x)$ Where P is a point on the minor arc AD
	(b)	$\frac{1}{2}x$ oe final ans	2	FT 180 – their (a) B1 for angle $\underline{ACD} = \text{their (a)}$	Must be $f(x)$

Question			Answer	Marks	Part marks and guidance	
11	(a)	(i)	$6a^6b^5$ final ans	2	B1 for ka^6b^5 or $6a^kb^5$ or $6a^6b^k$	
		(ii)	$8x^6y^{12}$ final ans	2	B1 for kx^6y^{12} or $8x^ky^{12}$ or $8x^6y^k$	
	(b)		$\frac{1}{27}$ cao isw	3	B2 for ans 1/-27 or ± 27 seen Or B1 for ± 3 nfw or 729 nfw M1 for inverting at any stage	As an integer not eg $\pm 27/18$
12	(a)		$\frac{5}{17}$ oe isw attempts to change form	1		Ratios, 'in', 'to' etc –1 once in question 0.294 to 0.2942
	(b)		$\frac{5}{68}$ oe isw attempts to change form	2	M1 FT for $\frac{a}{b} \times \frac{a-1}{b-1}$ where $\frac{a}{b}$ is <i>their</i> (a) with three out of four numbers 'correct'	eg $\frac{20}{272}$, 0.0735 to 0.07353

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