

Methods in Mathematics (Pilot)

General Certificate of Secondary Education

Unit **B391/02**: Higher Tier

Mark Scheme for January 2011

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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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Marking instructions

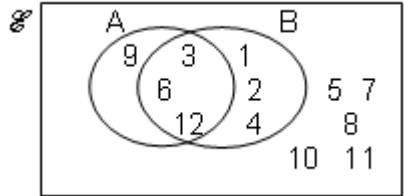
1. Mark strictly to the mark scheme. I
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Work crossed out but not replaced should be marked.
4. **M** (method) marks are not lost for purely numerical errors.
A (accuracy) marks depend on preceding **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.
5. Two additional situations may appear in the mark scheme allowing the award of **A** marks or independent (**B**) marks:
 - i. Correct answer with no working
 - ii. Follows correctly from a previous answer whether correct or not (“ft” on mark scheme and on the annotations tool).
6. 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).
7. 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.
8. 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.
9. 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. If the answer is missing, but the correct answer is seen in the body allow full marks. If the correct answer is seen in 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.
10. Ranges of answers given in the mark scheme are always inclusive.
11. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work.

12. Award 0 if:
- There is any attempt that earns no credit. This could, for example, include the candidate copying all or some of the question, or any working that does not earn any marks, whether crossed out or not.
13. Where a follow through mark is indicated on the mark scheme for a particular part question, you must ensure that you refer back to the answer of the previous part question if this is not shown within the image zone.
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.

Abbreviations

The following abbreviations are commonly found in GCSE Mathematics mark schemes.

- Where you see **oe** in the mark scheme it means **or equivalent**.
- Where you see **isw** in the mark scheme it means **ignore subsequent working** (after correct answer obtained), provided the method has been completed.
- Where you see **cao** in the mark scheme it means **correct answer only**.
- Where you see **soi** in the mark scheme it means **seen or implied**.
- Where you see **www** in the mark scheme it means **without wrong working**.
- Where you see **rot** in the mark scheme it means **rounded or truncated**.
- Where you see **seen** in the mark scheme it 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.
- Where you see **figs 237**, for example, this means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point e.g. 237000, 2·37, 2·370, 0·00237 would be acceptable but 23070 or 2374 would not.

Question		Marks	Guidance
1	(a)	0 1 2 (3) 4 5 1 0 1 2 3 (4) 2 1 0 1 2 3 (3) 2 1 0 1 2 4 3 2 1 0 1 5 4 (3) 2 1 0	2 Condone omission of all zeros B1 for up to 3 errors or either side of leading diagonal correct or SC1 for numbers all correct with some wrong signs
	(b) (i)	8/36 oe	1 FT from completed table In both parts, isw for attempt to simplify or covert to decimal/percentage If leading diagonal not filled in, still give if denominator 36 Penalise wrong notation once
	(ii)	18/36 oe	2 FT from <i>their</i> completed table and <i>their</i> 36 B1 for 18 seen If 0 scored give SC1 for both fractions /36 Accept denominator 30
2	(a)		3 B2 for one misplaced or B1 for 2 or 3 misplaced or 5, 7, 8, 10, 11 omitted
	(b)	3	1 FT their intersection
3	(a)	Triangle at $(-3, -1)$, $(3, -1)$, $(3, -4)$	3 B2 for 2 points correct or enlargement with centre $(6, 2)$ with any sf or B1 for enlargement sf 3 with any centre.
	(b)	Centre $(3, k)$ Mirror line $y = k + 1$	1 2 B1 for $y = n$ (any n)

4	(a)		Insufficient data recorded, oe	1		
	(b)	(i)	$\frac{9}{200}$	1	In both parts, isw for attempt to simplify or convert to decimal/percentage	
		(ii)	$\frac{1}{25}$ oe	2	M1 for $\frac{1}{5}$ oe seen	
5	(a)		$\frac{3}{10}$ oe	2	B1 for $\frac{2 \times 3}{5 \times 4}$	
	(b)	(i)	Any example where $0 < b \leq 1$	1	Example must be completed correctly	
		(ii)	Any example where $a > 0$ and $b < 0$ and $ b \geq a$	1	Example must be completed correctly	
6	(a)		$4x - 16$	3	B2 for $ax - 16$ or $4x - 16$ seen in working or B1 for $4x + k$ or three terms correct in $6x - 6 - 2x - 10$	
	(b)	(i)	x^6	1		
		(ii)	a^5 www	2	B1 for a^7 or $a \times a^4$ or $a^3 \times a^2$ seen or M1 for 1 correct application of indices rules seen.	
	(c)	(i)	$4(2a - 1)$	1		

		(ii)	$2xy(2x - 3y)$	3	<p>B2 for $xy(4x - 3y)$ or $2y(2x^2 - 3xy)$ or $2x(2xy - 3y^2)$</p> <p>or</p> <p>B1 for $2(2x^2y - 3xy^2)$ or $x(4xy - 6y^2)$ or $y(4x^2 - 6xy)$</p> <p>or</p> <p>SC1 for $2xy$ extracted with two terms in bracket</p>	
7*			substantially correct	4	<p>B4 for 1.5 with good evidence e.g Vol (brick) = $1200 \text{ (cm}^3\text{)}$, Area (base) tank = 40×20 or $800 \text{ (cm}^2\text{)}$, $1200/(40 \times 20) = 1.5 \text{ cm}$ Units imply V and A</p> <p>B3 for 1.5 with partial evidence e.g without words or omission of division shown.</p> <p>B2 answer 1.5 unsupported or 2 steps with evidence for at least 1 (could be implied by units)</p> <p>B1 for 1 step with evidence or 2 without evidence</p>	Evidence for B1 could be $20 \times 10 \times 6$
8			<p>40°</p> <p>Reason mentioning semicircle or diameter</p> <p>Angles in the <u>alternate segment</u></p>	<p>2</p> <p>1</p> <p>1</p>	<p>B1 for Angle $ACB = 90^\circ$ seen</p> <p>Dep on $ACB = 90^\circ$</p>	May be on diagram eg right angle symbol

9	(a)	5 910 000 000	1		
	(b)	$1.37(21) \times 10^9$	2	B1 for figs 137(21) or M1 for 143×10^7 or 0.0579×10^9 or 1 430 000 000 – 57 900 000	
	(c)	500 s www	3	B1 for 3×10^5 oe and M1 for figs 15 ÷ figs 3 (or 2998)	B3 for 660 to 670 following 2×10^8
10	(a)	$2a - b$	2	Accept $2a + -b$ B1 for $\pm 2a \pm b$ or M1 for $\begin{pmatrix} 3 \\ 5 \end{pmatrix} = r \begin{pmatrix} 2 \\ 1 \end{pmatrix} + s \begin{pmatrix} 1 \\ -3 \end{pmatrix}$ or vector triangle where one side is a multiple of a or b	
	(b)	$-b - 3a$	2	Accept $-b + -3a$ or $-3a + -b$ B1 for $\pm b \pm 3a$ or M1 for $\begin{pmatrix} -7 \\ 0 \end{pmatrix} = r \begin{pmatrix} 2 \\ 1 \end{pmatrix} + s \begin{pmatrix} 1 \\ -3 \end{pmatrix}$ or correct vector with arrows If $0 + 0$ SC1 for $\begin{pmatrix} 3 \\ 5 \end{pmatrix}, \begin{pmatrix} 2 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 \\ -3 \end{pmatrix}, \begin{pmatrix} -7 \\ 0 \end{pmatrix}$	
11		$10 + 4\sqrt{3}$	3	B1 for $(\sqrt{3})^2 = 3$ at any stage and M1 for $4 + 2\sqrt{3} + 2\sqrt{3} + \sqrt{3}\sqrt{3}$ soi	Allow 1 error

12	(a)		$9x + 3y = 10$ and $3x + y = 7$ Both have gradient -3	1 1	Dep on previous mark allow $9x + 3y = 21$ is the same as $3x + y = 7$	
	(b)		$y = 2x - 5$ and $2y + x = 3$ Gradients 2 and $-\frac{1}{2}$ (and $2 \times -\frac{1}{2} = -1$)	1 1	Dep on previous mark If 0 + 0 scored SC1 for 3 gradients correct seen	
13			$\frac{1}{17}$ oe (eg 156/2652)	2	M1 for $13/52 \times 12/51$ oe	Allow 1 error (numerical or sign wrong/omitted) eg 13/52 , 12/51 seen

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