

Methods in Mathematics (Pilot)

General Certificate of Secondary Education

Unit **B391/02**: Higher Tier

Mark Scheme for June 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.

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Subject-Specific Marking Instructions

1. **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 awarded for a correct final 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.
 - **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).
 - **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. 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'.
 7. 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).
 8. 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.
 9. 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.
 10. 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.

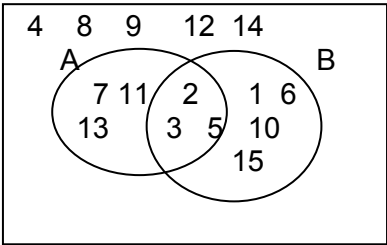
If the answer space is blank but the correct answer is seen in the body allow full marks. Place the annotation ✓ next to the correct answer.

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.
 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)	27 753	1	
		(ii)	638	1	
	(b)		$\frac{V}{L \times W}$ oe Figs 40 (or 39), 60, 30 (or 25) 20 to 23 nfwf	M1 M1 A2	Numerical, eg $(V \div L) \div W$ Accept for any 2 of these roundings seen A1 for 1800 or 1500 nfwf or 600 to 700 nfwf or 1300 to 1400 nfwf Dep on M1 M1 If M0 M0 or M1 M0 scored then SC1 for answer in range 20 to 23 ie one stage in calculation done correctly or 'cancelled' versions of these
2	(a)		0.55	2	M1 for $1 - (0.4 + 0.05)$ oe
	(b)		76	2	M1 for 190×0.4 oe, soi by figs 76 Accept $\frac{2}{5}$ of 190
3	(a)		Translation $\begin{pmatrix} -5 \\ -4 \end{pmatrix}$	1 1	Accept 5 left, 4 down, SC1 for 2 translations which end up in correct position Condone fractions, coordinates Condone 'across - 5' but not 'across 5' but condone '5 back' Condone eg left - 5 Any other indication of 2 transformations scores zero

Question		Answer	Marks	Part marks and guidance	
	(b)	Vertices at (3, 1), (3, 2), (6, 3), (6, 1)	3	B2 for 3 vertices correct or B1 for $y = x$ drawn or SC2 for reflection in $y = -x$ or SC1 for any reflection of A	MR -1 for reflections of B instead of A
4	(a)	(2, -1)	1		
	(b)	12 cm ²	1 1	Indep	
	(c)	$-\frac{1}{3}$ oe	2	M1 for y step/ x step soi by $\frac{1}{3}$, 0.33, $\frac{1}{3}x$, $-\frac{1}{3}x$ etc or SC1 for -3	
5	(a)	Cost of notepads = 4x Cost of pens = 5y Total = £20	1	Must refer to 2 from 4x being notepads and 5y being pens Cost = x and cost = y £20	Cost of notepads = 4x and pens = 5y Counts as first 2

Question		Answer	Marks	Part marks and guidance	
	(b)	Straight line which would go through (0, 4) and (5, 0)	3	B2 for 'straight' line which would go through (0, 4) or (5, 0) with negative gradient or B1 for 2 correct points plotted or SC1 for ruled line through (4, 0) and (0, 5)	Must be ruled For 3 or B2 must go across at least 3 large squares horizontally Could be freehand
	(c)	2.60	1 FT	Correct or FT from graph $\pm \frac{1}{2}$ small square	
6		$\frac{4}{9}, \frac{5}{9}$ oe	3	B2 for either or B1 for $\frac{3}{9}$ and $\frac{6}{9}$ seen or $1\frac{1}{3}$ and $1\frac{2}{3}$	oe must be single fractions eg $\frac{8}{18}$ or $\frac{3k}{9k}$ and $\frac{6k}{9k}$
7	(a)	$2x^4 - 10x^3$	2	Mark final answer unless clear transcription B1 for 1 term correct in $ax^m - bx^n$	
	(b)	$2xy(x + 2y - 3)$	3	Mark final answer B2 for $2xy$ extracted and two terms correct or correct partial factorisation with two factors extracted. or B1 for $2xy$ extracted and one term correct or for two factors extracted with one error or correct partial factorisation with one factor extracted.	eg $2x(xy + 2y^2 - 3y)$ eg $2(x^2y + 2xy^2 - 3xy)$ For all marks condone omission of final bracket

Question		Answer	Marks	Part marks and guidance	
8	(a)	$2 \times 2 \times 5 \times 7$	2	M1 two correct steps in factor tree or factor ladder or complete factor tree or ladder with one error or 3 number factorisation of 140 seen or 2, 2, 5, 7	Condone $1 \times 2 \times 2 \times 5 \times 7$ eg $10 \times 2 \times 7$
	(b)	1260	2	SC1 for any multiple of 1260 or M1 for $2 \times 2 \times 3 \times 3 \times 5 \times 7$ oe or sequence of multiples of both seen up to > 1000 or <i>their</i> LCM found	eg 7×180 , 9×140 etc Condone 1 error
	(c)	150	2	M1 for $2 \times 3 \times 5 \times 5$ or $(2 \times 3 \times 5)^3$ oe	eg 27 000
9	(a)	7	2	M1 for $x + 2 - 3 = 6$ soi or 2^{x+2-3} or 2^9	
	(b)	2 nfw	3	M2 for $4y = y + 6$ oe nfw or M1 for 3^{4y} or 3^{y+6} or one error in above or SC1 for 2 from $a^{4y} = a^{y+6}$	eg $4y = 6y$ not $2y \times 2$
10	(a)		2	B1 for 2, 3, 5 in intersection or all correct except one or two misplaced or omitted or all correct plus extras	

Question		Answer	Marks	Part marks and guidance	
12		$\frac{380}{9900}$ oe	3	<p>M2 for $\frac{20}{100} \times \frac{19}{99}$ oe</p> <p>or</p> <p>M1 for above with 1 error or $\frac{20}{100}$ and $\frac{19}{99}$ seen and associated</p> <p>or</p> <p>SC1 for $\frac{1}{25}$ oe</p>	<p>eg $\frac{19}{495}$</p> <p>isw attempts to 'cancel' or change to decimal or %</p> <p>count a and a – 1 instead of 20 and 19 as 1 error</p>
13	(a)	$\vec{AB} = -5\mathbf{a} + 5\mathbf{b}$ oe $\vec{CD} = -3\mathbf{a} + 3\mathbf{b}$ oe $\vec{CD} = \frac{3}{5}\vec{AB}$ oe and conclusion	<p>1</p> <p>1</p> <p>1</p>	<p>Alternative proof</p> <p>B1 $OC:OA = OD:OB = (3 : 5)$ oe</p> <p>B1 Angle O is common oe</p> <p>B1 Triangles similar, and conclusion including 'corresponding angles'</p> <p>Accept eg \vec{CD} is a multiple of \vec{AB} if their $CD = kAB$, $k > 0$</p>	<p>Condone the sides are proportional</p> <p>NB Treat $\vec{CA} = 5\mathbf{a}$ and $\vec{DB} = 5\mathbf{b}$ as a misread</p> <p>Can score last mark after consistent sign errors in AB and CD</p>
	(b)	3 : 5 oe	1		

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