

Methods in Mathematics (Pilot)

General Certificate of Secondary Education

Unit **B391/02**: Higher Tier

Mark Scheme for January 2012

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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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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

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.

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.

- 1 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. Work follows correctly from a previous answer whether correct or not ("FT" on mark scheme and on the annotations tool).

- 2 The following abbreviations are commonly found in GCSE Mathematics mark schemes.
 - i. Where you see **oe** in the mark scheme it means **or equivalent**.
 - ii. Where you see **cao** in the mark scheme it means **correct answer only**.
 - iii. Where you see **soi** in the mark scheme it means **seen or implied**.

- iv. Where you see **nfw** in the mark scheme it means **not from wrong working**.
 - v. Where you see **rot** in the mark scheme it means **rounded or truncated**.
 - vi. 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.
 - vii. 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.
- 3 Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
- 4 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).
- 5 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.
- 6 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.
- 7 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.
- 8 Ranges of answers given in the mark scheme are always inclusive.
- 9 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.
- 10 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. You may find it easier to mark follow through questions candidate by candidate rather than question by question.
- 11 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)		21	2	SC1 for figs 21 seen or M1 for $294 \div 14$	
	(b)	(i)	-8	2	B1 for ± 20 soi by 32	
2	(a)		1	1	1	
	(b)	(i)	336	4	M3 for $2 \times \frac{1}{2} \times 6 \times 8 + 12 \times 10 + 12 \times 8 + 12 \times 6$ OR M1 for $\frac{1}{2} \times 6 \times 8$ soi by 24 and M1 for 2 of 12×10 , 12×8 , 12×6	+48 once give BOD but +48 twice gets M0
		(ii)	6.72	2FT	FT <i>their</i> 336×0.02 M1 <i>their</i> 336×0.02 soi by figs 672	Treat 0.2 as MR and give M1 for 'flaps' isw
3	(a)		0.4 , 0.3 , 0.12, 0.18	2	M1 for 2 correct fractions or percentages or divisions soi by 2 correct	
	(b)		Yes, large number of trials oe	1	Accept No if they say 'not large enough sample'	eg enough trials, large sample,
	(c)		1280 isw	2	M1 for <i>their</i> 0.4×3200 oe (<i>their</i> 0.4 must be less than 1) Condone $\frac{1280}{3200}$	$3200 \times \frac{80}{200}$

Question		Answer	Marks	Part Marks and Guidance	
4	(a)	$2\frac{2}{5}$ isw	2	B1 for $\frac{24}{10}$ or $\frac{12}{5}$ or 2.4 oe seen	
	(b)	$1\frac{1}{4}$ isw	4	B3 for any equivalent or B2 for $\frac{9}{6}$ oe or $\frac{7}{12}$ or $\frac{5}{12}$ oe or M1 for common denominator A1 for 2 correct numerators If 0 scored SC1 for correct conversion to mixed number in its lowest terms seen	corresponding to their denominator
5		55 , 110, 15	3	B2 any correct and sum = 180 or M1 $220 \div 4$ or $kx = 220$ or $x + 2x + x - 40 = 180$ oe or SC1 for all correct in wrong place	Any correct equation in one variable
6	(a)	(i) $15p^7$ Final ans	2	B1 for $15p^n$ or p^7 seen	
		(ii) $14x + 11$ Final ans	3	B2 for $ax + 11$ or $14x + b$ nfw or $14x + 11$ seen or B1 for $8x - 4 + 6x + 15$ condone 1 error or $6x + 15$ seen	Accept eg $8x + 6x + 11$ for B2
	(b)	$\frac{1}{7}$ or 0.14(28517) rot	3	M1 for correctly isolating x terms M1 for correctly isolating number terms M1FT their $kx = n$ to $x = \frac{n}{k}$, $k \neq 1$ or 0	Must be on opposite sides of equation eg $5x + 2x + 3 = 4$ gets M1 , $5x = 1 - 2x$ gets M1 , $7x - 1 = 0$ gets M1 only

Question		Answer	Marks	Part Marks and Guidance	
7		Smallest 5 greatest 14	3	B2 for either or both reversed If 0 scored M1 for Venn Diagrams showing 2 correct new trials	
8		E F C D	1 1 1 1		
9	(a)	R _ R R _	2	B1 for 4 correct decisions	
	(b)	Others have denominators which have (prime) factors 2 and/or 5 <u>only</u> OR If denominator is not a factor of a power of 10 then oe it recurs or divisions of all but $\frac{3}{5}$ to terminating or recurring stage	2	B1 for any mention of 2 and 5 or powers of 10 or 3 correct divisions	0.833, (0.6), 0.533, 0.714825, 0.075
10	(a)	0.6 0.63 $\frac{13}{20}$ $\frac{2}{3}$	2	B1 for 1 out of order or 0.65 or 0.66 (or better) seen If 0 scored SC1 for reverse order	Accept equivalents
	(b)	$\frac{\sqrt{5}}{2}$ $\frac{5}{\sqrt{5}}$ $2\sqrt{5}$ $(\sqrt{5})^3$	3	B2 for 1 out of order OR B1 for $\frac{5}{\sqrt{5}} = \sqrt{5}$, and B1 for $(\sqrt{5})^3 = 5\sqrt{5}$ If 0 scored SC1 for reverse order	Accept equivalents

Question		Answer	Marks	Part Marks and Guidance	
11*		Full proof To include opposite angles of cyclic quadrilateral (add to 180) and angles on a straight line and no incorrect statements	3	2 for proof with 1 reason missing or two statements with reasons but no conclusions or 1 for opposite angles of cyclic quadrilateral (add to 180) or 2 correct statements with no reasons	Angle ABC + angle ADC = 180 angle ADC + angle ADE = 180 so angle ABC = angle ADE Do not allow 'opposite angles of a cyclic quadrilateral are equal' but allow 'angles in the opposite segment'
12	(a)	$\frac{7}{10}$ $\frac{2}{10}$ and $\frac{1}{10}$ correctly positioned 3 branches from Blue labelled W B R with $\frac{7}{9}$ $\frac{1}{9}$ and $\frac{1}{9}$ correctly positioned And no branches from W and R	1 1	Condone branches from W if all probabilities = 0 Condone branches from R with P(W) = 7/9, P(B) = 2/9 and P(R) = 0 or that branch omitted	
	(b)	$\frac{11}{90}$ oe	3	0.122 (or better) or 12.2% (or better) M2 <i>their</i> $\frac{1}{10} + \text{their } \frac{2}{10} \times \frac{1}{9}$ oe dep on their probabilities <1 or M1 for <i>their</i> $\frac{2}{10} \times \text{their } \frac{1}{9}$ seen dep on their probabilities <1	Accept <i>their</i> $\frac{2}{10} \times \text{their } \frac{1}{9} \times \frac{1}{10}$ or $\frac{1}{10} \times \text{their } \frac{2}{10} \times \text{their } \frac{1}{9}$

Question	Answer	Marks	Part Marks and Guidance
13	$\frac{1}{5}\mathbf{a} + \frac{4}{5}\mathbf{b}$ or $\frac{1}{5}(\mathbf{a} + 4\mathbf{b})$	3	<p>B2 for unsimplified or M1 for $\overline{AB} = \overline{a} + \mathbf{b}$ or $BA = \overline{b} + \mathbf{a}$ or any vector path for OP eg $OA + AP$</p> <p>If 0 scored SC1 for $\frac{1}{4}\mathbf{a} + \frac{3}{4}\mathbf{b}$ or $\frac{1}{4}(\mathbf{a} + 3\mathbf{b})$</p>

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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Head office
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Facsimile: 01223 552553

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