

GCSE

Methods in Mathematics (Pilot)

Unit **B392/02**: Methods in Mathematics 2 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for November 2015

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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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12. Annotations used in the detailed Mark Scheme.

Annotation	Meaning
	Correct
	Incorrect
	Benefit of doubt
	Follow through
	Ignore subsequent working (after correct answer obtained), provided method has been completed
	Method mark awarded 0
	Method mark awarded 1
	Method mark awarded 2
	Accuracy mark awarded 1
	Independent mark awarded 1
	Independent mark awarded 2
	Misread
	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.

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 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.
 - **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. 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 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. In questions with a final answer line:
- (i) If one answer is provided on the answer line, mark the method that leads to that answer.
 - (ii) If more than one answer is provided on the answer line and there is a single method provided, award method marks only.
 - (iii) If more than one answer is provided on the answer line and there is more than one method provided, award zero marks for the question unless the candidate has clearly indicated which method is to be marked.
9. In questions with no final answer line:
- (i) If a single response is provided, mark as usual.
 - (ii) If more than one response is provided, award zero marks for the question unless the candidate has clearly indicated which response is to be marked.
10. 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.

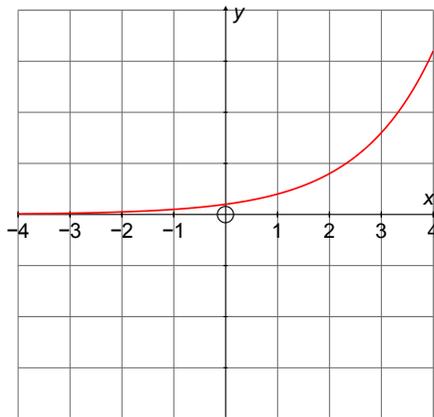
11. Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.
12. Ranges of answers given in the mark scheme are always inclusive.
13. 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.
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.

Question			Answer	Marks	Part Marks and Guidance	
1	(a)	(i)	19.683	1		
		(ii)	8.5	2	M1 for numerator or denominator	$\frac{30.6}{3.6}$
	(b)	(i)	7 200 000 000	1		Accept 7 200 million
		(ii)	$1.4[4] \times 10^{18}$	3	M2 for 14.4×10^{17} or answer from unrounded population correct in standard form OR M1 for world population $\times 200$ million (could be implied by number of wrong magnitude starting 14...)	M2 can be implied by answer of 1.44×10^{16} Accept 1sf (nfww)
	(c)	(i)	$\frac{1}{16}$ or 0.0625	2	M1 for equivalent fraction not in lowest terms e.g. $\frac{3}{48}$ isw	$\frac{1}{16}$ obtained and incorrectly converted can score M1
		(ii)	11 $\frac{55}{112}$ isw	1 1		Condone values outside the boxes if unambiguous and not contradicted
2*			19 houses with clear reasoning eg $5n + 1 = 100 \dots\dots n = 19.8 < 20 \dots\dots$ so 19 houses or sequence up to 96/101 with appropriate statement or $100 - 6 = 94 \dots\dots 94 \div 5 = 18.8 \dots\dots$ first house is 6 sticks with 94 left for others made of 5 sticks so it's $18 + 1 = 19$ houses	4	3 for $5n + 1 = 100$ or reasoning leading to 20 houses would take 101 sticks or 19 houses with incomplete/no reasoning or $94 \div 5 = 18.8$ OR 2 for correct formula for n th term or sequence up to 96 or 101 OR 1 for sequence started e.g. 6, 11, 16, 21. .. or 6, 11, 16 and +5 seen	
3	(a)		$\frac{18}{5}$	2	M1 for $3\frac{6}{10}$ or $3\frac{3}{5}$ or $\frac{36}{10}$	
	(b)		$\frac{19}{25}$	2	M1 for $\frac{76}{100}$ or $\frac{38}{50}$	

Question		Answer	Marks	Part Marks and Guidance	
4	(a)	6:3:10	2	M1 for 12:6:20	
	(b)	84	2	M1 for $7 \times (3 + 4 + 5)$ or 21:28:35 or $21 \div 3$	
5	(a)	$[x=] -11$	3	M1 for $3x - 21$ M1 for getting correct numbers or correct x on one side only M1 for correct FT from $kx + c = n$	
	(b)	5	1		Condone missing brackets
6	(a)	(3.5, 5)	2	B1 for one correct coordinate	
	(b)	2.5	3	M2 for $AB = 5$ OR M1 for $3^2 + 4^2$ or $\sqrt{\text{their}3^2 + \text{their}4^2}$ condoning one error in 3 or 4	Alternate method M1 for N coords (5, 7) AND M1 for Pythagoras to find MN $1.5^2 + 2^2$
7*		74° clearly presented with a correct reason for each angle used. eg $\angle GEF = 43^\circ$ (angles on a st. line) and $\angle GFE = 74^\circ$ (angle sum of triangle) and $\angle BCF = 74^\circ$ (corresponding angles) or $\angle GFE [= 137^\circ - 63^\circ] = 74^\circ$ (exterior angle = sum of opposite interior angles) and $\angle BCF [= \angle GFE] = 74^\circ$ (corresponding angles)	4	3 for $\angle BCF = 74^\circ$ with at least one reason clearly stated or complete solution with one numerical error OR 2 for one correct angle on route to answer with reason or $\angle BCF = 74^\circ$ with no reasons or working OR 1 for a correct angle which helps to get to the answer Ignore any additional irrelevant statements	
8	(a)	Correct explanation E.g. of correct explanation: x is how much the pennies are worth, $2y$ is how much the 2p coins are worth. They are worth 35p altogether.	1		Use of specific examples for x and y scores 0
	(b)	$x + y = 25$	1		NOT eg $2x + 4y = 70$

Question		Answer	Marks	Part Marks and Guidance	
	(c)	15, 10	3	M2 for $x + y = 25$ drawn OR M1 for at least two points on $x + y = 25$ found	Ft <i>their</i> (b) for method marks <u>Alternative method</u> M1 for elimination of one variable M1 for ft to x or y
9		144, 36	5	M1 angles of pentagon add up to 540° or exterior angle = 72° A1 108 AND M1 $360 - 2 \times \text{their}108$ or $360 - 3 \times \text{their}108$ or $\frac{360 - 2 \times \text{their}144}{2}$ or $180 - \text{their}144$ B1 144° B1 36°	Could be marked on diagram (eg 108 correctly placed scores M1, A1)
10	(a)	$8x^2 - 42x + 27$	3	M2 for three of the following terms : $8x^2 - 36x - 6x + 27$ OR M1 for two terms	$-42x$ counts as two terms
	(b)	1, -8	4	M2 for correct factors $(x - 1)(x + 8)$ OR M1 for factors which multiply to give two correct terms in $x^2 + 7x - 8$ B1, B1	<u>Alternate methods</u> M2 for $\frac{-7 \pm \sqrt{81}}{2}$ OR M1 for $\frac{-7 \pm \sqrt{7^2 - 4 \times 1 \times (-8)}}{2}$ condone 1 error OR M2 for $\left(x + \frac{7}{2}\right)^2 - 20\frac{1}{4} = 0$ oe OR M1 for $\left(x + \frac{7}{2}\right)^2$

Question		Answer	Marks	Part Marks and Guidance	
11	(a)	095	4	<p>M2 for $\sin^{-1}\left(\frac{7.8}{89.5}\right)$ oe</p> <p>OR</p> <p>M1 for $\sin B = \frac{7.8}{89.5}$ oe</p> <p>AND</p> <p>A1 for 5° (implied by ans of 95)</p> <p>OR</p> <p>SC2 for correctly calculating other angle in triangle</p>	<p>Must be three figure bearing for full marks</p> <p>0.08715....</p> <p>4.999..... for A1</p> <p>85°</p>
	(b)	137.6 – 137.7 or 138	3	<p>M2 for $\cos^{-1}\left(\frac{-27.35}{37}\right)$ oe</p> <p>OR</p> <p>M1 for</p> <p>$9.4^2 = 7.4^2 + 2.5^2 - 2 \times 7.4 \times 2.5 \cos Q$</p> <p>or for correct re-arrangement of the cosine formula to get eg</p> <p>$\cos Q = \frac{p^2 + r^2 - q^2}{2pr}$ oe</p>	
12	(a)	(i)	2	<p>B1 does not cross x-axis but is close to x-axis at left of grid</p> <p>B1 smooth curve with increasing positive gradient throughout</p>	Condone correct 9 dots
		(ii)	1		



Question		Answer	Marks	Part Marks and Guidance	
	(b)		4	M1 correct general shape B1 goes through x-axis at 0, 180, 360 B1 turning points at 90 and 270 <u>only</u> with same magnitude as each other B1 even scale on y-axis with max and min at 3 and -3	Use of st. lines for curve could score M0, B1, B1, B1
13	(a)	Clear demonstration that double cone is one third of cylinder oe	3	M1 vol of cylinder M1 vol of double cone A1 completion/conclusion	eg. Vol of cylinder = $\pi \times 4^2 \times 10$ Vol of double cone = $\frac{1}{3}\pi \times 4^2 \times 5 \times 2$ Double cone is $\frac{1}{3}$ of 160π oe Showing $\frac{1}{3}$ with decimals rather than in terms of π can score method marks only
	(b)	160.8 to 160.9..... or 161	4	M2 for $l = 6.4.....$ OR M1 for $l^2 = 4^2 + 5^2$ AND M1 for $2\pi \times 4 \times \text{their } l$	
14	(a)	$\frac{1}{2}, \frac{1}{6}$	3	M1 for $\frac{1}{1} - \frac{1}{2}$ or $\frac{1}{2} - \frac{1}{3}$ A1. A1	
	(b)	$\frac{1}{n(n+1)}$ oe	2	M1 for denominator or complete correct method with one error	
	(c)	Clear explanation that there is no such term (eg by example) eg 9 th term is $\frac{1}{90}$ and 10 th term is $\frac{1}{110}$	2	M1 for equating the correct fraction or <i>their</i> (b) to $\frac{1}{100}$ or for evaluating term 9 or term 10	eg. $n(n+1) = 100$. There are no two consecutive numbers that multiply to give 100.

Question		Answer	Marks	Part Marks and Guidance
15		120	4	<p>M1 for med triangle area 9 AND M1 for large triangle area 81 AND M1 for 12 small triangles</p> <p>Areas may be marked on diagram</p> <p>9 med triangles Can be implied by eg 12cm^2</p>
16		41[.3.....]	5	<p>M1 for πr^2 used or 60° or 30° AND M2 for $0.2165 r^2$ OR M1 for one of $r \sin 60^\circ$ or $r \cos 60^\circ$ or $\frac{r}{2}$ AND M1 for $\frac{6 \times \text{their } 0.2165 r^2}{\pi r^2}$</p> <p>Could be calculated using their choice of r May be marked on diagram</p>

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