

GCSE

Methods in Mathematics (Pilot)

Unit **B392/02**: Higher Tier

General Certificate of Secondary Education

Mark Scheme for June 2016

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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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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.

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)	$\frac{1}{4}$ 0.25 25% $\frac{7}{20}$ [0].35 35% $\frac{16}{25}$ 0.64 64% $\frac{11}{25}$ [0].44 44%	4	3 for five correct 2 for three correct 1 for two correct	Condone missing % signs
	(b)	$\frac{1}{14}$	1	Allow 14^{-1}	Accept 0.071428571.... Allow decimal (rot) in the answer box if acceptable answer seen elsewhere.
	(c)	Fraction or decimal between $\frac{1}{3}$ and $\frac{1}{2}$	2	M1 for 0.33.. and 0.5 or $\frac{1}{2} + \frac{1}{3}$ or correctly converting to fractions with common denominator	Condone correct % for M1

2*	<p>Angles 90° 270° 135° 135° 45° 45° identified correctly with clear, correct reasons relating to appropriate angles</p> <p>eg A = 90° (four of these at a point make 360°)</p> <p>B = 135° (angles at a point)</p> <p>F = 135° (equal to B by symmetry)</p> <p>D = 270° (angles at a point)</p> <p>C = E = 45° (symmetry and angles of hexagon add up to 720°)</p>	5	<p>4 for four correct angles with correct reasons that clearly apply to at least two angles or values for all six angles correctly identified with no reasons.</p> <p>3 for four angles correctly identified with no reasons or three angles with a correct reason that clearly applies to at least one of them.</p> <p>2 for at least three angles correctly identified</p> <p>1 for one of the four angles correctly identified</p> <p>Condone use of single letters to identify angles but marks for reasons cannot be awarded for calculations alone.</p>
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Question		Answer	Marks	Part Marks and Guidance	
3	(a)	10, 21	1,1		
	(b)	A correct comparison with justification	2	M1 Correct example or statement with no comparison	Alt method M1 for $[\frac{1}{2}] n^2$ A1 for $\frac{n(n+1)}{2} \neq 2n - 1$ oe
	(c)	50 nfw	4	M1 for $4n - 2 \rightarrow 200$ AND M1 for $4n \rightarrow 202$ AND M1 for $n \rightarrow 50.5$ OR if zero scored SC2 for 50.5 as answer	Alt method M3 for trials including $n=50$ and $n=51$ with correct results OR M2 for trials including $n=50$ or $n=51$ with correct results OR M1 for any correct trial
4	(a)	£32, £28	2	M1 for $60 \div (8 + 7)$	Either order
	(b) (i)	$\frac{3}{5}$ oe	1		Must be fraction
	(ii)	9:1	3	M2 for 9 red or ratio 9:6 seen or correct unsimplified ratio using whole numbers (9k:k) OR M1 for 6 black or correct ratio not in integer form	Not 6:9 for M2 eg 18:2 eg 3:0.333[3....]
5	(a)	[x=] 7.5 oe	3	M1 for $7x + 14$ M1 for getting numbers and x on different sides M1 for correct FT from $kx = n$	Correct numbers and correct x from their equation k \neq 1 Max. of M2 for incorrect answer
	(b)	$[t =] \frac{v-u}{a}$ oe	2	M1 for $v - u = at$ oe	

Question		Answer	Marks	Part Marks and Guidance	
6		36.8... to 36.9	3	<p>M2 for correct inverse trig statement for either angle or 53.1....</p> <p>OR</p> <p>M1 for $\cos A = \frac{4}{5}$ or $\sin A = \frac{3}{5}$ or</p> <p>$\tan A = \frac{3}{4}$</p>	Allow 37 (3 marks) or 53 (for M2) <u>with correct working.</u>
7	(a)	(-4, -2)	1,1		
	(b)	4.47....	3	<p>M2 for $\sqrt{(4^2 + 2^2)}$</p> <p>OR</p> <p>M1 for $4^2 + 2^2$ or $\sqrt{(4^2 - 2^2)}$</p> <p>OR after 0 scored</p> <p>SC1 for answer $\sqrt{80}$ oe</p>	Allow 4.5 or $\sqrt{20}$ or $2\sqrt{5}$ for 3 marks
	(c)	$x^2 + y^2 = 20$ oe	FT2	M1 for $x^2 + y^2$	FT for $x^2 + y^2 = \text{their } r^2$
8	(a)	57.1 to 57.14.... or 57 nfw	5	<p>B1 for radius = 4 cm soi</p> <p>M1 for Semicircle = $\frac{\pi(\text{their } 4)^2}{2}$</p> <p>A1 semicircle = 25.1 to 25.14.. or 25 or 8π</p> <p>M1 for $\frac{8 \times 8}{2}$ oe</p>	<p>May be on diagram</p> <p>25 without working scores 0 marks</p>
	(b)	4.3[2.....]	2	M1 for $350 \div 81$	

Question		Answer	Marks	Part Marks and Guidance	
9	(a)	-3, 0, -1, 0, 3.125	2	B1 for at least two correct	
	(b)		2	B1 for at least four points from <i>their</i> table correctly plotted AND B1 for <u>correct</u> smooth curve	Within half a small square Within half a small square B0 for multiple or “hairy” curves
10	(a)	$6x^2 + 17x - 3$	3	M2 for three of the following terms : $6x^2 + 18x - x - 3$ OR M1 for two terms	+ 17x may count as two terms
	(b)	-1.5, 2 nfww	4	M2 for correct factors $(2x + 3)(x - 2)$ OR M1 for factors which multiply to give two correct terms in $2x^2 - x - 6$ AND B1 for each answer	Alternative methods M2 for $\frac{1 \pm \sqrt{49}}{4}$ OR M1 for $\frac{1 \pm \sqrt{1^2 - 4 \times 2 \times (-6)}}{2 \times 2}$ condone 1 error OR M2 for $2\left(x - \frac{1}{4}\right)^2 - 6\frac{1}{8} = 0$ oe OR M1 for $\left(x - \frac{1}{4}\right)^2$

Question		Answer	Marks	Part Marks and Guidance
11		57.50	2	M1 for $69 \div 1.2$ or 57.5

12	(a)*	<p>All three equality statements with justifications and correct congruence statement.</p> <p>eg</p> <p>AM = BC [given]</p> <p>Angle BPC = angle ANM [= 90°] (corresponding)</p> <p>Angle PBC = angle MAN (90° - angle ABP)</p> <p>Triangles are congruent AAS</p>	4	<p>3 for three equality statements with justifications or three equality statements and congruence case relating to their statements</p> <p>2 for two equality statements with justifications or three equality statements</p> <p>1 for one equality statement with justification or two equality statements</p> <p>Condone use of F angles, etc.</p>
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Question		Answer	Marks	Part Marks and Guidance	
12	(b)	1:4 with correct working	2	B1 for length scale factor = 2 or $\frac{1}{2}$ soi or area scale factor = 4 or $\frac{1}{4}$ soi	Ratio of 1:2 or 2:1 may relate to length scale factor = 2
	(c)	1:5	FT1		FT <i>their</i> (b) ie ratio of a:b (a<b) in (b) will give ratio of a:a+b in (c) for FT
13	(a)	48	3	M2 for $y = 3h^2$ OR 3×4^2 OR M1 for $k = 3$ or for $y = kh^2$ OR after 0 scored SC1 for 16.97.... or $12\sqrt{2}$	
	(b)	[\pm]5	FT2	M1 for use of $75 = \text{their } kh^2$ oe OR SC1 for answer of 78.125 or for 12.5 from 24 in part (a)	FT from <i>their</i> k

Question		Answer	Marks	Part Marks and Guidance
14		258.8 to 259.2	6	<p>B1 for $\angle ABP=149$ or $\angle APB=5$ soi AND M3 for 502.9... as length of BP rot OR M2 for $\frac{100 \times \sin 26}{\sin \text{their } 5}$ OR M1 for $\frac{100}{\sin \text{their } 5} = \frac{BP}{\sin 26}$ oe AND M1 for <i>their</i>BPsin31 oe for PG</p> <p>Alternative method 1 B1 for $\angle ABP=149$ or $\angle APB=5$ soi AND M3 for 590.9... as length of AP rot OR M2 for $\frac{100 \times \sin \text{their } 149}{\sin \text{their } 5}$ oe OR M1 for $\frac{100}{\sin \text{their } 5} = \frac{AP}{\sin \text{their } 149}$ oe AND M1 for <i>their</i>APsin26 oe for PG</p> <p>----- Alternative method 2 M2 for $BG = \frac{PG}{\tan 31}$ OR M1 for $\tan 31 = \frac{PG}{BG}$ AND M2 for $AG = \frac{PG}{\tan 26}$ OR M1 for $\tan 26 = \frac{PG}{AG}$ AND M1 for $AG - BG = \frac{PG}{\tan 26} - \frac{PG}{\tan 31}$ oe 100 = PG x 0.386...</p>

Question		Answer	Marks	Part Marks and Guidance	
15		607.5	6	<p>M1 for area of base of pyramid = $\frac{1}{2} \times 4.5 \times 4.5$</p> <p>M1 for volume of pyramid = $\frac{1}{3}$ (their base area) $\times 4.5$</p> <p>A1 for 15.1875</p> <p>AND</p> <p>M2 for $9^3 - 8 \times$ <i>their</i> 15.1875 OR M1 for 9^3 or 729 or $8 \times$ <i>their</i> 15.1875</p>	<p>May be contained within eg $\frac{1}{2} \times 4.5 \times 4.5 \times 4.5$</p>
16		2, -7	5	<p>M1 attempt to eliminate y</p> <p>M1 <i>their</i> 3 term quadratic [=0]</p> <p>M1 factorise correctly or other fully correct method</p> <p>B1, B1 for correct answers</p>	<p>Correct is $x^2 - 4x + 4 = 0$ (allow 1 arithmetic slip) $(x - 2)^2 = 0$</p> <p>Equivalent marks for process that eliminates x</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
Telephone: 01223 552552
Facsimile: 01223 552553

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