

GCSE

Methods in Mathematics (Pilot)

Unit **B392/02**: Higher Tier

General Certificate of Secondary Education

Mark Scheme for June 2017

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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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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

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.

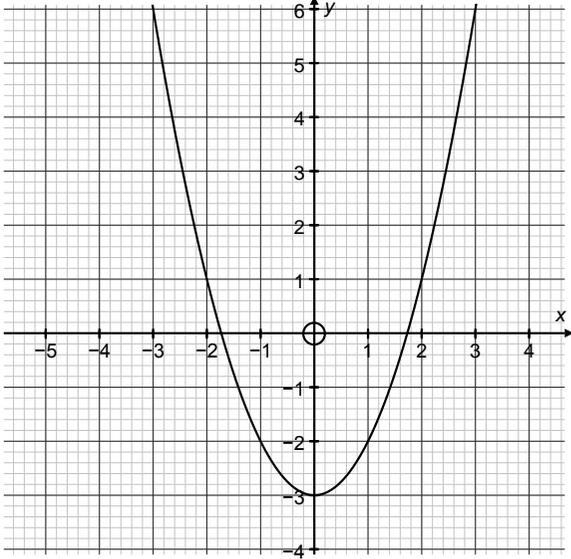
Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, eg FT $180 \times (\textit{their} '37' + 16)$, or FT $300 - \sqrt{(\textit{their} '5^2 + 7^2')}$. Answers to part questions which are being followed through are 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)	97.336	1		
		(ii)	1.27	3	M2 for 1.2692337... OR M1 for 4.0615...	
	(b)	(i)	0.3125	2	M1 for $5 \div 16$	
			$\frac{5}{9}$	3	M2 for equivalent fraction or for $10a = 5.55555555\dots$ OR M1 for 0.555555555...	
2	(a)		PRQ	1		
			PRQ	1		
	(b)	(i)	72	2	M1 for $360 \div 5$	
		(ii)	36	2	M1 for <i>their</i> (a) $\div 2$ OR for $\angle AED = 108^\circ$	
3	(a)		6, -2, -2, 1	2	B2 all values correct OR B1 2 values correct	
	(b)			2	B1 for at least four of <i>their</i> points correctly plotted AND B1 smooth curve through their points	Within half a small square Within half a small square Curve must have one min turning point. B0 for multiple or "hairy" curves

Question		Answer	Marks	Part Marks and Guidance	
	(c)	-2.6, 2.6 (± 0.1)	2	B1, B1 (or ft <i>their curve</i>) If 0 scored, M1 evidence of reading from $y=4$	
4	(a)	28	2	M1 for 0.8×35 or £7	
4	(b)*	Clear correct explanation with conclusion that it is not a 30% discount e.g. $0.8 \times 0.9 = 0.72$. This is a 28% discount, not 30%.	3	2 for correct complete working but no conclusion 1 for either 30% reduction worked out (£24.50) or 20% then 10% (£25.20)	
	(c)*	Compares offers and offers clear explanation with conclusion that buy two get one free is better. E.g. Buy two get one free is one third off (33.3..%). Buy one and get one half price mean getting two and paying for one and a half – this is one quarter off (25%). The first offer is better.	3	2 for correct complete working but no conclusion 1 for getting one offer into a form in which it could be compared with the other (e.g. using fractions or percentages).	
5	(a)	1: 1.5 or $1:\frac{3}{2}$ or $1:1\frac{1}{2}$	2	M1 for $12 \div 8$	
	(b) (i)	$\frac{2}{5}$	1		
	(ii)	$\frac{14}{5}$ o.e.	1		
	(c) (i)	30, 15	1,1		
	(ii)	$\frac{15}{64}$ oe	2	M1 for multiplying by a power of $\frac{1}{2}$	
6	(a)	$[x=] -5.5$ oe	3	M2 for $2x = -11$ oe OR M1 for $2x - 10$ M1 for getting numbers or x on one side only M1 for correct FT from $kx + c = n$	
				to maximum 2 marks	

	(b)		2, 4	4	<p>M2 for correct factors $(x - 4)(x - 2)$ OR M1 for factors which multiply to give two correct terms in $x^2 - 6x + 8$ B1, B1</p>	<p>Can be solved by completing square or use of formula M2 for $\frac{6 \pm \sqrt{4}}{2}$ OR M1 for $\frac{6 \pm \sqrt{6^2 - 4 \times 1 \times 8}}{2 \times 1}$ condone 1 error OR M2 for $(x - 3)^2 - 1 = 0$ oe OR M1 for $(x - 3)^2$</p>
	(c)		$4x - 4$	3	<p>M1 for evidence of splitting shape into rectangles or for $2x$ AND M1 for $x - 2$ soi by $2(x - 2)$ or $2x - 4$ or $2x - 2$</p>	
7	(a)		5.7[4....]	3	<p>M2 $\sqrt{7^2 - 4^2}$ OR M1 $7^2 - 4^2$</p>	SC1 for any Pythagoras statement
	(b)		34.8[4....]	3	<p>M2 for $\sin^{-1} \frac{4}{7}$ OR M1 for $\sin C = \frac{4}{7}$</p>	<p>Allow correct use of tan or cos with <i>their</i> (a) for method marks eg $\cos C = \frac{\text{their}(a)}{7}$</p>
8	(a)	(i)	Circle centre origin Radius 3	M1 A1		Judge by eye
		(ii)	$x^2 + y^2 = 9$	2	M1 for $x^2 + y^2$	
	(b)		Horizontal translation 1 to right (graph through (0, -1))	1 1		Judge by eye

9		6.6 or 6.64	3	<p>M1 for length sf is 1.879... (or reciprocal 0.532...)</p> <p>AND M1 for vol sf is <i>their</i> length sf cubed</p>	<p><u>Alternative method</u></p> <p>M1 for $\frac{4\pi}{3} \times 6371^3$ or $\frac{4\pi}{3} \times 3390^3$</p> <p>AND M1 for dividing <i>their</i> Earth volume by <i>their</i> Mars volume</p>
10		$n^2 + 2noe$	2	<p>M1 for n^2 or 2^{nd} difference = [+]2</p> <p>OR for factor n in expression for nth term</p>	
11		$\sqrt{11}$	4	<p>M1 for $1^2 + 3^2$</p> <p>AND M1 for <i>their</i> $BD^2 + 1^2$</p> <p>AND M1 for 11 (can be implied by 3.32...)</p>	
12	(a)	At intersection points, both equations are true So solution of simultaneous equations gives intersection points	M1 A1		
	(b)	(0, 0) and (100, 10 000)	5	<p>M1 for eliminating y</p> <p>AND M1 for $x^2 - 100x = 0$</p> <p>AND M1 for factorising</p> <p>A1, A1 for each pair of values</p>	
	(c)	2	1		
13		Complete proof	5	<p>M1 for Length $(b - a)$</p> <p>M1 for Width $\left(\frac{1}{a} - \frac{1}{b}\right)$</p> <p>M1 for Area $(b - a)\left(\frac{1}{a} - \frac{1}{b}\right)$</p> <p>M1 for $\frac{a}{b} + \frac{b}{a} - 2$ oe</p>	<p>$\frac{1}{a}$ and $\frac{1}{b}$ even if not subtracted</p> <p>eg $(b - a)\frac{(b - a)}{ab}$</p>

14	(a)	Correct explanation	1		eg GC is the radius and this is 4 cm
	(b)	17.2[168..]	8	<p>M1 for $\cos GCD = \frac{1}{4}$</p> <p>A1 for $\angle GCD = 75.5^\circ$ (need not be rounded)</p> <p>AND</p> <p>M1 for area triangle GCD = $\frac{1}{2} \times 2 \times 4 \times \sin 75.5$</p> <p>A1 for 3.87.. cm²</p> <p>AND</p> <p>M1 for area sector GCE = $\frac{75.5}{360} \times \pi \times 4^2$</p> <p>A1 for 10.54...</p> <p>AND</p> <p>M1 for 2 x <i>their</i> 10.54.. – <i>their</i> 3.87..</p>	

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