

Mathematics C (Graduated Assessment)

General Certificate of Secondary Education

Unit **B280**: Module M10 (Sections A&B)

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.
W marks are workless marks, which 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).
 - **nfw** 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 **W** marks. Deduct 1 mark from any **A** or **W** 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.

Section A

Question		Answer	Marks	Part marks and guidance	
1	(a) (i)	$\frac{2}{3}$ oe	1		
	(ii)	$\frac{2}{30}$ oe	1	Or FT their (i)/10	For oe do not accept 0.6/9
	(b)	$\frac{23}{30}$	2	M1 for $7/10 + 2/30$ FT <i>their</i> $2/30$ Or $10r = 7.66$, $100r = 76.6$, $1000r = 766$, $9r = 6.9$, $99r = 75.9$, $999r = 765.9$ $90r = 69$, $990r = 759$, $9990r = 7659$ SC1 $76/99$ as final answer	NB $9 = 6.9$ alone (missing unknown) is insufficient for M1, but if leads to $6.9/9$ award M1
2	(a)	$\frac{3x+1}{2}$ or $1.5x + 0.5$ oe as final answer	2	M1 for $2x(3x + 1)$ or $\frac{3x^2 + x}{2x}$ or $\frac{6x + 2}{4}$ seen	
	(b)	$\frac{10x+6}{x(x+2)}$ or $\frac{2(5x+3)}{x(x+2)}$ oe as final answer	2	M1 for $3(x+2) + 7x$ seen	Condone $3x + 2 + 7x$ (but not eg $10x + 2$ only) Accept two fractions for M1 eg $\frac{3(x+2)}{x(x+2)} + \frac{7x}{x(x+2)}$ condone eg $\frac{3x+2}{x^2+2} + \frac{7x}{x^2+2}$ but do not condone $\frac{3(x+2)}{x} + \frac{7x}{x+2}$

Question		Answer	Marks	Part marks and guidance
3	(a)	$x^2 + (2x + 1)^2 = (x + 4)^2$ oe $x^2 + 4x^2 + 4x + 1 = x^2 + 8x + 16$	<p>1</p> <p>1</p>	<p>Allow brackets to be implied by the next statement.</p> <p>First line may be implied by correct second line.</p> <p>Allow $2x + 2x$ for $4x$ and $4x + 4x$ for $8x$</p> <p>Absence of brackets in second statement may be condoned if 'recovered' eg $x^2 = x^2 + 8x + 16 - 4x^2 + 4x + 1$ then $x^2 = -3x^2 + 4x + 15$</p> <p>If 0 allow 1 for $4x^2$ [+] $2x$ [+] $2x$ [+] 1 and x^2 [+] $4x$ [+] $4x$ [+] 16 (or better)</p> <p>(may be seen in grids)</p> <p>Condone work for (b) seen in (a) (and (a) in (b))</p>
	(b)	$(2x + 3)(2x - 5)$ or $\frac{4 \pm \sqrt{16 + 240}}{8}$ 2.5	<p>M2</p> <p>A1</p>	<p>Allow + in place of \pm</p> <p>Or M1 for $(2x \pm 3)(2x \pm 5)$ or for factors giving two terms (out of 3) correct or for substitution into quadratic formula with at most two errors</p> <p>W2 for 2.5 and -1.5</p> <p>If 0, W1 for 2.5</p> <p>Factors may be seen in table Allow eg $2x(2x + 3) - 5(2x + 3)$</p> <p>Allow - -240 for +240</p>

Question		Answer	Marks	Part marks and guidance	
4		$1 + 4\sqrt{3}$ isw	2	M1 for multiplying numerator and denominator by $\sqrt{3}$ Or writing $12 = (2\sqrt{3})^2$ or $4\sqrt{3}\sqrt{3}$	condone $4\sqrt{3} + 1$ and $1 + 4 \times \sqrt{3}$ Condone eg $\frac{\sqrt{3} \times 12 + \sqrt{3}}{\sqrt{3} \times \sqrt{3}}$ Multiplication sign may be implied by further working. $\sqrt{3} \times \left(\frac{12 + \sqrt{3}}{\sqrt{3}} \right)$ scores M0 unless multiplication of numerator and denominator is implied by further working.
5	(a)	(1, -2)	1		
	(b)	(4, 1)	1		
	(c)	(4, -6)	1		
6	(a) (i)	$b - a$ oe	1		
	(ii)	$2b - 2a$ oe	1	$-a + 2b - a$ isw	
	(b)	A, B and C are collinear and $AB = BC$	2	W1 for AB is parallel to AC or $AB = BC$ or A, B and C are collinear W1 is dependent on 2 scored in (a) or (i) $a - b$ and (ii) $2a - 2b$	2 marks only awarded if (a)(ii) seen in simplified form (ie $2(b - a)$ or $2b - 2a$) or (i) $a - b$ and (ii) $2a - 2b$ Accept B is the midpoint of AC for 2 marks
7		58000	3	nfww M1 $29 + 36 + n$ seen M1 3×41	Do not allow eg $29 + 36 + 53$ to imply $29 + 36 + n$

Section A Total: 25

Section B

Question		Answer	Marks	Part marks and guidance	
8	(a)	$x^2 + (3x - 5)^2 = 16$ soi	1	Implied by $x^2 + 9x^2 - 15x - 15x + 25 = 16$	Count $+15x + 15x$ as 1 error
		$x^2 + 9x^2 - 15x - 15x + 25 = 16$	2	Accept $10x^2 - 30x + 25 = 16$ for 2 marks but not to imply 1 st mark. M1 for expansion correct or with one error	
	(b)	2.66 and 0.34	3	W2 for 1 correct solution 2.66... or 0.338... or 0.34 Or 2 negative solutions -2.66 and -0.34 M2 for $\frac{30 \pm \sqrt{900 - 360}}{20}$ Or M1 for substitution in quadratic formula; condone 2 errors	Substitution errors include short line, -30^2 (unless 900 also shown). Allow 30^2 Condone work for (b) seen in (a) (and (a) in (b))
9	(a)	$40 \times \frac{24}{60}$	2	Allow $40 \div 2.5$ or allow $\frac{2}{3}$ of 24 – provided, in both cases, 60 seen. M1 2.5 or 0.4 or M1 $\frac{2}{3}$ or $\frac{3}{2}$ oe – nfw and provided 60 seen	Accept $60/24 = 2.5$ and $40/16 = 2.5$ for 2 marks. Accept 40 to 60 is the same as 16 to 24 for 2 marks.

Question	Answer	Marks	Part marks and guidance	
	(b) 3166 to 3167 or 1008π	3	M2 for $\pi \times 20 \times 60 - \pi \times 8 \times 24$ Or M1 for $\pi \times 8 \times 24$ or $\pi \times 20 \times 60$ SC1 6333 to 6334 or 2016π	= 603.(...) or 3769.(...) Condone additions for M2 eg $1008\pi + 400\pi$ or 1408π or 4423. ALT M2 $\pi \times \frac{(40 + 16)}{2} \times 36$
10	(a) 0 because eg 'The 9 cannot be used twice so it is impossible to score 99.'	1		Allow 0/n or zero or none for 0
	(b) 1/9 oe (or 0.11 or better)	2	nfw M1 for 90 [possible total outcomes] or 10 [outcomes for 9] or the 10 outcomes listed or $1/10 \times 1/9$	
11	Classy selected and justified by eg Classy 54% and Maxwell 51%	4	M2 for either total correct (C=70 or M=78) or both totals for more than £8000 correct (C = 38 and M= 40) Or M1 for any 5 correct frequencies (C: 6, 16, 10, 30, 8) (M: 12, 14, 12, 20, 20) or for C = 38 or M = 40 And M1 for correct % for either C or M For final solution or M1 allow decimals or fractions with same denominators	<u>Alternative method (counting squares):</u> M2 for either total correct (C=35 or 875 or M=39 or 975) or both totals for more than £8000 correct (C = 19 or 475 and M= 20 or 500) Or M1 for 5 squares from either C or M (C: 3, 8, 5, 15, 4 or 75, 200, 125, 375, 100) (M: 6, 7, 6, 10, 10 or 150, 175, 150, 250, 250) or for C = 19 or 475 or C = 20 or 500 Condone consistent proportional frequencies And M1 for correct % for either C or M NB if candidates consider less than 8000 and method is clear M2 and/or M1 (%) can be awarded

Question			Answer	Marks	Part marks and guidance
12		(a)	4	1	Accept embedded answer
			-0.5 oe	2	M1 for 0.5 or $^{-}2$ Accept embedded answer
13			14.6 to 14.7	4	M1 for $\angle ASB = 29$ evident And M2 for $\frac{8.7 \times \text{their sin } 125}{\text{their sin } 29}$ Or M1 for $\frac{AS}{\text{their sin } 125} = \frac{8.7}{\text{their sin } 29}$ For their sin 125 accept 125 or '180 – 26 – their <ASB' or their <ABS marked on diagram. Their 125 must be obtuse. Candidates finding SB instead of SA can be regarded as MR and can score M3

Section B Total: 25

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