

Mathematics C (Graduated Assessment)

General Certificate of Secondary Education

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

Mark Scheme for March 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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GCSE Mathematics C (Graduated Assessment) – J517
Units B272 to B280

1. Mark strictly to the mark scheme.
2. Make no deduction for omission of units except as indicated on the mark scheme (although if this leads to a later error this will of course be penalised).
3. Work crossed out but not replaced should be marked.
4. **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.
W (workless) marks are independent of M (method) marks and are awarded for a correct final answer or a correct intermediate stage.
5. Subject to 4, two situations may be indicated on the mark scheme conditioning the award of A marks or independent marks:
 - i. Correct answer correctly obtained (no symbol)
 - ii. Follows correctly from a previous answer whether correct or not (“FT” on mark scheme and on the annotations tool).
6. 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).
7. Always mark the greatest number of significant figures seen, even if this is then rounded or truncated on the answer line, unless the question asks for a specific degree of accuracy.
8.
 - i. Allow full marks if the correct answer is seen in the body and the answer given in the answer space is a clear transcription error, unless the mark scheme says ‘mark final answer’ or ‘cao’.
 - ii. Allow full marks if the answer is missing but the correct answer is seen in the body.
 - iii. Accuracy marks for an answer are lost if the correct answer is seen in the working but a completely different answer is seen in the answer space. Method marks would normally be given.
9. 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.

10. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work.
11. For answers scoring no marks, you must either award NR (no response) or 0, as follows:
Award NR if:
 - Nothing is written at all in the answer space
 - There is a comment which does not in any way relate to the question being asked (“can’t do”, “don’t know”, etc.)
 - There is any sort of mark that is not an attempt at the question (a dash, a question mark, etc.)Award 0 if:
 - There is any attempt that earns no credit. This could, for example, include the candidate copying all or some of the question, or any working that does not earn any marks, whether crossed out or not.
12. Where a follow through (FT) 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.
13. In cases where there is clear evidence that a calculator has been used in section A, mark the script as normal then raise an exception.
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.

Abbreviations

The following abbreviations are commonly found in GCSE Mathematics mark schemes.

- Where you see **oe** in the mark scheme it means **or equivalent**.
- Where you see **cao** in the mark scheme it means **correct answer only**.
- Where you see **soi** in the mark scheme it means **seen or implied**.
- Where you see **www** in the mark scheme it means **without wrong working**.
- Where you see **rot** in the mark scheme it means **rounded or truncated**.
- 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 on the answer line, even if it is not in the method leading to the final answer.
- 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.

Section A

1	$\frac{x-4}{3(x+2)} \text{ or } \frac{x-4}{3x+6}$ as final answer www	3 M1 for $(x-4)(x-2)$ seen M1 for $3(x+2)(x-2)$ or $(3x+6)(x-2)$ or $(x+2)(3x-6)$ seen	allow Ms even if expressions 'spoilt' by subsequent wrong 'cancelling' or 'solving' etc
2	(a) $6\sqrt{5}$ www	2 allow 2 for $6 \times \sqrt{5}$ 1 for $3\sqrt{20}$ or $2\sqrt{45}$ or $\sqrt{36 \times 5}$ or $\sqrt{36} \times \sqrt{5}$ or $\sqrt{2} \times \sqrt{2} \times \sqrt{3} \times \sqrt{3} \times \sqrt{5}$ seen	0 for eg $\sqrt{9 \times 20}$ - not sufficient since still two steps to go
	(b) $11 + 5\sqrt{3}$ www	2 M1 for at least 3 terms correct of $14 - 2\sqrt{3} + 7\sqrt{3} - 3$ oe	middle two terms may be combined for M1; ie $5\sqrt{3}$ counts as two terms
3	$2x^2 - 5x - 1 = 2x - 4$ $2x^2 - 7x + 3 [= 0]$ $(2x - 1)(x - 3)$ $x = \frac{1}{2}, y = -3$ $x = 3, y = 2$	M1 or attempt at eliminating y by subtraction M1 for attempt to rearrange to zero (condone one error); implies previous M1 M2 for correct factorising or use of quadratic formula or completing square (FT <i>their</i> eqn); M1 if one error W1 or W1 for both x values and W1 for both y values; marking to benefit of candidate for full 6 marks the working must be totally correct	or M1 for eliminating x , condoning one error (which may be repeated if it applies to more than one term) $y = 2\left(\frac{y+4}{2}\right)^2 - 5\left(\frac{y+4}{2}\right) - 1$ allow M1 M1 for $y = 2x^2 - 7x + 3$ eg M2 for $\frac{7 \pm \sqrt{25}}{4}$ or FT; M1 for subst <i>their</i> eqn in formula with up to one error FT (as in q8) eg M1 for factors which would give two terms of quadratic correct or for sign error if more than one attempt, mark the best

4	(a)	<table border="1"> <tr> <td>x</td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>y</td> <td>0.25</td> <td>0.5</td> <td>1</td> <td>2</td> <td>4</td> <td>8</td> </tr> </table>	x	-2	-1	0	1	2	3	y	0.25	0.5	1	2	4	8	M2 for all points plotted correctly M1 for 4 of these plotted correctly or for whole table completed correctly A1 dep on at least M1 gained; must be all above x axis and a reasonably smooth increasing curve	allow Ms for curve through correct points if no plots visible no ft from their table curve within 1mm of their points
		x	-2	-1	0	1	2	3										
y	0.25	0.5	1	2	4	8												
smooth curve of correct shape																		
	(b)	answer in range 2.2 to 2.4	1 condone embedded	independent of gaining marks in part (a)														
5	(a)	sketch of graph between given graph and x axis	1 should be reasonably symmetrical; be generous on intent	ignore any sketches of translated graphs for part (b)														
	(b)	$y = 2(x - 3)^2$ isw	2 1 for $2(x - 3)^2$ or $y = 2(x + 3)^2$ or $y = (2x - 3)^2$ oe	accept equivalents eg 2 for $y = 2x^2 - 12x + 18$ 0 for just $y = f(x - 3)$														
6		$\frac{4}{3} \times \pi \times 3^3 [=36\pi]$ $\pi \times 2^2 \times h$ or $[h =] \frac{\text{volume}}{\pi \times 2^2}$ their vols equated or $[h =] \frac{\text{volume of sphere}}{\text{area of base}}$ for correctly eliminating π <u>and</u> dealing with 3 in denominator, FT their eqn $h = 9$	M1 M0 for $4\pi r^2 = 36\pi$ M1 M0 for $2 \times \pi \times 2 \times h$ M1 M3 for $\frac{4}{3} \times \pi \times 3^3 = \pi \times 2^2 \times h$ oe M1 eg M1 for $36 = 4h$ or $4 \times 3^3 = 12h$ etc (M0 if 36π comes from $4\pi r^2$) A1 W2 only, for $h = 9$ without clear correct method shown (A0 if obtained wrongly)	bod first M1 for 36π as first statement for sphere bod 2nd M1 for $4\pi h$ as first statement for cylinder allow 3 rd M1 for $\frac{4}{3} \pi r^3 = \pi r^2 h$ or for surface areas or mixture of area and vol equated eg $\frac{4}{3} \times \pi \times 9 = \pi \times 4 \times h$ without correct earlier step showing the 3^3 gets M0M1M1, and followed by $h = 3$ gets 4 th M1 FT														

Section A Total: 25

Section B

7	(a) 'since the 1% was not a % of the same amount each month' oe	1	or $0.99^{12} = 0.886... \Rightarrow 11.4$ or $11.36..%$ [decrease] (or less than 12%) or calculation of both $300(000) \times 0.99^{12}$ and $300(000) \times 0.88$	0 for just 'it is less than 12' with no reasoning condone 'the % is compounded' oe
	(b) 265 915 to 265 920 or 265 900 or 266 000 www	3	M2 for $300(000) \times 0.99^{12}$ or for digits 265 915 to 265 920 with wrong dp Or M1 for 297 (000) <u>and</u> 294 (030) <u>and</u> digits 291089 to 291090 seen SC2 for 268 600 to 268 605 or for 263 250 to 263 260 SC1 for $300(000) \times 0.99^{11}$ or for $300(000) \times 0.99^{13}$	
8	$\frac{-7 \pm \sqrt{7^2 - 4 \times 3 \times -4}}{2 \times 3}$ o.e. 0.47 or -2.81		M1 condone one error or $\left(x + \frac{7}{6}\right)^2 = \frac{4}{3} + \left(\frac{7}{6}\right)^2$ o.e., condoning two errors A2 A1 for one solution or for both to 1 or more dp (for other methods eg trace and zoom on graphics calculator or trial and improvement allow W1 for one soln, W3 for both	allow eg a substituted wrongly twice as one error; allow short division line as one error; allow one error in quoted formula A1 for 0.4748... and -2.808... rounded to 1 dp or to 3 or more dp; or A1 for -0.47 and 2.81
9	(a) 8	1		
	(b) 34	1		

	<p>(c) 'average weights about the same' oe</p> <p>correct supporting evidence:</p> <p>London Irish have greater range/ have more varied weights oe [eg weights of LW are more consistent]</p> <p>correct supporting evidence: eg accept 'they have a player weighing less than 80 kg and two weighing over 130 kg and all London Wasps are between 80 and 125 kg'</p> <p>For ranges: allow LI 55-60 and LW 45 (or less with comment) or mention of LI: lower end 75 to 80, upper end 135 (or less with comment) LW: lower end 80, upper end 125 (or eg mention of may be more than 80 and less than 125)</p>	<p>M1 allow 'median of LI [slightly] less' if consistent with their correct medians</p> <p>A1 median LW = 102 – 103 (by interpolation) median LI = 101 – 103</p> <p>M1 allow 'similar' only if IQR used correctly</p> <p>A1 For IQRs: By interpolation, LW LQ = 91 - 92 UQ = 113 - 114 IQR = 21 - 23 LI LQ = 89 – 90 UQ = 112 - 113 IQR = 22 – 24</p> <p>SC1 for correct ranges for both teams with no comparison</p>	<p>allow refs to histogram and cf graph oe instead of LW and LI</p> <p>allow eg LW player is second smallest in 100-110 group; condone estimate of mean of LW = 102(-4...) found and compared with median of LI</p> <p>if modal classes used, numerical evidence is required: allow 'LW heavier' only if comparison of modal classes: LW 110-120, LI 100-110 (accept 100-105 or 105-110); allow 'LI heavier' if comparison of modal classes: LW 85-90 and LI 100-110</p> <p>M0 for comparison of modal class and mean/median</p> <p>must be statement about lower end of range as well as top end eg A1 for 'both start at 80 but LI has players over 125 and LW hasn't'</p> <p>NB if no evidence seen in statements, scroll down to look for evidence by graphs, for both average and range</p>
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10	$5 \cdot 1^2 + 3 \cdot 7^2 - 2 \times 5 \cdot 1 \times 3 \cdot 7 \times \cos 108$ $51 \cdot 2$ to $51 \cdot 4$ or $\sqrt{(51 \cdot 2 \text{ to } 51 \cdot 4)}$ $[AC =] 7 \cdot 155$ to $7 \cdot 17$ or $7 \cdot 2$ extra distance = $1 \cdot 6$ or $1 \cdot 63$ or $1 \cdot 64$	M1 condone one error A1 implies previous M1 A1 may be implied by correct final answer A1 allow W3 for correct value for AC www or W4 for correct value for extra distance www	eg M1 if correct except for sign error or a letter appearing for the angle instead of 108
11 (a)	$\overline{OB} = \mathbf{a} + \mathbf{c}$ or $\overline{OP} = \frac{2}{3}(\mathbf{a} + \mathbf{c})$ oe $-\mathbf{a} + \frac{2}{3}(\mathbf{a} + \mathbf{c})$ or $\mathbf{c} - \frac{1}{3}(\mathbf{a} + \mathbf{c})$ or $-\mathbf{a} + \frac{2}{3}\overline{OB}$ or $\mathbf{c} - \frac{1}{3}\overline{OB}$ oe	1 or $\overline{BO} = -\mathbf{a} - \mathbf{c}$ or $\overline{BP} = -\frac{1}{3}\mathbf{a} - \frac{1}{3}\mathbf{c}$ oe 1 second mark does not imply first without more evidence If 0, allow SC1 for $\frac{2}{3}\mathbf{c} - \frac{1}{3}\mathbf{a}$ route shown clearly on diagram	condone lack of vector notation accept longer equivalent routes allow 2 for using this route with better justification eg $AF : FB = OP : PB = 2 : 1$ etc where F is on AB
(b)	$\mathbf{c} - \frac{1}{2}\mathbf{a}$ or $-\mathbf{a} + \mathbf{c} + \frac{1}{2}\mathbf{a}$ oe isw	1	
(c)	comment that $\overline{AQ} = k\overline{AP}$	1 dep on \overline{AQ} correct	eg $\overline{AQ} = \frac{3}{2}\overline{AP}$ or $\overline{AP} = \frac{2}{3}\overline{AQ}$

12	<p>One branch method:</p> $P(p',p') = \frac{17}{25} \times \frac{16}{24} \text{ oe } (= \frac{34}{75} \text{ oe})$ $P(\text{at least one } p) = 1 - P(p',p')$ $\frac{328}{600} \text{ or } \frac{41}{75} \text{ oe}$	<p>or three branch method:</p> <p>M1 M1 for $P(p,p) = \frac{8}{25} \times \frac{7}{24} \text{ oe } (= \frac{7}{75} \text{ oe})$</p> <p>M2 and M1 for $P(p,p') = \frac{8}{25} \times \frac{17}{24} \text{ oe } (= \frac{17}{75} \text{ oe})$ or for $P(p',p) = \frac{17}{25} \times \frac{8}{24} \text{ etc}$ and M1 for $P(\text{a least one } p) = P(p,p) + P(p',p) + P(p,p')$ FT <i>their</i> probs</p> <p>A1 allow W4 for $\frac{41}{75} \text{ oe } \text{www}$</p> <p>If replacement. SC2 for $1 - \left(\frac{17}{25}\right)^2 = \frac{336}{625}$ or $\left(\frac{8}{25}\right)^2 + \frac{136}{625} + \frac{136}{625} = \frac{336}{625} \text{ oe, and similarly for}$ the 5-branch method</p>	<p>or five branch method:</p> <p>M3 for $P(p,p)+P(p,m)+P(p,w)+P(m,p)+P(w,p)$ with correct products or answers eg $\frac{56}{600} + \frac{96}{600} + \frac{40}{600} + \frac{96}{600} + \frac{40}{600}$ or M2 for at least 3 of these added or M1 for all 5 branches identified (may be on diagram)</p> <p>accept equiv decimals or %; allow A1 or W4 for 0.546 to 0.547</p>
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Section B Total: 25

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