

# **Mathematics C (Graduated Assessment)**

General Certificate of Secondary Education

Unit **B279**: Module M9 (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).
  - **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. 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)	1	1		
	(b)	$\frac{1}{36}$	1		
	(c)	8	2	<b>M1</b> for $\sqrt[4]{16^3}$ soi	e.g. $2^3$ or $\sqrt[4]{4096}$
2		$[r^3 =] \frac{3V}{2\pi}$ oe $[r =] \sqrt[3]{\frac{3V}{2\pi}}$ or $[r =] \sqrt[3]{\frac{1.5V}{\pi}}$ final answer	<b>M2</b> <b>M1</b>	<b>M1</b> for division by $2/3$ o.e. <u>or</u> $\pi$ at any stage isw <b>or</b> for $3V = 2\pi r^3$ <b>M1</b> Mark the answer line Cube root sign at final stage must go below fraction line and cover whole expression – allow FT from their expression	For <b>M2</b> – no ‘double decker’ fractions NB $[r =] \sqrt[3]{\frac{V}{2/3\pi}}$ seen scores <b>M1 + M1</b> only After <b>M0</b> fully correct reverse flowchart scores <b>SC1</b>
3		$3.2[8] \times 10^{17}$ or $3 \times 10^{17}$	2	<b>M1</b> for $32[.8] \times 10^{16}$ or $30 \times 10^{16}$ oe or answers $3.2[8] \times 10^n$ or $3 \times 10^n$ where $n$ is a positive integer or answer $k \times 10^{17}$ where $1 < k < 10$	For <b>2</b> marks allow $3.3 \times 10^{17}$ after $3.28 \times 10^{17}$ seen For <b>1</b> or <b>2</b> marks do not accept e.g. $3.2 \text{ exp } 17$ , $3.2^{17}$ etc <b>M1</b> could be earned for answer written out in full
4		2.25	3	nfw <b>M2</b> for $66.5 - 64.25$ or $64.25 - 66.5$ $[-2.25]$ or <b>M1</b> for $66.5$ <b>or</b> $64.25$ seen	For <b>3</b> marks allow 2.25 from $64.25 - 66.5$ Beware $66.5 - 64.35 = 2.25$ gets <b>M1</b> only Condone 66.50

Question		Answer	Marks	Part marks and guidance	
5		188	3	<b>M2</b> for 4 of 30, 35, 58, 40, 25 or <b>M1</b> for 2 correct products soi from $20 \times 1.5$ , $10 \times 3.5$ , $10 \times 5.8$ , $10 \times 4$ , $50 \times 0.5$	Values could be on diagram  After 0 scored <b>SC1</b> for answer 94 from consistent scale misread
6	(a)	$2x^2 + 5x - 4x - 10 = 18$  $2x^2 + x - 28 = 0$ as final answer	<b>M2</b>  <b>A1</b>	<b>M1</b> for $(2x + 5)(x - 2) = 18$ or $2x^2 + 5x - 4x - 10$ seen or better which could be in a table  dep on <b>M2</b> with no errors seen	Do not accept $2x^2 + x - 10 = 18$ alone without further evidence e.g. table shown, initial statement of at least $(2x + 5)(x - 2)$ For <b>M2</b> allow the 18 to be brought in after the brackets are removed even if error after correct expansion e.g. $2x^2 + 5x - 4x - 10$ then $2x^2 - x - 10 = 18$ allow <b>M2</b>
	(b)	(i) $(2x - 7)(x + 4) = 0$  $7/2$ isw oe and $-4$	<b>M2</b>  <b>A1</b>	<b>or M1</b> for $(2x \pm 7)(x \pm 4)$ <b>or</b> for factors using integers excluding 0, giving two terms correct when expanded  and <b>A1FT</b> <i>their</i> factors, dependent on <b>M1</b>	Allow method marks for correct factors shown in <b>(a)</b> provided not contradicted in <b>(b)(i)</b>  Allow <b>A1</b> for correct answers seen in working but factors given on answer line or transcription error Allow <b>W2</b> for both answers correct from no working or using the formula or completing the square or T & I
		(ii) 12 and $3/2$ oe	<b>1FT</b>	Correct or FT ( <i>their</i> positive root $\times 2 + 5$ ) and ( <i>their</i> positive root $- 2$ ) dep on positive and negative root from part <b>(b)(i)</b>	Not available from one root or 2 positive roots in part <b>(b)(i)</b>

Question		Answer	Marks	Part marks and guidance
7	(a)	$\frac{-1-5}{3-0}$ or $\frac{5- -1}{0-3}$	1	<p>Accept <math>-6/3</math> or <math>6/-3</math></p> <p>Accept clear diagram with rise/run shown with explanation of why a negative gradient if only <math>6/3</math> shown e.g. <math>6/3 = 2</math> then slopes downwards so grad = <math>-2</math></p> <p>Condone negative correlation after <math>6/3</math> shown Do not accept explanations involving numbers other than 6 and 3 from diagram e.g. across 1 and down 2</p>
	(b)	$y = \frac{1}{2}x + 5$ oe final answer	2	<p><b>M1</b> for gradient of line = <math>\frac{1}{2}</math> soi or <math>y = mx + 5</math> where <math>m</math> not equal to <math>-2</math> or 0</p> <p>Condone <math>y = \frac{1}{2x} + 5</math> for 2 marks</p> <p>e.g. <math>y = \frac{1}{2}[m] + 5</math> scores <b>M1</b> for grad = <math>\frac{1}{2}</math> soi e.g. <math>y = -\frac{1}{2} + 5</math> scores <b>0</b> (eqn not <math>y = mx + 5</math>)</p>

Section A Total: 25

## Section B

Question		Answer	Marks	Part marks and guidance
8	(a)	$(x + 4)(x - 4)$ final answer	1	Condone 'solutions' after correct factors
	(b)	$\frac{x + 4}{x - 1}$ final answer	3FT	<p>nfw FT <i>their (a)</i> provided 1 factor cancels</p> <p>Accept <math>1 + \frac{5}{x - 1}</math> for 3 marks</p> <p>e.g. <math>(x - 4)^2</math> in (a) then <math>\frac{x - 4}{x - 1}</math> gets 3 FT</p> <p>e.g. <math>\frac{(x + 4)(x - 4)}{(x - 1)(x + 4)} = \frac{x - 4}{x - 1}</math> scores <b>M1 + M1 dep</b></p>
9		17 or 18	2	<p>nfw <b>M1</b> for <math>3600/(9500 + 7300 + 3600) \times 100</math> or 17.6 to 17.7</p> <p>[3600/20400×100]</p>
10	(a)	12.5	2	<p>nfw <b>M1</b> for 15/12 or 1.25 or 12/15 or 0.8 soi</p> <p>For 2 marks or 1 mark do not accept from use of right-angled trig methods in both (a) and (b) <b>M1</b> can be implied by answer 11.25 nfw</p>
	(b)	44 to 44.2	2	<p>nfw <b>M1</b> for <math>(15/12)^2</math> or 1.56[25] or <math>(12/15)^2</math> or 0.64 oe soi or <i>(their SF)</i><sup>2</sup> from (a)</p> <p><b>M1</b> can be implied by answer 107(.4..) nfw</p>
11	(a)	65 angles in <u>same segment/same arc/same chord</u>	1 1	<p>Accept longer reason – <u>opposite angles</u> of a <u>cyclic quadrilateral</u> adds up to 180°/supplementary with two calculations shown</p> <p>Must mention underlined phrases in reasoning and make no incorrect statement</p> <p>e.g. accept opp. angles of cyclic quad then <math>180 - 65 = 115</math> and <math>180 - 115 = 65</math></p>



Question		Answer	Marks	Part marks and guidance	
	(b)	25	3	nfw <b>W1</b> for <u>angle ABD</u> = 90 soi e.g. angle marked as right angle <b>and W1</b> for <u>angle ABC</u> = 115 soi	e.g. 25 from no working scores <b>3</b> 115 – 90 = 25 scores <b>3</b> Check diagram for working allow <b>W</b> marks  <b>Alt method</b> Finds angle CED = 90 – 65 then CBD = 25 [angles on same arc] <b>but</b> do not allow this if angle ABD is marked as 65 Beware false methods leading to 25 e.g. angle ABC = 90 then angle ABD = 65, answer 25 scores <b>0</b> 90 – 65 = 25 alone scores <b>0</b>
12	(a)	0.6, 0.4, 0.7 and 0.3 correctly placed on tree diagram	1	Ignore any additional branches drawn	
	(b)	0.88 o.e.	3FT	FT <i>their</i> (0.6 + 0.4 × 0.7) correctly evaluated <b>M2</b> for <i>their</i> (0.6 + 0.4 × 0.7) or 1 – <i>their</i> (0.4 × 0.3) or <b>M1</b> for <i>their</i> (0.4 × 0.7) seen	Accept fractions/% isw cancelling conversion FT probabilities 0 < p < 1 only
13		Sketches a reciprocal graph Accept $y = \frac{a}{x}$ or $y = \frac{-a}{x}$	2	<b>W1</b> for one quadrant correct (and other wrong or missing) or for both 'correct' apart from crossing axis/axes	For <b>2</b> marks both parts in 1 <sup>st</sup> <b>and</b> 3 <sup>rd</sup> quadrants <b>or</b> the 2 <sup>nd</sup> <b>and</b> 4 <sup>th</sup> quadrants required Curves can touch axes but must not clearly cross axes Curves must be long enough to be 'curves' Additional curves after correct ones shown are penalised by <b>1</b> mark in total Curve(s) must not clearly change to positive gradient penalised by <b>1</b> mark in total.

Question		Answer	Marks	Part marks and guidance
14		2512 to 2514	4	<p><b>W2</b> for [height =] 24 or <b>M1</b> for <math>h^2 + 10^2 = 26^2</math> o.e.</p> <p><b>and M1</b> for <math>1/3 \pi 10^2 [x]</math> <i>their h shown</i> where <i>their h</i> is in range 16 to 36</p> <p>If <b>0</b> scored, <b>SC1</b> for answer 2722 to 2724 or 2720</p> <p>Allow <b>4</b> marks for final answer <math>800\pi</math></p> <p>Condone 0.33.. used for 1/3</p>

Section B Total: 25

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