Mathematics C (Graduated Assessment)

General Certificate of Secondary Education

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

Mark Scheme for January 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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Marking instructions for examiners (January 2011)

GCSE Mathematics C (Graduated Assessment) – J517
Units B271 to B282

Marking instructions

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.
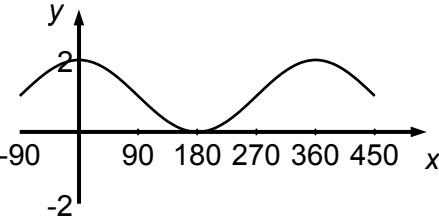
Abbreviations

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	(a)	5	1	Accept -5 or ± 5	
	(b)	$y = 2x - 1$ drawn (−1·7 to −1·9, −4·6 to −4·8) or (2·5 to 2·7, 4·15 to 4·35)	**M1** **A2**	Accept line segments or points **A1** for one point correct or for both x values or both y values **SC1** for complete reversed co-ordinates After **M0** award **W1** for one correct point using attempt at correct diagonal line	[answers to 2 dp are (-1·83, −4·65) or (2·63, 4·25)]
2	(a)	$\dfrac{2x-6}{x(x+2)}$ or $\dfrac{2x-6}{x^2+2x}$ or $\dfrac{2(x-3)}{x(x+2)}$ or $\dfrac{2(x-3)}{x^2+2x}$ as final answer www	3	**M1** for $2x - 6$ or $5x - 3(x + 2)$ oe seen at any stage (may be in two separate fractions) <u>and</u> **M1** for $x^2 + 2x$ or $x(x + 2)$ seen at any stage as common denominator (may be in two separate fractions); condone missing final bracket or **SC2** for final answer of $\dfrac{2x+6}{x(x+2)}$ or $\dfrac{2x+6}{x^2+2x}$ or $\dfrac{2(x+3)}{x(x+2)}$ or $\dfrac{2(x+3)}{x^2+2x}$	**M0** for $x + x + 2$ as denominator
	(b)	(i) $(x - 6)^2 + 4$ or $a = 6$ and $b = 4$	3	**W1** for $(x - 6)^2$... or $a = 6$ <u>and</u> **M1** for $- (\textit{their } 6)^2 + 40$ (may be implied by their b) or **SC2** for $(x - 6) +4$ or **SC1** for $(x + a)^2 +4$ or $b = 4$, when $a \neq \pm6$	eg **SC1** for $(x - 12)^2 + 4$ eg **M1** for $(x - 12)^2 - 104$ **M1** for $(x - 3)^2 + 31$
		(ii) (6, 4) or FT *their* (a, b)	2	**1** for each coordinate	only FT for a from $(x - a)^2 + b$ FT from *their b*

3	(a)	34/333 as final answer	3	**W2** for 102/999 or better Or **M1** for 999x = 102	
	(b)	$\sqrt{5}$	2	**W1** for $\sqrt{90} = 3\sqrt{10}$ or better or for $3\sqrt{2} = \sqrt{18}$ soi or $\dfrac{\sqrt{10}}{\sqrt{2}}$ or $\dfrac{\sqrt{45}}{3}$ or $\dfrac{\sqrt{180}}{6}$	
4	(a)	freq densities 0·5, 1·2, 1·6, 0·9, 0·4 soi bars correct heights bars correct widths	**M1** **A1** **W1**	at least 3 correct	eg may be implied by correct heights of bars
	(b)	two valid, worthwhile comparisons eg at least one girl raised over £100 but no boy did both distributions had a positive skew	2	**1** each	Take best part of the comment condone 'modal class is the same' or 'most common amount collected was £20 to £50'
5	(a)		1	mark intent	
	(b)	a = 3 b = 0·5 or ½	1 1		

Section A Total: 25

Section B

6	(a)	250	1		
	(b)	62·797… rot to 2 sf or more	1	e.g. 62, 63, 62.7, 62.8	
	(c)	8 www	2	**1** for one correct trial (of M or $10^{-0.3t}$) with $5 \le t \le 10$ (condone t not an integer)	values of M or $10^{-0.3t}$ must agree with these r.o.t. to 2 sf

values of M or $10^{-0.3t}$ must agree with these r.o.t. to 2 sf

t	10^(-0.3*t)	M	t	10^(-0.3*t)	M
5	0.0316228	7.905694	7.8	0.004571	1.14272
6	0.0158489	3.962233	7.9	0.004266	1.066449
7	0.0079433	1.985821	8.1	0.003715	0.928838
8	0.0039811	0.995268	8.2	0.003467	0.866842
9	0.0019953	0.498816			
10	0.001	0.25			

Values of t if seen need to match the value in the table

condone log methods: **M1** for $[t =]\dfrac{\log\left(\dfrac{M}{250}\right)}{-0.3}$ or

equivalent with $M = 1$ substituted

7	(a)	$(5x - 1)(x - 4)$ isw	2	**M1** for factors giving two terms correct or for sign error	e.g. $(5x+1)(x+4)$ or $(5x+9)(x-6)$ or $(5x\pm1)(x\pm4)$
	(b)	$[x =]\dfrac{17 \pm \sqrt{17^2 - 4 \times 5 \times 4}}{2 \times 5}$ 3·15 or 0·25	**M1** **A2**	condone one error or for $(x - 1·7)^2 = 1·7^2 - 0·8$ o.e., condoning two errors **A1** for one solution or for both to 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 **A1** for 3·1456… and 0.2543…rounded to 1 dp or to 3 or more dp; or **A1** for −3·15 and −0·25

8		$P(R,R) = \dfrac{3}{6} \times \dfrac{2}{5}$ o.e. (= $\dfrac{6}{30}$ o.e.)	**M1**	If replacement. **SC2** for	
		$P(B, B) = \dfrac{2}{6} \times \dfrac{1}{5}$ o.e. (= $\dfrac{2}{30}$ o.e.)	**M1**	$\left(\dfrac{3}{6}\right)^2 + \left(\dfrac{2}{6}\right)^2 + \left(\dfrac{1}{6}\right)^2 = \dfrac{14}{36}$ o.e. isw	
		P(both same) = *their* $P(R, R)$ + *their* $P(B, B)$ *(+ their P(G,G))*	**M1**		
		$\dfrac{8}{30}$ o.e. isw www	**A1**	**W4** for 8/30 o.e. isw. www	
9		$\dfrac{220}{360} \times \pi \times 3 \cdot 2^2$ or $19 \cdot 659..$	**M2**	**or M1** for $\dfrac{140}{360} \times \pi \times 3 \cdot 2^2$ or $12.51…$ and **M1** dep for subtraction from $\pi \times 3 \cdot 2^2$	Accept numbers rot
		$½ \times 3 \cdot 2^2 \times \sin 140$ or $3 \cdot 291…$	**M2**	or **M2** for complete method using perp ht and AB or **M1** for perp ht = $3 \cdot 2 \cos 70$ or $1 .09…$ or ½ AB = $3 \cdot 2 \sin 70$ o.e. or $3.007…$	
		total area = 22·9 to 23 (·0)	**A1**	**W5** for 22·95…www	
10	(a)	(i) **b** – **a** o.e.	1		
		(ii) 3**b** – **a** or FT *their* (a)(i) + 2**b**	1	accept unsimplified	
	(b)	$\overrightarrow{OD}$ = 3**b** − 2**a**	1	accept unsimplified	
		comment that $\overrightarrow{OD} \neq k\overrightarrow{AC}$	1	dep on $\overrightarrow{OD}$ and $\overrightarrow{AC}$ both correct and simplified	
11		arcs drawn with same radius o.e. OP = OP (and common) SSS	1 1 1	or just OP is common dependent on OP correct	accept ditto marks accept in words, no mention of angles

Section B Total: 25