

Mathematics C (Graduated Assessment)

General Certificate of Secondary Education **B280**

Module M10 (Sections A&B)

Mark Scheme for June 2010

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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

1. Mark strictly to the mark scheme. If in doubt, consult your team leader using the messaging system within *scoris*, e-mail, or by telephone.
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. If in doubt, consult your team leader.
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.)


The hash key [#] on your keyboard will enter NR.

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.

- 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 if this is not shown within the image zone. You may find it easier to mark follow through questions candidate-by-candidate rather than question-by-question.
- 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 (malpractice) in *scoris*. All suspected malpractice should be flagged using exceptions.
- 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.
- Holding the F2 key on your keyboard displays the annotations toolbar next to your cursor. The following annotations are available:

✓ and ✗

	Highlighter
BOD	Benefit of doubt
FT	Follows through
ISW	Ignore subsequent working (after correct answer obtained)
M0, M1, M2	Method mark awarded 0, 1, 2
A1	Accuracy mark awarded 1
W1, W2	Workless mark awarded 1, 2
SC	Special case
^	Omission
MR	Misread

These should be used whenever appropriate during your marking. **The A, M and W annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks.** It is vital that you annotate these scripts to show how the marks have been awarded. It is not mandatory to use annotations for any other marking, though you may wish to use them in some circumstances.

- The comments box will be used by the Principal Examiner to explain his or her marking of the practice scripts for your information. Please refer to these comments when checking your practice scripts. **Please do not type in the comments box yourself.** Any questions or comments you have for your team leader should be communicated using the *scoris* messaging system, e-mail, or by telephone.
- As far as possible you should mark roughly equal numbers of RIGs from sections A and B. It is helpful to mark some in each section as you go, rather than marking all RIGs in one section, then all RIGs from the other.

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)	73/99 cao	2	M1 for $100(r) = 73.73$ or better
	(b)	1/6	2	M1 for evaluating square root or interpreting reciprocal
	(c)	$9 - 4\sqrt{5}$	2	M1 for 3 or more terms correct soi of $\sqrt{5} \sqrt{5} - 2\sqrt{5} - 2\sqrt{5} + 4$
2	(a)	1.4 oe	1	
	(b)	Y11; more of the students (a greater proportion) are closer to the correct time of 50 seconds	1	any comment referring to more Y11 in the intervals around 50 or less in the extreme intervals at both ends, but not just about spread see exemplars
3	(a)	$b - a$	1	
	(b)	$\frac{1}{4}(b - a)$ oe	1	ft <i>their</i> (a) if in terms of a and b
	(c)	$\frac{3}{4}a + \frac{1}{4}b$ or $\frac{1}{4}(3a + b)$ or $a + \frac{1}{4}(b - a)$ or $b + \frac{3}{4}(a - b)$ accept correct equivalents	2	mark final answer M1 for correct route identified eg $\overrightarrow{OA} + \overrightarrow{OC}$, $a + \frac{1}{4}AB$, $a + \textit{their}(b)$, etc but not just for arrows on the diagram ft <i>their</i> (b) for M1 only
4	(a)	$(x - 4)^2 - 6$	3	M2 for $(x - 4)^2 - 16 (+ 10)$ or $x^2 - 4x - 4x + 16 - 16 (+ 10)$ Or M1 for $(x - 4)^2$ or $(\dots)^2 - 6$ Or SC2 for $(x + 4)^2 - 6$
	(b)	-6	1ft	ft <i>their</i> -6 from (a)

<p>5</p>	<p>$3x + 4 + x - x^2 = 7$ oe or $7 - 3x = 4 + x - x^2$ oe</p> <p>$x^2 - 4x + 3 (= 0)$ or $-x^2 + 4x - 3 (= 0)$ seen as part of solution leading to final answer</p> <p>$(x - 3)(x - 1)$ oe</p> <p>$x = 3, y = -2$ $x = 1, y = 4$</p>	<p>W1 for eliminating x or y</p> <p>M1 for correctly collecting <i>their</i> terms on one side, (allow $x^2 - 4x = -3$ if going on to complete the square)</p> <p>M1 ft factorising <i>their</i> quadratic equation or correct substitution to reach <i>their</i></p> <p>$(x =) \frac{4 \pm \sqrt{(-4)^2 - 4 \times 1 \times 3}}{2}$ or better</p> <p>W1 W1 if W0, allow W1 for two correct x values correct answers from trial and improvement scores W2 only</p>
<p>6</p>	<p>$\frac{36}{90}$ oe www ignore subsequent cancelling</p>	<p>4</p> <p>M1 for one colour correct (seen) $\frac{6}{10} \times \frac{5}{9}$ or $\frac{3}{10} \times \frac{2}{9}$ or $\frac{1}{10} \times \frac{0}{9}$ or better</p> <p>M1 for both red and yellow correct $\frac{6}{10} \times \frac{5}{9}$ and $\frac{3}{10} \times \frac{2}{9}$ or better</p> <p>M1 for adding probabilities for RR, YY and BB (clearly identified) $\frac{6}{10} \times \frac{5}{9} + \frac{3}{10} \times \frac{2}{9} (+ \frac{1}{10} \times \frac{0}{9})$</p>

Section A Total: 25

Exemplar responses: 2(b)**Responses scoring 1 mark:**

Y11 because ...

- no-one took longer than 70s and fewer took less than 40s unlike Y7.
(Reference to less Y11 in extreme intervals. Reference to Y7 not necessary in this example.)
- they had a smaller frequency density than year 7 at 20 – 40 and 60 – 90 seconds.
(Condone reference of frequency density for number of students. Refers to extreme intervals.)
- there were less students who estimated too high or too low.
(Condone too high and too low as reference to extreme intervals.)
- more students estimated 50 seconds or near.
(Accept this as a reference to the intervals around 50.)
- there are more in the interval 40 – 60 (or 40 – 55) than Y7.
(Refers to the intervals around 50.)
- more took over 70s and less than 40s unlike Y11.
(Refers to less Y11 in the extreme intervals. Without '..unlike Year7' this would not have been allowed as the words identify that Year 7 have less in the extreme intervals.)
- frequency density between 40 to 55 is higher student per second.
(Refers to more Year 11 students around 50 seconds.)
- there are 141 year 11 students between 40 and 60 but year 7 have only 127.
(Accept correct numerical evidence from both years.)

Responses scoring 0 marks:

Y11 because ...

- they have a higher frequency density of 50 seconds than the Year 7s.
(Incorrect to talk about frequency density of a single value.)
- Y7 had a bigger range.
(True but has no bearing on which year group were closer to 50.)
- there is a much lower fluctuation of values, they are less spread out which makes it easier to see the trend.
(No reference to closeness to 50.)
- frequency density between 40 to 60 is high student per second.
(Not a comparison. Would need to say fd is higher.)
- the frequency density is higher for the year 11 students.
(Does not make it clear which intervals are referred to.)
- year 7s estimates have a range of 70s which means they are more spread whereas year 11s estimates have a smaller range of 50s so they are overall closer to the answer due to a smaller spread of estimates.
(Smaller spread does not imply that the data is closer to 50 for year 11.)
- there were more people in the modal group that estimated 50 seconds and there's a smaller range than year 7.
(Only refers to one interval, rather than a group of intervals around 50. Spread irrelevant.)
- year 7 have more people who took longer than 60 seconds.
(Only refers to one of the extremes.)
- they had a higher frequency density at 50 to 55 seconds.
(Only refers to one interval rather than a group of intervals around 50.)
- most of the students had estimated closer to the 50 second mark.
(Not a comparison but a statement about Y11 which is also true for Y7.)

Section B

7	(a)	(i) 18.8 - 18.9	1	
		(ii) points plotted correct curve	1 1	ft <i>their</i> table; condone one error
	(b)	8.0 – 8.6	1	or ft <i>their</i> graph (± 2 mm)
8	(a)	(average) weight decreasing (until 2002) and then increasing again	1	
	(b)	1821 – 1921 answer must ft <i>their</i> moving average	2	M1 for $\frac{677+525+947+1530+x}{5} = \text{'1110'}$ or $5 \times \text{'1110'} - 3679$ condone 1100 – 1120 for the moving average
9	(a)	9.16(...) or 9.2 ignore subsequent rounding after correct answer seen	3	M2 for $\frac{5.8 \sin 115}{\sin 35}$ Or M1 for $\frac{BD}{\sin 115} = \frac{5.8}{\sin 35}$
	(b)	48.7 – 48.94	2	M1 for $0.5 \times 13.5 \times \text{'BD'} \times \sin 52$
10		$3(2x - 1) + 4(x + 2) = 2(2x - 1)(x + 2)$ or better $4x^2 - 4x - 9 (= 0)$ or $-4x^2 + 4x + 9 (= 0)$ $(x =) \frac{4 \pm \sqrt{160}}{8}$ 2.08 and -1.08	M2 A1 M2 A2	for M1 and M2, condone one error or omission if the brackets are expanded without brackets being shown M1 for multiplication by one denominator or left in the form fraction = 2 or denominators removed with 2 of the three terms correct as an equation or expression dep on M2 award when first seen even if then spoilt for M1 and M2 ft <i>their</i> quadratic equation M1 for $(x =) \frac{4 \pm \sqrt{4^2 - 4 \times 4 \times -9}}{2 \times 4}$ substitution into formula (condone two errors) A1 for either value correct or both given to wrong accuracy eg 2.081, -1.081 or 2.1, -1.1 If A0 then SC1 for their answers seen and rounded to 2dp

11		13043·8 or 13044 or 13040 or 13000 www	4	M1 for $\frac{1}{3} \times 27 \cdot 5^2 \times 66$ or 16637·5 M1 for $\frac{1}{3} \times 16 \cdot 5^2 \times "66 - 26 \cdot 4"$ or 3593·7 M1 for subtraction of their volumes (soi)
12		123·6 - 123·7 303·6 - 303·7	1 1	SC1 for two answers differing by 180° between 0 and 360

Section B Total: 25

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