OCR
RECOGNISING ACHIEVEMENT

GCSE

Mathematics C (Graduated Assessment)

General Certificate of Secondary Education

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

Mark Scheme for January 2012

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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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Annotations

Annotation	Meaning
✓	Correct
✗	Incorrect
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working (after correct answer obtained), provided method has been completed
M0	Method mark awarded 0
M1	Method mark awarded 1
M2	Method mark awarded 2
A1	Accuracy mark awarded 1
B1	Independent mark awarded 1
B2	Independent mark awarded 2
MR	Misread
SC	Special case
^	Omission sign

These should be used whenever appropriate during your marking.

The **M**, **A, B** etc 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.

Subject-specific Marking Instructions

i. **M** marks are for <u>using a correct method</u> and are not lost for purely numerical errors.
A marks are for an <u>accurate</u> answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
B marks are <u>independent</u> of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
SC marks are for <u>special cases</u> that are worthy of some credit.

ii. 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 <u>not from wrong working</u> **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.

iii. 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 × (*their* '37' + 16), or FT 300 – √(*their* '$5^2 + 7^2$'). Answers to part questions which are being followed through are indicated by eg FT 3 × *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.

iv. 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.

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

- **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**.

vi. 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'.

vii. 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).

viii. 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 **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the MR annotation. **M** marks are not deducted for misreads.

ix. 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.

x. 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'. 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.

xi. Ranges of answers given in the mark scheme are always inclusive.

xii. 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.

xiii. 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.

Question			Answer	Marks	Part marks and guidance	
1			6350	3	**M2** for $4 \times 6020 - (6980 + 5550 + 5200)$ Or **M1** for 4×6020 or 24080 or $6980 + 5550 + 5200$ or 17730 or $\frac{6980 + 5550 + 5200 + x}{4} = 6020$	Condone 6·35 following 6350
2			One comment from each category: i. Faster times / slower times, a range of times (but not one interval), average time ii. Spread/consistency, number of students	2	**B1** for each Examples: i. There are more faster times in Y11, More students took over 10 minutes in Y7, Y11 are (generally) quicker than Y7 ii. The two year groups have the same range of times	The two comments must be from different categories See list of exemplars
3	(a)		$4\sqrt{5}$	2	**M1** for $\sqrt{9} \times \sqrt{5}$ or $3\sqrt{5}$ or $\sqrt{9 \times 5}$	
	(b)		$11 - 6\sqrt{2}$	3	**M1** for $9 + \sqrt{2}\sqrt{2} - 3\sqrt{2} - 3\sqrt{2}$ **M1** for 11 (or 9 + 2) or $-6\sqrt{2}$	Condone 3 terms correct, allow $\sqrt{2^2}$ $11 - 6\sqrt{2}$ then $5\sqrt{2}$ scores **M2** only

Question			Answer	Marks	Part marks and guidance	
4	(a)		$\frac{10x+5}{(x+2)(2x-1)}$ oe single fraction	3	Mark final answer Accept $2x^2 + 3x - 2$ as the denominator **M2** for $\frac{6x-3+4x+8}{(x+2)(2x-1)}$ Or **M1** for $3(2x-1) + 4(x+2)$	For **M2** expression can be two separate fractions with a common denominator Condone incorrect expansion of correct denominator For **M1** ignore any denominators
	(b)		$\frac{x}{(x-4)}$ **nfww**	3	Mark final answer **M1** for $x(x+3)$ **M1** for $(x \pm 4)(x \pm 3)$	
5			Amplitude of 3 Passes through (0, 0) Period of 180°	1 1 1	from sine or cosine curve dep on positive sine curve dep on consistent period	For 3 marks curve must use complete range to 360 All marks dependent on a minimum of 1 wave
6	(a)		b – c	1		
	(b)		$\overrightarrow{AB} = 2\overrightarrow{CD}$ oe	1	Condone vector AB = 2 × vector CD Do not accept AB = 2CD	
7	(a)		ON = ON : common OA = OB : radii (of the circle) SSS	1 1 1	or OA = OB : radii of the circle $\angle$OAN = $\angle$OBN : ΔOAB is isos SAS **If 0** out of 3, award **SC1** for two correct statements	SSS and SAS dependent on correct statements (ignore reasons)
	(b)		$\angle$ONA is a right angle	1	Ignore extra statements	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Part marks and guidance</th><th></th></tr>
<tr><td>8</td><td>(a)</td><td></td><td>40 749</td><td>1</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>8</td><td>2</td><td>M1 for any trial over 3 years (accept rounded or truncated)
or
ln(50/35) ÷ ln(1·052) or 7.03(…)
or 7.04

Condone 40749 as starting amount leading to answer of 5 for 1 mark.</td><td><table><tr><th>Years</th><th>Balance</th></tr><tr><td>4</td><td>42867·78</td></tr><tr><td>5</td><td>45096·90</td></tr><tr><td>6</td><td>47441·94</td></tr><tr><td>7</td><td>49908·92</td></tr><tr><td>8</td><td>52504·19</td></tr></table></td></tr>
<tr><td>9</td><td></td><td></td><td>123·9 - 125</td><td>5</td><td>B3 for PQ = 14·7(…)
or QR = 16·9 – 17(·0…)
Or
M2 for (PQ =) $\frac{21{\cdot}5 \times \sin 43}{\sin 85}$
or (QR =) $\frac{21{\cdot}5 \times \sin 52}{\sin 85}$
Or
M1 for $\frac{PQ}{\sin 43} = \frac{21{\cdot}5}{\sin 85}$ oe
or $\frac{QR}{\sin 52} = \frac{21{\cdot}5}{\sin 85}$ oe

M1 for ½ × 21·5 × "PQ" × sin52

or ½ × 21·5 × "QR" × sin43</td><td>ALTERNATIVE (perpendicular height)

M2 for (h =) 21·5 × sin43
or 14·6 – 14·7
Or
M1 for $\frac{h}{21{\cdot}5}$ = sin43

Rads
PQ = 101.565, Area = 1077(·…)

QR = –120.47

Grads
PQ = 13·8246, Area = 108·335

QR = 16.118</td></tr>
</table>

Question			Answer	Marks	Part marks and guidance	
10			$x^2 + (x - 2)^2 = 34$	M1	Also $(y + 2)^2 + y^2 = 34$	Condone one error: 2 of the 3 terms of $x^2 - 4x + 4$ or $y^2 + 4y + 4$ must be correct
			$x^2 + x^2 - 4x + 4 = 34$	M1	$y^2 + 4y + 4 + y^2 = 34$	
			$2x^2 - 4x - 30$ (= 0) or $x^2 - 2x - 15$ (= 0) **nfww**	A1	$2y^2 + 4y - 30 = 0$ **nfww**	(Terms do not all need to be on the same side)
			$(x - 5)(x + 3)$ oe	M1	$(y - 3)(y + 5)$ or correct substitution in formula	FT from a 3-term quadratic, formula: **M1** for $\frac{2 \pm \sqrt{64}}{2}$ or better, FT *their* equation
			$x = 5$ and $x = {}^-3$	B1	FT *their* factorisation = 0 or formula for 2 values of x or 2 values of y	
			$y = 3$ and $y = {}^-5$	B1	FT *their* values of x using $y = x - 2$ If **B0** then **SC1** for $x = 5$, $y = 3$ or for $x = {}^-3$, $y = {}^-5$	
11	(a)		f(x) translated 3 units down	1		
	(b)		f(x) translated 3 units left	1		
	(c)		$y = 2$f(x) circled	1		

Question			Answer	Marks	Part marks and guidance	
12			$\frac{11}{30}$ oe	4	**M3** for $\frac{3}{6} \times \frac{1}{5} + \frac{2}{6} \times \frac{3}{5} + \frac{2}{6} \times \frac{1}{5}$ or $\frac{3}{6} \times \frac{1}{5} + \frac{2}{6} \times \frac{4}{5}$ Or **M2** for $\frac{3}{6} \times \frac{1}{5}$ and $\frac{2}{6} \times \frac{3}{5}$ and $\frac{2}{6} \times \frac{1}{5}$ or $\frac{3}{6} \times \frac{1}{5}$ and $\frac{2}{6} \times \frac{4}{5}$ or the sum of any two of the three products or two-way table (6 by 6) with 11 of 30 cells identified Or **M1** for any one of the products seen or two-way table (6 by 6) with 11 of 36 cells identified or tree with relevant branches identified and labelled	Accept cancelled versions or decimals rot to 2dp or better throughout for all M marks **SC3** for $\frac{11}{30}$ from probability that the second card is higher With replacement, $\frac{11}{36}$, scores **M2** for complete method (see M3) Or **M1** for partial method (see M2) And **A1**
13	(a)		$(x - 3)^2 - 2$ or $(x - 3)^2 + {}^{-}2$	3	**M1** for $(x - 3)^2$ oe or $x^2 - 3x - 3x + 9$ **M1** for $7 - 3^2$ or $7 - 9$ or ${}^{-}2$ or $7 - (\textit{their } a)^2$	
	(b)		${}^{-}2$	1	or FT their constant term	Dep on expression of the correct form

APPENDIX

Exemplar responses for question 2

Response	**Mark awarded**
More Y7s took longer than Y11s.	1
The amount of frequency density for 2-6 minutes for both graphs is the same.	0
The graph for Y11 shows that most students took 8-10 mins whereas the Y7s had 12-14 mins. *This shows that Y11s were better at completing the puzzle.*	1
Y7 and 11 had the same number of students per minute completing the puzzle between 2-4 and 16-20m.	0
All students completed the puzzle between 2 and 20 minutes.	0
They both started and finished at the same time.	0
The second group took longer during the 8-10 mins but overall they used less students per minute.	0
Y7 took longer to complete the puzzle.	1
The Y11 students had a higher fd from 8-10 mins than the Y7 students.	0
The Y7 students had a higher range of students per minute finishing the puzzle than the Y11 students.	0
It took mainly 8-10 minutes for most Y11 to complete the puzzle	0
Majority of Y7 students took a longer time of more than 10 mins to 16 mins.	0
All the students in both year groups took 2 to 20 mins to complete the puzzle, the spread of data is equal.	1
The distribution of Y7 is bigger than Y11 *as they took longer to complete the puzzle*.	1
The time it took both years were equal but Y11 had a bigger distribution 8>10 and Y7 had a consistent time and *fd of Y7 from 10 mins and onwards was higher than Y11*.	1
The Y11s have more people on a lower time than Y7.	1
Both graphs have a equal distance from 2 to 20 mins.	0
The majority of Y7s took between 10-16 mins *whereas Y11 students were 6-10 mins*.	0
Year 7 graph is more evenly distributed	0
The majority of year 11 completed the puzzle in a shorter time to the majority of year 7	1
More year 11s finished the puzzle quicker than year 7s	1
Both year 11s and year 7s had the same range of times	1
More year 7 students completed the puzzle than year 11 students	1
On average year 7 students took longer than year 11 students	1
The frequency density on the year 11 graph between 8-10 mins is higher than year 7	0
The average of the year 7 graph is higher than the average of year 11 graph	1
Class widths are the same	0
It took more year 11 students to complete the puzzle in 8-10 minutes than it did year 7 students	0
On average year 7s took longer than year 11s	1

The amount of time the year 7s took is distributed more evenly than year 11s time	0
On average it took year 7 longer to complete the puzzle	1
Year 11 varied less as most results are similar	0
The year 11 students on average their times were shorter meaning they completed the puzzle faster on an average	1

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