GCSE

Mathematics A

General Certificate of Secondary Education

Unit **A502/02:** Mathematics B (Higher Tier)

Mark Scheme for November 2011

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A502/02   **Mark Scheme**   **November 2011**

1   Annotations used in the detailed Mark Scheme.

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

1   **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 awarded for a correct final answer or a correct intermediate stage.
      SC marks are for <u>special cases</u> 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 <u>not from wrong working</u> **full marks** should be awarded.

      Do <u>not</u> award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen <u>and</u> 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 × (*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.

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 **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.

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
     i   mark scheme says 'mark final answer' or 'cao'. Place the annotation ✓ next to the correct answer.

     ii   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.

     iii   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.

1	(a)	BADC with correct working	3		Allow names or fractions for 3 marks
				M1 for attempt to change any 2 fractions to a common denom, decimal or % **A1** for any 2 correctly changed $(A=)\dfrac{12}{48}$ $(B=)\dfrac{16}{48}$ $(C=)\dfrac{9}{48}$ $=0.25$ $=0.33(...)$ $=0.18(...)$ $(D=)\dfrac{10}{48}$ $=0.20(...)$ Or If converting to unit fractions **B1** for $C=\dfrac{1}{5.3(...)}$ or $D=\dfrac{1}{4.8}$ Or If a pictorial approach used: **B1** for 4 reasonable pictures Or, if 0, **SC1** for BADC	Condone 1 incorrect conversion with up to 2 correct for up to 3 marks Allow 0.33.., 0.34.., 0.18.., 0.19.., 0.20..0.21.. and equivalent % Condone unconventional fractions eg $\dfrac{4.5}{24}$ ie from wrong or no working
	(b)	They don't add up to 1	1ft	Total = $\dfrac{47}{48}$, 0.98, 98% ft sum of their 4 terms	Allow 'It only adds up to 47' oe ft Allow 'whole' for '1' if not contradicted. Allow 'not all money distributed' etc Allow 'too much money distributed' if their sum > 1 whether or not evaluated
		Any 1 fraction increased by $\dfrac{1}{48}$	1	cao Or 0.02, 2%	Condone unconventional fractions eg $\dfrac{0.5}{24}$

2					In both (a) and (b) Ignore label. Clear intention to plot these points, condone freehand. [Overlays available]
	(a)	Correct rotation	3	**B2** for correct orientation, wrong position or for correct 90° acw rotation about O Or **B1** for two correct vertices	
	(b)	Correct reflection	2	**B1** for reflection in $x = -1$ or **B1** for $y = -1$ drawn	
	(c)	(SF =) -2 Centre origin	1 1	Generally if >1 transformation, **0**, **0** but **SC1 for** (enlargement) SF=2 **and** rotation 180° about O	Allow 'point', 'about', 'through' etc for 'centre'
3	**(a)**	$x < 4$	2	**B1** for $x = 4$ or **M1** for $5x < 18 + 2$ or better	Condone $\leq$ for 1 or 2 marks
	(b)	$p = 5$, $q = 17$	3	**B2** if reversed Or **M1** for either −1 or 5 substituted for x **A1** for either value correct If 0, **SC1** for $p = -4, q = -1$	M1 not lost even if final answer comes from a different method. Correct answer with no working scores 3 $q = 17$ only nfww scores **B2** but $p = 5$ alone scores 0

4		464.8 in either A or B	1	**SC3** if 16.6 correct but in wrong box or intermediate steps wrong or missing	
		4 in C	1		
				For the next two marks no more than one of them can be ft	
		116.2 in D	1(FT)	FT exact answer to *their* (non-integer) 464.8 ÷ 4	Exact answers may be fractions
		16.6 in E	1(FT)	FT exact answer to *their* (non-integer) 116.2 ÷ 7	
				If 0 or 1, allow **SC2** for figs 166 seen	
5	(a)	5 points correct	2	**B1** for at least 2 points correct	'Touching' overlay Do not zoom from 'fit width' Ignore any extra points
	(b)	Ruled line	1	Within overlay for 30<music<70	
	(c)	Positive	1	Ignore strong, weak etc	
	(d)	Point with greatest vertical distance above $F = M$ ringed	1		

6	(a)	(i) 50	1		
		(ii) 40	1		
	(b)	Single ruled line within overlay	2	Any length **M1** for any 2 points plotted or implied by eg line through (0, 0) and (1, 55)	Line, if it were to be extended, must stay within tramlines. ½ square tolerance
	(c)	A1, 30 - 50	1 + 1	If 0 scored **M1** for 330 or 290	
	(d)	3 hrs 20 mins	1	Allow anything (and any format) from 3h 10m to 3h 30m O Or FT their crossing point $\pm$ 2 small squares, 12mins	Condone 3:1(0) but not 3.1, however 3.2 to 3.5 are in range so OK If lines (nearly) parallel allow the mark for 'No crossing point'. oe
7	(a)	(i) 64	2	**B1** for 4^3 seen	
		(ii) 1	1		
		(iii) 2 nfww	3	**B2** for $(\sqrt[3]{8})^4 \times \frac{1}{8}$ or $16 \times \frac{1}{8}$ or $2^4 \times \frac{1}{8}$ Or **B1** for $(8^{-1}) = \frac{1}{8}$ or $8^{\frac{4}{3}} = (\sqrt[3]{8})^4$ or $\sqrt[3]{8^4}$ or $(8^{\frac{4}{3}}) = 2^4$ or 16 Or $8^{\frac{4}{3}} \times 8^{-1} = 8^{\frac{1}{3}}$ **M1** $= \sqrt[3]{8}$ **A1**	Correct answer, no working scores 3 If decimals used, 0.33, 1.33 or better.
	(b)	10	1	cao	

8		Correct proof well explained and clearly laid out	**5**	Condone minor errors in spelling, punctuation or grammar	**Interior angle method**
					Pentagon $180 - \dfrac{360}{5} = 108$
		Correct proof well explained with: • one reason missing • layout not clear • some use of poor mathematical language • significant errors in spelling, punctuation or grammar	**4-3**	For lower mark – Correct method leading to 117° with: • significant omissions in calculation • more than one reason missing or correct method with one arithmetic error that would lead to answer other than 117°	Octagon $180 - \dfrac{360}{8} = 135$ Exterior angles of a polygon (= 360) Angles on a straight line (= 180) $p = 360 - 108 - 135$ $= 117$ Angles round a point (= 360) Or $[(n-2) \times 180] \div n$ for n = 5 and 8 Then as above Or Listing multiples of 180 Then as above
		Any correct calculation with related reason seen eg Ext angle of pentagon $\dfrac{360}{5} = 72$ with Exterior angles of a polygon = 360 Or any two angles seen from 72, 108, 45, 135, 243, 540, 720, 900, 1080	**2-1**	For lower mark – Any correct calculation, angle or reason seen.	Or **Exterior angle method** Required angle clearly shown to be the sum of the two ext angles $\dfrac{360}{5} + \dfrac{360}{8} = 72 + 45$ $= 117$ Exterior angles of a polygon (= 360) If this method not clear here then max 3 marks eg $\dfrac{360}{5} + \dfrac{360}{8} = 72 + 45$ gets 3 $= 117$
		Nothing of any worth.	**0**		

9		$x = 1\frac{1}{2}$ oe nfww $y = -5$	3	**M1** for multiplying one (or both) equation(s) to get either coefficient equal (allow 1 error) *and* adding or subtracting as appropriate (allow 1 (further) error) eg $\begin{array}{l} 4x + y = 1 \\ 4x - 6y = 36 \end{array}$ or $\begin{array}{l} 12x + 3y = 3 \\ 2x - 3y = 18 \end{array}$ $7y = -35$ or $14x = 21$ **A1FT** for either x or y correct oe isw $y = -5$ or $x = \frac{3}{2}$ or $1\frac{1}{2}$ or 1.5 Or if substitution used **M1** for rearranging and substituting eg $2x - 3(1 - 4x) = 18$ or better (allow 1 error) then A mark as above.	If no more than 1 error in multiplication (and no errors in addition/subtraction) follow through for a maximum of 2 marks If separate attempts made to eliminate x and y mark to the candidate's benefit Correct x or y with no working implies **M1A1** Correct answer with no working scores **3**.
10	(a)	$4\sqrt{5}$	2	**M1** for $\sqrt{16} \times \sqrt{5}$ or $\sqrt{16 \times 5}$ or $\sqrt{4} \times \sqrt{20}$ or $\sqrt{4 \times 20}$ or $2\sqrt{20}$ or $4 \times \sqrt{5}$	Condone extra $\times$ signs for M mark eg $2 \times \sqrt{20}$
	(b)	$4\sqrt{3}$	3	**B2** for $\frac{12\sqrt{3}}{3}$ isw or $\frac{4\sqrt{3}}{1}$ or or $4 \times \sqrt{3}$ Or **M1** for $\frac{12}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$ or $\frac{12\sqrt{3}}{\sqrt{9}}$ or $\sqrt{48}$	Condone extra $\times$ signs for B and M marks eg $\frac{4 \times \sqrt{3}}{1}$ scores B2

11		PQS or PSQ $= \dfrac{180 - 30}{2} (= 75)$	**M1**	Allow Q, no label etc if unambiguous	'Isos triangle' alone gets 0.
					75° on answer line scores 2 if unambiguous
		Tangents and either 'point' or 'equal' QRS = 75°	**1** **A1FT**	*their* PQS or PSQ	
		Alt(ernate) seg(ment)	**1**	Or **M1** QOS = 150° **1** (Angle between) tangent and radius = 90° **A1FT** QRS = 75° **1** Angle at the centre/circumference	Condone 'opposite' segment
12		$\begin{pmatrix} 8 \\ 0 \end{pmatrix}$	**3**	**Geometric method** **B1** for both B and C marked on grid and **B1** for D marked anywhere on horizontal line level with A	Labels not needed for B marks providing unambiguous
				Algebraic method **M2** for $\begin{pmatrix} 9+m \\ 1+m \end{pmatrix} = \begin{pmatrix} x \\ 0 \end{pmatrix}$ oe Or **M1** for $\begin{pmatrix} 9+m \\ 1+m \end{pmatrix}$ or $\begin{pmatrix} x \\ 0 \end{pmatrix}$ or $\begin{pmatrix} 8 \\ y \end{pmatrix}$ oe	

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