GCSE

Applications of Mathematics (Pilot)

General Certificate of Secondary Education

Unit **A381/02:** Higher Tier

Mark Scheme for June 2013

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
λ	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 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.

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* '5² + 7²'). 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.

     -   **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 and applies as a default.
     -   **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.   In questions with no final answer line, make no deductions for wrong work after an acceptable answer (ie **isw**) unless the mark scheme says otherwise, indicated by the instruction 'mark final answer'.

7.   In questions with a final answer line following working space,

(i)   if the correct answer is seen in the body of working and the answer given on the answer line is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.

(ii)   if the correct answer is seen in the body of working but the answer line is blank, allow full marks. Place the annotation ✓ next to the correct answer.

(iii)   if the correct answer is seen in the body of working but a completely different answer is seen on the answer line, then accuracy marks for the answer are lost. Method marks could still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.

8.   In questions with a final answer line:

(i)   If one answer is provided on the answer line, mark the method that leads to that answer.

(ii)   If more than one answer is provided on the answer line and there is a single method provided, award method marks only.

(iii)   If more than one answer is provided on the answer line and there is more than one method provided, award zero marks for the question unless the candidate has clearly indicated which method is to be marked.

9.   In questions with no final answer line:

(i)   If a single response is provided, mark as usual.

(ii)   If more than one response is provided, award zero marks for the question unless the candidate has clearly indicated which response is to be marked.

10.   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.

11. 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.

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

13. 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.

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.

Question			Answer	Marks	Part Marks and Guidance	
1	(a)	(i)	Maths and ICT **nfww**	3	**M2** for cancelling Maths and ICT to equivalent fractions (both $\frac{7}{10}$) or for converting to decimals (0.7) or to percentages (70%) OR **M1** for cancelling down/up any two fractions $\frac{3}{5}$, $\frac{3}{4}$, $\frac{7}{10}$, $\frac{17}{25}$, $\frac{7}{10}$ or for converting any two to decimals or percentages 0.6, 0.75, 0.7, 0.68, 0.7 or 60%, 75%, 70%, 68%, 70%	Condone omission of percentage signs as long as method is clear Condone any clear indication for Maths and ICT
		(ii)	4	2	**M1** for $\frac{30}{40} = \frac{15}{20}$ or $\frac{12}{20} = \frac{24}{40}$ or 75% of 20 = 15 **oe** Can be implied by an answer of 3 or $\frac{6}{40}$ **SC1** $\frac{7}{40}$	Condone $\frac{4}{20}$

Question			Answer	Marks	Part Marks and Guidance	
	(b)		$\dfrac{9}{40}$ **oe**	3	**M1** for $\dfrac{16}{40} + \dfrac{15}{40} \left[= \dfrac{31}{40} \right]$ **oe** or $1 - \dfrac{2}{5}$ or $1 - \dfrac{3}{8}$ And **M1** for $1 - their\ \dfrac{16}{40} + \dfrac{15}{40}$ dep on **M1** or $their\ \dfrac{3}{5} - \dfrac{3}{8}$ or $their\ \dfrac{5}{8} - \dfrac{2}{5}$ If **M0**, **SC1** for $1 - $ their attempt to add given fractions	At least one of the numerators must be correct For **M** marks accept 0.4 + 0.375 [=0.775] and $1 - their$ 0.775 [= 0.225] **isw** incorrect cancelling following a correct fraction
2	(a)		7.35	3	**M2** for $\dfrac{1}{2} \times 3.5 \times 1 + \dfrac{1}{2} \times 3.5 \times 3.2$ or $1.75 + 5.6$ or $\dfrac{1}{2} \times 3.5 \times 4.2$ or 3.5×2.1 OR **M1** for $\dfrac{1}{2} \times 3.5 \times 1$ or $\dfrac{1}{2} \times 3.5 \times 3.2$ or 1.75 or 5.6	
	(b)		2.205 or 2.21 or 2.2	1FT	**FT** $0.3 \times their$ 7.35	
	(c)		8.91 - 8.955 or 8.9	2FT	**M1** for $19.7 \div their$ 2.205	

Question			Answer	Marks	Part Marks and Guidance	
3	(a)		Any two from AEF, AHJ, ALN, AQR, RNP, RJK, RFG, RCD	1		Ignore order of lettering
	(b)		Sides not in proportion	1		See exemplars
	(c)		118 and reasons	4	**B2** for ∠QJR = 118 Or **B1** for any correct angle, eg ∠AJH = 38, ∠QJH = 24, ∠JRQ = 38 ∠QAJ = 52, ∠AQJ = 66 And **B2** for full reasons given Or **B1** for one correct reason Reasons must clearly identify with the appropriate steps of working	Angles may be on the diagram Repeat reasons not needed Accept similar triangles as a reason if identified in **(a)** or **(c)** Reasons not required for any right angle or ∠MQL Condone F angles, Z angles ALTERNATIVE ∠BAC = 52, angles in a triangle ∠QRJ = 38 ∠QJR = 118 scores **B2**, **B2**

Question			Answer	Marks	Part Marks and Guidance	

4	**(a)***		Complete and correct solution, 200ml or small size, supported by correct calculations and clearly explained	3	**3** for <u>Cost per ml</u> **oe**:
					    A: 435 ÷ 330 = 1.31 [p/ml] and
					    B: 260 ÷ 200 = 1.3 [p/ml]
					 or
					    <u>Amount per £</u> **oe**:
					    C: 330 ÷ 4.35 = 75.8 or 76 [ml/£] &
					    D: 200 ÷ 2.60 = 76.9 or 77 [ml/£]
					 or
					    <u>Cost of 330ml using small bottle</u>
					    E: 2.6(0) × 330 ÷ 200 = [£]4.29
					 or
					    <u>Cost of 200ml using large bottle</u>
					    F: 4.35 × 200 ÷ 330 = [£]2.63 - 2.64
					
					 AND a correct conclusion explained
					
					 Or
					 2 for same as for 3 marks but no conclusion
					 or
					    one of A or B incorrect and a correct conclusion based on their results
					 or
					    one of C or D incorrect and a correct conclusion based on their results
					 or
					    E (or F) correct with an incorrect conclusion
					 Or
					 1 for one of A, B, C or D correct
					 or either 2.6(0) × 330 ÷ 200
					 or 4.35 × 200 ÷ 330
					 or 200 ÷ 330 = 0.6 - 0.61
					 or 330 ÷ 200 = 1.65
						<u>Cost of N ml using small/large bottle</u>
						 Apply the same scheme as cost of 330ml
						
						 Explanation can be:
						
						 use of the underlined text **oe**
						 or
						 units given with the answers to the calculations
						 or
						 reference to the units in the concluding statement

Question			Answer	Marks	Part Marks and Guidance	
(b)	**(i)**		$250 \times \left(\dfrac{12}{17.9}\right)^3 = 75.3(\ldots)$ **oe**	2	**M1** for $\left(\dfrac{12}{17.9}\right)^3$ or $0.3(\ldots)$ or $\left(\dfrac{17.9}{12}\right)^3$ or $3.31 - 3.32$ **SC2** for $75 \times \left(\dfrac{17.9}{12}\right)^3 = 248.9[\ldots]$ **SC1** for $75 \times \left(\dfrac{17.9}{12}\right)^3$	
	(ii)		$1.44 \div 0.7 = 2.05 - 2.06$ or 2.1 or ≈ 2	4	**M2** for $\dfrac{figs\,108}{75}$ and $\dfrac{figs\,175}{250}$ OR **M1** for either calculation and **A1** for 1.44 or 0.7 and **B1** for $1.44 \div 0.7 \approx 2$	Allow **M2** for $\dfrac{75}{figs\,108}$ and $\dfrac{250}{figs\,175}$ OR **M1** for either calculation and **A1** for 0.69[4…] or 1.42 to 1.43 **B1** for $1.42 \div 0.69 \approx 2$ You get twice as much shampoo for your money with the large bottle Condone $0.7 \times 2 = 1.4$

Question			Answer	Marks	Part Marks and Guidance	
5	(a)		$8x - 20$	2	**M1** for $2x + 20$ or $8x$ or -20	Condone expression in an equation
	(b)		$(x =)$ 25	2	**M1FT** for *their* $8x - 20 = 180$ or better	May be solved in **(a)**
	(c)		40, 70, 70	3	**B1FT** for each correct angle If **B0** then **SC1** for 3 angles adding to 180	Must be positive
	(d)		Isosceles	1	**FT** *their* angles	

6	(a)		242 000
			or
			241 591 - 241592
				3	**M2** for $225\,000 \times 1.024^3$
					     or 235929.6×1.024
					OR
					M1 for $225\,000 \times 1.024$ or 230 400
					OR
					SC1 for $225\,000 \times 1.24^3$
					     or $428990[.4]$
						Mark at the most accurate value

	(b)		180 000	2	**M1** for $171\,000 \div 0.95$	
	(c)		4.52	2	**B1** for $4.517\ldots$ or for rounding *their* answer (seen) correctly to 3sf **SC1** for answer of 4.51	

Question			Answer	Marks	Part Marks and Guidance	
7			20, 150 or 30, 100 or 50, 60	4	**M1** for attempt at prime factors of 300 (at least 3 correct) or $10 = 2 \times 5$ **A1** $2 \times 2 \times 3 \times 5 \times 5$ and 2×5 (values may be on a diagram) **M1** prime factors of any of 20, 150 or 30, 100 or 50, 60 **OR** **M1** at least 4 multiples of 10 (20 – 300) **M1** at least 4 factors of 300 (> 12) **A1** for 20, 30, 50, 60, 100, 150, 300 If 0 scored, **SC1** for two numbers (> 12) with HCF of 10 or with LCM of 300	$20 = 2 \times 2 \times 5$ $150 = 2 \times 3 \times 5 \times 5$ $30 = 2 \times 3 \times 5$ $100 = 2 \times 2 \times 5 \times 5$ $50 = 2 \times 5 \times 5$ $60 = 2 \times 2 \times 3 \times 5$ Accept prime factors in a Venn diagram
8			$3s + 5c = 55$ or $7s + 4c = 67$	B1		Condone the use of ☐ and ◯
			$12s + 20c = 220$ and $35s + 20c = 335$	M1	$21s + 35c = 385$ and $21s + 12c = 201$	For **M2** condone a max of one error in the solution of *their* two equations
			$23s = 115$	M1	$23c = 184$	
			$s = 5$ and $c = 8$	A1	$c = 8$ and $s = 5$	$c = 8$ and $s = 5$ from trial and improvement scores **SC1** if both correct
			119	B1	**FT** *their* values	
9	(a)		160	1	Tolerance ±8 miles	
	(b)		Correct flight path (ruled)	1	Tolerance ±2°	Condone any length Use overlay

Question			Answer	Marks	Part Marks and Guidance	
	(c)		2 (hours) 20 (minutes)	5	**M1FT** for 6.8 – 7.2 (cm) **M1FT** for 272 – 288 (miles) or 40 × *their* 6.8 - 7.2 **M1FT** for *their* (272 – 288) ÷ 120 **A1FT** for 2.26 – 2.4 (**rot** to 3sf) **B1** for correctly converting *their* time in hours into hours and minutes **SC2** for 320 ÷ 120 = 2.66[6…] = 2h 40m **SC1** for 160 ÷ 120 = 1.33[3…] = 1h 20m	Allow maximum of 4 marks for candidates calculating the time before the aircraft is within range. First **M** mark is not available. *Their* time must be accurate for *their* distance