GCSE

Mathematics B

General Certificate of Secondary Education

Unit **J567/04:** Paper 4 (Higher Tier)

Mark Scheme for November 2012

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 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* '$5^2 + 7^2$'). 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.

    - **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 for example 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. 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).

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 **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.

10. 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.

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.

Question			Answer	Marks	Part Marks and Guidance	
1	(a)		16 1 1 3 7 9 17 0 0 1 2 6 7 9 18 0 4 5 5 8 19 1 3	3	**M2** for correct ordered diagram with one error or omission OR **M1** for correct ordered diagram with at most three errors or omissions or correct unordered diagram	161 etc counts as one error
	(b)		176	1		
2	(a)		7134 or 7130	2	**M1** for $\frac{1}{2}$ × 164 × 87 or 82 × 87	May be done in stages
	(b)		281.6 or 282	2	**M1** for $\frac{1}{2}$ (14.8 + 20.4) × 16	May be done in stages
3	(a)		$6n – 2$ **oe** final answer	2	**B1** for $6n$ seen eg $6(n – 1)$	Equivalents include $6(n – 1) + 4$ Condone other letters and $n6$ and $n × 6$ for $6n$
	(b)		118	1	Correct or **FT** *their* linear expression in (a)	
4			3 **nfww**	4	**M1** for 6 ÷ (1 + 3) or can be implied by 1.5 or 1500 **M1** for *their* '1.5' × 3 or 4.5 or 4500 seen **M1** for *their* '4.5' – *their* '1.5' can be implied	6l could be 6000 (ml) accept any correct method Allow 3000 **ml** as answer

Question			Answer	Marks	Part Marks and Guidance	
5			Angle bisector of A correct and with two correct pairs of arcs **and** at least one line parallel to canal at a distance of 2 cm **and** at least one 5 cm horizontal line within a correct region	4	**B2** for ruled angle bisector of A correct and with two correct pairs of arcs OR **B1** for correct line but no construction or correct arcs with no correct line AND **B1** for straight line parallel to canal at a distance of 2 cm either to the right or left AND **B1** for straight 5 cm horizontal line within correct region	Tolerance is ± 2 mm for lengths and ± 2° for angles <u>Overlay</u>: **angle bisector** needs to lie on or within the red lines Mark <u>best</u> parallel **line** on or within the green lines Ignore semicircles at the ends of the canal Mark <u>best</u> **runway** use end circles as tolerance by eye
6	(a)		7	1		Do not accept 6^7
	(b)		18	1	Penalise incorrect form once, see below	
	(c)		10	1	Penalise incorrect form once eg (a) 6^7 (b) a^{18} (c) p^{10} scores 0, 1, 1	
7			18.66	2	**M1** for 2.56 or 0.45[7....] seen or for answer of 18.65[7...] or 18.7	

Question			Answer	Marks	Part Marks and Guidance	
8	(a)		0.14 **oe**	2	**M1** for 1 – (0.38 + 0.17 + 0.31) implied by 14 and [0].14	0.24 is **BOD** for **M1**
	(b)		2.48[....] or 2.5	3	**M1** for attempt at Σ*pf* or 278 **soi** by eg 3 of these 26, 76, 72, 64, 40 with an attempt to add or answer of 238.3[5…] **M1dep** for *their* '278' ÷ (*their* 'Σ*f*' or 112)	Look for the correct answer in working if the answer has been rounded too much Σ*f* implied by a number at the base of the frequency column, not 5 or 15
	(c)	(i)	stopped	1	Accept any comment that implies a stop	
		(ii)	EF or return journey or 13 00 to 14 00	1		
	(d)		50 **nfww** or 49.99[9…]	2	**M1** for either 885 or 835 seen	Condone 884.99[9…]

Question			Answer	Marks	Guidance
9*			This needs to be the correct answer of 24 with all correct unit conversions seen and all operations clearly communicated and with no errors.	5	Calculation : $$\frac{\textbf{figs 60}}{(80 \times 500 \times \textbf{figs 210} \times \textbf{figs 297}) \div (10^6 \times 10^3)} = 24.0500240\ldots$$
			This could be an answer of 24.05[…..] or incorrectly rounded with fully correct supporting working. or We need to see all 4 correct operations or 3 of the 4 correct operations **and** a correct unit conversion, eg 80 × 500 × [0].21[0] × [0].297 scores 4 marks as there are 3 correct operations and they have changed the mm^2 to m^2 by changing the two lengths correctly or [0].08[0] × 500 × 210 × 297 also scores 4 marks as they have correctly converted the g to kg and there are 3 of the 4 operations correct .	4 - 3	We need to see 3 of the 4 correct operations or 2 of the 4 correct operations **and** a correct unit conversion, eg 500 × [0].21[0] × [0].297 scores 3 marks because there are 2 correct operations and 1 correct unit conversion. or A final answer of 24 with insufficient correct working or no working.
			We need to see 2 of the 4 correct operations or 1 of the 4 correct operations **and** a correct unit conversion, eg [0].21[0] × [0].297 scores 2 marks because there is 1 correct operation and 1 correct unit conversion.	2 - 1	We need to see 1 of the 4 correct operations or a correct unit conversion, eg [0].21[0] **and** [0].297 seen scores 1 mark because there is 1 correct unit conversion, or 60 000 seen scores the mark or 80 × 500 scores 1 mark.
			No worthwhile work attempted.	0	Answer 24 from completely wrong work scores 0

Question	Answer	Marks	Part Marks and Guidance	
10	No with a complete argument eg (66 ÷ 12) = 5.5 leading to 100 × 5.5 = 550 which is compared to 520	3	**M1** for working out a valid scale factor between the two triangles or a ratio within one triangle (which can be implied) **M1dep** for working out another relevant scale factor or ratio, or using *their* first sf/ratio to find a comparable relevant length. **A1dep** on **M2** for stating "No" eg **M1** for (gradient =) 12 ÷ 100 (= 0.12) **M1** for 66 ÷ 520 (= 0.126 to 0.127 or 0.13) **A1** for No OR eg scale factor **M1** for 520 ÷ 100 (= 5.2) **M1** for 5.2 × 12 (= 62.4) **A1** for No OR eg common height **M1** for 100 × 11 (= 1100) **M1** for 520 × 2 (= 1040) **A1** for No OR any other correct method eg use of angle **M1** for (angle =) $\tan^{-1}(12 \div 100)$ (= 6.8[4…]) **M1** for $\tan^{-1}(66 \div 520)$(= 7.2[3…]) **A1** for No	Mark to the candidate's advantage Allow equivalents such as percentages or fractions with a common denominator, also allow any correct method such as use of similar triangles or comparison of scale factors(eg 5.2 and 5.5)

Question			Answer	Marks	Part Marks and Guidance	
11	(a)		6 8	1		
	(b)		correct ruled line from $x = 0$ to $x = 3$	2	**B1** for three points correctly plotted **FT** *their* table	Tolerance ± 1mm by eye ie centre of cross within 'circle'
	(c)		2	1	Correct or **FT** *their* ruled line Condone (2,10)	Be generous in tolerance
12	(a)		(5.5, 8) **nfww**	2	**B1** for either ordinate correct or for a clear attempt to add together two ordinates and divide by 2 or any other correct method	Accept fractional equivalents for 5.5
	(b)		9.4[3...] or 9 with supportive working	3	**M2** for $\sqrt{(8-3)^2 + (12-4)^2}$ or better OR **M1** for 8 – 3 and 12 – 4 or 5 and 8 marked on a diagram as lengths or for a correct Pythagorean statement using *their* figures eg $5^2 + 8^2$.	±9.4[3...] or $\sqrt{89}$ scores **M2**
13	(a)	(i)	⁻18	1		
		(ii)	45	1		
	(b)		1.6 **oe**	2	**M1** for 11 – 3 = 5x **oe** or for $x = a \div 5$ after 5$x = a$ if **M0** then **SC1** for answer ⁻1.6 or correct embedded solution	eg accept $\dfrac{8}{5}$
	(c)		(n =) 2T + 5 final answer	2	**M1** for 2$T = n - 5$ or an answer of 2$T - 5$ or 2(T + 5) **oe** or $\dfrac{T}{2} + 5$	Allow 2 × T and T2 for 2T and t for T

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Question			Answer	Marks	Part Marks and Guidance	
14	(a)		18 471.79 or 18 471.8[0] or 18 472	3	**M2** for 16 800 × (1.024)^4 **oe** or 18 471[.795…] or implied by 1671.79 or 1671.[80] OR **M1** for 16 800 × 1.024 or 17 203.2[0]	Simple interest is 1612.8[0] and total 18412.8[0] scores **0**
	(b)		1.2 × 10^{13} or ⁻1.2 × 10^{13}	3	**M2** for 1.202 × 10^{13} or 12 000 000 000 000 **oe** OR **M1** for 1.42 × 10^{13} – 2.18 × 10^{12} **oe** or 12 020 000 000 000 oe or figs 12[02] AND **B1** for *their* standard form answer rounded to 2sf	Accept numbers subtracted in either order You must see both the unrounded and rounded numbers

Question			Answer	Marks	Part Marks and Guidance	
15	**(a)**		$(x + 10)(x - 3)$	2	**M1** for $(x \pm 10)(x \pm 3)$ or two factors that have two terms correct eg $(x + 5)(x - 6)$	Condone missing final bracket and $1x$
	(b)	**(i)**	$x(y + 2)$	1		Condone missing final bracket
		(ii)	$(x =) \dfrac{3y + 15}{y + 2}$ **oe**	3	**M1** for $xy + 2x = 3y + 15$ **and M1FT** for $x(y + 2) = 3y + 15$ or *their* (b)(i) $= 3y + 15$ or $x(y - 2) = 3y + 15$ better **or SC2** for $\dfrac{3y + 15}{y - 2}$	Ignore attempts to simplify a correct answer
	(c)		$(x =)\ ^-5\ \ (y =)\ 3$ with correct supporting algebraic working	4	**M1** for × eq 1 by eg 2, allow 1 error **M1** for × eq 2 by eg 3, allow 1 error (or **M2** if they multiply one equation) **M1** for eg subtract, allow 1 error **A1** for $(x =)\ ^-5\ \ (y =)\ 3$ If no correct working seen allow **SC1** for the correct answers seen Accept any correct method eg × eq 1 by 5 and × eq 2 by 2 and add or substitution	Must get equal coefficients of x or y, mark best effort Substitution: **M1** for rearranging one equation to make x or y the subject allowing one error **M1** for correct substitution into the other equation **M1** for rearranging *their* equation to $ax = b$ allowing one error

Question			Answer	Marks	Part Marks and Guidance	
16	(a)		$\frac{4}{10}$ **oe** on first branch and $\frac{5}{9}$ and $\frac{4}{9}$ after 'Girl' and $\frac{6}{9}$ and $\frac{3}{9}$ after 'Boy'	2	**B1** for $\frac{4}{10}$ on first branch or one correct pair on the second branch	all probabilities are **oe**
	(b)		$\frac{48}{90}$ **oe** or 0.53[3...]	3FT	**FT** *their* tree, providing branches have probabilities clearly written ($\neq 0.5$) **M2** for $\frac{6}{10} \times \frac{4}{9} + \frac{4}{10} \times \frac{6}{9}$ Allow decimal equivalents such as 0.44 for $\frac{4}{9}$ (at least two dp **rot**) OR **M1** for both branches identified or for one branch calculation seen eg $\frac{6}{10} \times \frac{4}{9}$	Equivalents include $\frac{24}{45}$ and $\frac{8}{15}$ and 53[.3....]%. Replacement answer would be $\frac{48}{100}$ **oe** Ignore subsequent simplification of their correct answer
17	(a)		6.9	1	allow 6.9 billion or 6 900 000 000	
	(b)		1.2 **oe**	1		
	(c)		2017 with at least one correct attempt or 2016 with correct attempts at years 2016 and 2017	3	**M1** for one correct attempt beyond 2010, results **rot** correct to 2sf or better **M1** for a second correct attempt nearer(years) to the solution OR **B2** for (*n*=) 7 with at least one correct attempt OR **B1** for 2017 and no correct working	(*n*=1)2011 6.98(..) (*n*=2)2012 7.06(..) (*n*=3)2013 7.15(..) (*n*=4)2014 7.23(..) (*n*=5)2015 7.32(..) (*n*=6)2016 7.41(..) (*n*=7)2017 7.50(..)

Question			Answer	Marks	Part Marks and Guidance	
18	(a)		122[.02…] or 122.03	2	**M1** for (189 + 91 + 88 + 112 + 90 + 110 + 174) ÷ 7 **oe** eg 120.6 + $\dfrac{174 - 164}{7}$	Condone missing brackets
	(b)		196	3	**M2** for 123 × 7 – (91 + 88 + 112 + 90 + 110 + 174) **oe** OR **M1** for 123 × 7 or (91 + 88 + 112 + 90 + 110 + 174) **oe**	eg 189 + 7 × (123 – *their* (a)) **M1** for 7 × (123 – *their* (a)) Watch out for 195 or 195.8
19	(a)		$(x-3)^2 - 7$ final answer	3	**B1** for $(x-3)^2$ **B2FT** for – 7, **FT** *their* '– 3' eg $(x-6)^2 - 34$	
	(b)		$^-7$	1	Correct or **FT** *their* '+ b'	
20	(a)		$(c =) \ ^-5$	1	Condone correct vector	
	(b)		$(d =) \ ^-1$	1	Condone correct vector	
21	(a)		11.5[...] or 12 **and** 168.4[...] or 168.5 or 168	1 2FT	 **FT** 180 – *their* '11.5' If **0** scored **M1** for 180 – *their* '11.5' seen	rads 0.20[1…] and 2.9[4…] grads 12.8[…] and 187[. ….] score **B1 B1**

Question	Answer	Marks	Part Marks and Guidance	
(b)	27.9[.…] or 28 with correct supporting trig working	4	**M1** for $\sin CAB = \dfrac{38.6 + 66.8}{164}$ or (0.642[..]) **M1** for the sight of valid inverse trig function (39.99[..]) **M1** for *their* '39.99[..]' – 12 OR **M1** for $\dfrac{\sin CDA}{164} = \dfrac{\sin 12}{38.6}$ **M1** for sight of valid inverse trig function eg sin CDA = 0.8833 then CDA = 117.95 **M1** 117.95 – 90 (answer 27.95) OR **M1** $\sqrt{164^2 - 105.4^2}$ (= 125.6456) **M1** $\tan x = \dfrac{66.8}{\textit{their } '125.64'}$ **M1** for the sight of valid inverse trig function OR **M1** for finding AB then AD **M1** for $\sin x = \dfrac{66.8}{\textit{their } AD}$ **M1** for the sight of valid inverse trig function OR **M1** for correct sight of sin rule in any triangle **A1** for angle ADC (=117.9[…]) **M1** for ADC – 90 OR **SC2** for unsupported answer of 28 Scale drawing scores **0** marks	Use of 105 can score max **M3** In any method accept any correct trig working Answer in radians ⁻11.3 (from angle CAB = 0.697 – 12) in grads 32.4[…] (from 44.4[…] – 12) can score all the **M** marks so max 3 Note: in some other methods use of rads leads to math error in calculator If their method has an error in eg treating triangle ADC as a right-angled triangle then the max marks they can get is 2 marks.	

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