OCR
Oxford Cambridge and RSA

GCSE

Mathematics B (Linear)

Component **J567/04:** Mathematics Paper 4 (Higher)

General Certificate of Secondary Education

Mark Scheme for November 2014

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 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.

MARK SCHEME

Question			Answer	Marks	Part marks and guidance	
1	(a)		20.9	2	Mark final answer **B1** for 20.8[8] or 20.87[7…] or for answer 5.9 or for *their* answer to more than 1dp correctly rounded to 1dp	Condone answer $20.\dot{8}$ for B1 Both unrounded and rounded value must be seen
	(b)		90	1		Condone answer 90^3
2	(a)		$x > 3$	2	Mark final answer **M1** for $6x > 23 - 5$ or better OR **B1** for answer 3 or > 3 or x … 3 with = or any incorrect inequality symbol or for $6 \times 3 + 5 > 23$ as final answer	Condone use of = or incorrect inequality symbol for M1
	(b)		$[r =] \dfrac{p+7}{3}$	2	Mark final answer **M1** for $3r = p + 7$ or $\dfrac{p}{3} = r - \dfrac{7}{3}$ OR **SC1** for answer $p + 7 \div 3$ or $\dfrac{p-7}{3}$ or $\dfrac{p}{3} + 7$	
3	(a)	(i)	2 | 1 5 8 3 | 2 4 4 6 8 4 | 0 1 2 3 5 5 8 5 | 2 3 7 6 | 0 2	3	**M2** for ordered diagram with one error, omission or extra or for unordered diagram with all 20 values in correct rows and no extras OR **M1** for [un]ordered diagram with no more than two errors, omissions or extras	Give bod for unclear numbers if crossed out as part of median calculation If two diagrams, mark better

Question			Answer	Marks	Part marks and guidance	
		(ii)	41.5 or $41\frac{1}{2}$	2	**M1** for 41 and/or 42 as answer or identified in table or working or for 1.5 as answer or figs 415 as answer	e.g. accept 1 and/or 2 ringed in 40 row in table for M1 or ordered list of at least first/last 11 values But M0 for 1 5 8 2 4 … without further clarification
		(iii)	$\frac{2}{5}$	2	Mark final answer **B1** for $\frac{8}{20}$ **oe** seen OR **M1** for *their* fraction simplified fully	$\frac{2}{5} = 0.4$ scores B1 only Must see both unsimplified and simplified fraction
	(b)		26.5	4	**B1** for midpoints 17.5, 22.5, 27.5, 32.5, 37.5 **soi** condone one error or omission **M1** for 18×17.5 + 34×22.5 + 32×27.5 + 26×32.5 + 10×37.5 condone one error **M1 dep** for *their* 3180 ÷ *their* 120	**nfww** **FT** *their* 'midpoints' where each midpoint is any point in the interval or an endpoint 315 + 765 + 880 + 845 + 375 or 3180 seen implies M2 Attempt to divide *their* sum by *their* 120 implied by correct answer to division after total seen
	(c)	(i)	13 : 25	2	**M1** for 650 : 1250 or better seen or for answer 25 : 13 OR **SC1** for answer $\frac{13}{25}$	

Question			Answer	Marks	Part marks and guidance	
		(ii)	1140	2	**M1** for (650 + 1250) ÷ (2 + 3) or 380 seen or 1140 seen OR **SC1** for answer 760	Answer 1140 : 760 scores M1 only
4	(a)	(i)	⁻2	1		
		(ii)	At least 6 points plotted correctly Correct smooth curve drawn for -5 < x < 1	1 1	1 mm tolerance, **FT** *their* table 1 mm tolerance from correct points	Points implied by correct curve No ft mark for curve, it must be through the 7 correct points Intention of a continuous smooth curve
		(iii)	⁻3.3 to ⁻3.5 and ⁻0.5 to ⁻0.7	2	**FT** *their* graph **B1** for one correct value	Tolerance of ±0.1 for reading Max **B1** if *their* graph has more than two solutions
	(b)		Two correct trials of x for 2 < x < 3 with one outcome less than 24 and one greater than 24 x = 2.3	M2 B1	**M1** for any correct trial for 2 ≤ x ≤ 3 Independent mark	Correct outcome rounded or truncated to at least 2sf <table><tr><td>x</td><td>$x^3 + 5x$</td></tr><tr><td>2</td><td>18</td></tr><tr><td>3</td><td>42</td></tr><tr><td>2.1</td><td>19.761</td></tr><tr><td>2.2</td><td>21.648</td></tr><tr><td>2.3</td><td>23.667</td></tr><tr><td>2.4</td><td>25.824</td></tr><tr><td>2.5</td><td>28.125</td></tr><tr><td>2.6</td><td>30.576</td></tr><tr><td>2.7</td><td>33.183</td></tr><tr><td>2.8</td><td>35.952</td></tr><tr><td>2.9</td><td>38.889</td></tr><tr><td>2.35</td><td>24.72788</td></tr></table>

Question			Answer	Marks	Part marks and guidance	
5	(a)		Correct octagon, with all vertices on circle	2	**B1** for 45° or 135° seen or for octagon with at least three angles from centre of 45° or for 8 points plotted on circle within tolerance	Tolerance for angles ± 2°
	(b)		150	2	**M1** for 360 ÷ 12 or $\dfrac{(12-2)180}{12}$	M1 implied by 30 seen or may be part of calculation
6	(a)		Rotation or enlargement 180° or [SF] −1 (3, 1)	1 1 1	No other transformation Must be consistent with given transformation	Eg rotate **then** $\begin{bmatrix} 6 \\ -3 \end{bmatrix}$ loses 1st mark Centre given as vector rather than coordinates is not a second transformation
	(b)		Reflection in *x*-axis **oe**	3	**B2** for vertices (⁻3, 1), (⁻6, 1), (⁻6, 2), (⁻4, 2), (⁻4, 3), (⁻3, 3) plotted or for reflection in x-axis implied by imprecise description OR **B1** for reflection stated	Do not penalise for restatement of first transformation eg use of flip in place of reflection
7	(a)		5516.22	3	**M2** for 5340 × 1.033 **oe** OR **M1** for 5340 × 0.033 **oe**	M2 implied by 5516 M1 implied by 176.22 seen
	(b)		2450	3	**M2** for 2597 ÷ 1.06 **oe** OR **M1** for 1.06 **oe** used	Not for just 106% seen

Question			Answer	Marks	Part marks and guidance	
8	**(a)**		Correct Pythagoras statement with hypotenuse 6 or sides 3 $s^2 + s^2 = 6^2$ or $s^2 = 3^2 + 3^2$	**M1**	Alternative method: **M1** for use of 45° with trigonometry	accept any letter in place of s
			Simplified statement for square side $s^2 = 18$	**M1**	**M1** for $\sin 45 = \dfrac{s}{6}$ **soi**	or equivalent using cosine
			Concluding statement $s = \sqrt{18} = 4.24[2\ldots]$	**A1**	**A1** for $s = 6 \sin 45 = 4.24[2\ldots]$ After 0 awarded **SC2** for $4.24^2 + 4.24^2 = 5.99[..]^2$ which rounds to 6 **soi** Or **SC1** for use of Pythagoras **soi**	
	(b)		36.3 to 36.8	**5**	**M1** for $\pi \times 3^2$ And **M1** for 4.24^2 And **M1** for (*their* '28.3' – *their* '18') And **M1** for *their* 'shaded area' ÷ *their* '28.3' or *their* 'square area' ÷ *their* '28.3'	Circle area = 28.3 Square area = 18 or 17.9[…] Shaded area = 10.3

Question			Answer	Marks	Part marks and guidance	
9			140 **nfww**	5	**M2** for $a + 2a + 2a + 40 + a + 20 = 360$ **oe** OR **B1** for any three of a, $2a$, $2a + 40$, $a + 20$ **oe soi** or angles in quadrilateral = 360 **soi** AND **M2FT** for $a = 50$ OR **M1FT** for $6a = 360 - 60$ or $ma = 360 - n$ AND **M1FT** for answer 2 × *their* 'a' + 40 **Max 4 marks if answer incorrect**	accept any letter used in place of a **FT** solution of *their* $ma + n = 360$ or 180 rearrangement of their equation to isolate algebraic terms FT *their* stated value for angle a
10	(a)		Correctly completed box plot	3	**B1** for min 158, max 186 indicated **B1** for LQ at 166, UQ at 180 indicated **B1** for median 174 indicated **Max 2 marks if box plot not complete**	half square accuracy

Question			Answer	Marks	Part marks and guidance	
	(b)		Girls shorter on average, median 164 compared with 174 for boys Boys heights are more varied, IQR is 14 compared with 10 for girls	3	**B1** for a comparison without relevant statistic **B1** for a correct statistic for girls stated	See exemplars For 3 marks one comparison must be related to IQR or range, and the other to median with the two relevant statistics for each stated and at least one comment must interpret context |	B	G | |---|---|---| | **Min** | 158 | 150 | | **Max** | 186 | 178 | | **Median** | 174 | 164 | | **IQR** | 14 | 10 | | **LQ** | 166 | 158 | | **UQ** | 180 | 168 | | **Range** | 28 | 28 |
11	**(a)**		$y = 2x - 3$ **oe**	2	**B1** for $2x - 3$ **oe** or $y = mx - 3$ **oe** $(m \neq 0)$ or $y = 2x + c$ **oe**	
	(b)		$x \leq 3$ $y \leq 2x - 3$	1 1	**FT** *their* $y = mx + c$ from (a)	condone use of <
12	**(a)**		$\dfrac{8.2}{\cos 32} = 9.66[\ldots]$ or or $\dfrac{8.2}{\cos 32} = 9.7$	2	**M1** for $\cos 32 = \dfrac{8.2}{AC}$ **oe**	accept alternative for AC eg x or 9.7 Accept complete equivalent method for 2 marks, eg use of sin 58 or use of tan leading to [CD =] 5.12[…] seen then Pythagoras A circular argument starting with 9.7 scores max M1 if correct trig statement seen

Question	Answer	Marks	Part marks and guidance	
(b)	6.19 to 6.22	3	**M2** for $\dfrac{9.7 \sin 37}{\sin 110}$ OR **M1** for $\dfrac{BC}{\sin 37} = \dfrac{9.7}{\sin 110}$ **oe**	accept alternative for BC eg x or blank
13 (a)	$x = 2.5$ or $2\dfrac{1}{2}$ or $\dfrac{5}{2}$	4	**nfww** **M1** for $18x - 3 - 4x - 2$ **oe** **M1** for multiplying both sides by 6 **M1dep** for correct collection of x terms and numbers in *their px + q = r* leading to $ax = b$ **M1** for $x = \dfrac{b}{a}$ after $ax = b$ seen **Max 3 marks if answer is incorrect**	At least three terms correct Dependent on at least M1 $14x = 35$ accept unsimplified improper fraction or decimal correct to at least 3sf

	Question		Answer	Marks	Part marks and guidance	
	(b)		1.44 and $^-$0.84	3	**M2** for $\dfrac{3 \pm \sqrt{3^2 - 4 \times 5 \times \text{-}6}}{2 \times 5}$ or $\dfrac{3 \pm \sqrt{129}}{2 \times 5}$ or one solution correct to 2dp or both solutions rounded or truncated to at least 2dp OR **M1** for use of formula with two errors or one solution to more than 2dp	Condone one error in formula for M2, examples of one error: • a substituted wrongly twice • short division line • one error in quoted formula For completing the square method award M2 for $\left(x - \dfrac{3}{10}\right)^2 = \dfrac{6}{5} + \left(\dfrac{3}{10}\right)^2$ **oe**, condoning one error Exact solutions: 1.43578…, -0.83578…
14	**(a)**		12, 6, 9, 18, 15	3	**B2** for 3 correct frequencies OR **B1** for 1 correct frequency or for frequency density × correct interval width attempted or for all frequency densities linked with correct interval	0.8, 0.4, 0.3, 0.9, 0.75
	(b)		No, oldest person could be anywhere in range $80 < a \le 100$	1		see exemplars Response must include reference to age range
15	**(a)**		Parabola with minimum at ($^-$2, 0)	1		Clear intention of translation to left
	(b)		113° **and** 247°	2	**B1** for one correct or for two values, both >90, that sum to 360	Accept answers rounding to these

Question	Answer	Marks	Answer
16	Fully correct calculation of time to fill tank in minutes and seconds showing use of max capacity ÷ min rate. Each calculation shown and clearly identified	**5**	eg Maximum capacity = 8650, so fill to 0.95 × 8650 = 8217.5 Minimum flow rate = 735 Maximum time = 8217.5 ÷ 735 = 11.18 Maximum time = 11 minutes 11 seconds
	Complete calculation of time in minutes to fill tank to 95% of capacity with each calculation shown using at least one of upper bound of capacity or lower bound of flow rate	**4-3**	Complete calculation of time to fill tank to 95% of capacity without use of bounds, leading to answer 11.04 minutes or 11 minutes 2 seconds OR Complete calculation of time in minutes to fill tank to 95% of capacity with incorrect use of bounds OR Correct result for calculation A using upper bound of capacity or for calculation B using lower bound of flow rate
	Correct upper and lower bounds for capacity and flow rate seen OR Correct result for calculation A or B using *their* capacity and/or rate	**2-1**	At least two correct values of bounds seen OR Attempt at calculation A, B or C
	Required calculations A Calculation of 95% of capacity B Calculation of time = capacity ÷ rate C Conversion of time in minutes to minutes and seconds		Eg 0.95 × 8600 [= 8170] Eg 8600 ÷ 740 [= 11.62…] Eg 11.04 minutes = 11 min and 0.04 × 60 seconds
	Bounds Capacity LB = 8550 UB = 8650 95% Capacity LB = 8122.5 UB = 8217.5 Rate LB = 735 UB = 745		For 4 marks or less allow use of eg 8649.9[9] etc for bounds

Question			Answer	Marks	Part marks and guidance	
17	(a)		Correct Pythagoras statement leading to $H = \sqrt{119} + 5 = 15.9[0\ldots]$ or 15.91	3	**M1** for $5^2 + h^2 = 12^2$ or better	
					B1 for $\sqrt{119}$ seen	accept 10.91 or 10.9[…] for $\sqrt{119}$
					M1 for $10.9 + 5 = 15.9[0\ldots]$ or 15.91	or $\sqrt{119} + 5 = 15.9[0\ldots]$ or 15.91
	(b)		546.8 to 547.4	4	**B1** for stating or using both correct volume formulae	Must be hemisphere formula
					M1 for $\dfrac{1}{3}\pi \times 5^2 \times 10.9$	implied by 285.[…] seen
					M1 for $\dfrac{2}{3}\pi \times 5^3$	implied by 261.[…] seen
					M1 for *their* '285.4' + *their* '261.8'	Must be from attempt to use correct two formulae
					Max 3 marks if answer incorrect	

APPENDIX

Exemplar responses for Q.14(b)

Response	Mark
No there is a 20 gap range for which patient could have age	**1**
No, it's a range from 80 to 100	**1**
No, it's between 80 and 100	**1**
No, he doesn't know the exact age	**0**
Yes, highest number on graph is 100	**0**
No, it could be any lower than 99	**0**

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