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 2016

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

2.   **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.

3.   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.

4. 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.

5. 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.

6. 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**.

7. 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'.

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. 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' or 'cao'. 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.

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)		$3^2 \times 5^2 \times 7$ oe	3	**B2** for correct answer with one error or 3,3,5,5,7 or **B1** for 3, 5 and 7 as factors or 9,25,7 as factors	
	(b)		$7 \times 3^2 \times 5^2 \times 7$ $= 3^2 \times 5^2 \times 7^2$ or $(3 \times 5 \times 7)^2$	1		
2	(a)		-1 7	2	**B1** for each	
	(b)		[y value oe] lies between a negative and a positive	1	Accept any correct explanation	
	(c)		1.2 first correct result of a trial of a value of x between 1 and 2 second correct result of a trial of a value of x between 1 and 2	1 1 1	The result of each trial can be rot to at least 2 sf e.g. for $x = 1.7$, the result could be 3.6, 3.61, 3.613, etc Allow trials to more than 1 decimal place e.g. $x = 1.35$ gives 0.8103..… so we allow 0.81, 0.810, 0.8103, and so on	<table><tr><td>1.1</td><td>-0.569</td></tr><tr><td>1.2</td><td>-0.072</td></tr><tr><td>1.25</td><td>0.203</td></tr><tr><td>1.3</td><td>0.497</td></tr><tr><td>1.4</td><td>1.144</td></tr><tr><td>1.5</td><td>1.875</td></tr><tr><td>1.6</td><td>2.696</td></tr><tr><td>1.7</td><td>3.613</td></tr><tr><td>1.8</td><td>4.632</td></tr><tr><td>1.9</td><td>5.759</td></tr></table>
3	(a)		44	2	**M1** for $\dfrac{22}{50}$ oe	Allow fully correct non calculator method.
	(b)		0.44	1		Condone 44% or $\frac{44}{100}$
	(c)	(i)	192	2	**M1** for 0.12×1600 oe	

Question			Answer	Marks	Part marks and guidance	
		(ii)	A larger sample oe eg record the results for more than one week	1	Accept any correct explanation	
4	(a)		5 25	2	**B1** for each	
	(b)		$9n - 12$	2	**M1** for $9n$	
5			18	3	**M1** for a correct first step eg $5x - 3 = 522 \div 6$ oe or better **M1** for a correct second step eg $5x = 87 + 3$ **M1** for $x = b/a$ after $ax = b$ to a maximum of 2 marks	
6			39.26[…] or 39.27 or 39.3 cm^2	2 1	**M1** for $\pi \times 5^2$ oe soi 78.5[…]	

Question	Answer	Marks	Part marks and guidance
7	19 cao	5	**M4** for $\sqrt{12.35^2 - 4.75^2 + 15.2^2}$ or better or **M3** for $15.2^2 + 11.4^2$ or $15.2^2 + 129.96$ or $12.35^2 - 4.75^2 + 15.2^2$ or **M2** for $12.35^2 - 4.75^2$ or 11.4 or 129.96 or $[\ldots]^2 + 4.75^2 = 12.35^2$ and $15.2^2 +$ *their* BD^2 or $\sqrt{15.2^2 + their BD^2}$ or **M1** for $[\ldots]^2 + 4.75^2 = 12.35^2$ or $15.2^2 +$ *their* BD^2	Accept any correct method

Question	Answer	Marks	Part marks and guidance
8*	A full and correct solution, clearly communicated with each step clearly shown, eg 40 females in total, proportion of females is $6 \div 40 = 15\%$ oe and proportion of males is $4 \div 25 = 16\%$ so males as $16\% > 15\%$ oe.	6	
	A fully correct solution which is difficult to follow but has a correct conclusion or a fully correct solution without a clear or correct conclusion. The total of females (40) is correct and two comparable quantities (e.g. 16% and 15%) seen.	5 – 4	The total of females (40) is correct and one of the two proportions is also correct and the method for the other is correct but the figure is incorrect (e.g males as 16% and $6 \div 40$ for the females but the figure is incorrect.)
	The percentage of left-handers amongst females correctly calculated, eg $6 \div 40 = 15\%$ or the correct number of females (40) and the correct percentage of left-handers amongst males correctly calculated, eg $4 \div 25 = 16\%$ or the correct number of females (40) shown and the method for both males and females is also correct but both figures are incorrect.	3 – 2	The correct percentage of males calculated or the correct number of females seen (40) and the correct method for calculating the percentage of females or males seen but the figure given is incorrect.
	The correct number of females (40) correctly calculated or the correct method to calculate the percentage of males seen. .	1 - 0	No worthwhile work seen.
			Allow any method to compare these figures eg percentages, decimals or fractions with the same denominators. Allow correct calculation of proportion of right-handers.

Question			Answer	Marks	Part marks and guidance	
9			15	**3**	**M1** for 180 – 156 or 24 **M1** for 360 ÷ *their 24*	Accept any correct method
10	**(a)**		2*n* is divisible by 2 or it is 2 × *n*. It is always even Therefore 2*n*+1 is always odd	**1** **1**	Accept any correct explanation	
	(b)		Fully correct explanation	**4**	**M1** for $(2n + 1)^2$ **M1** for at least three correct terms from $4n^2 + 2n + 2n + 1$ **A1** for $4n^2 + 4n + 1$ **B1** for statement that $4n^2$ and $4n$ are even	
11			Southern Bank: Y1 5000 × 1.02 or 5100 Y2 5100 × 1.03 or 5253 Y3 105.06 × 1.04 or 5463.12 Northern Bank 5000 × 1.035^3 or 5543.58[9…] or 5543.59 So Northern Bank by 80.46, 80.47 or 80.5[0]	**6**	**M3** for correct method to obtain 5463.12 oe or **M2** for correct method for two years or **M1** for correct method for one year **and** **M2** for 5000 × 1.035^3 oe or **M1** for 5000 × 1.035 oe	
12	**(a)**		24.25 or 24.3	**4**	**B1** for 3 midpoints seen from 5, 15, 25 and 40 **M1** for attempt at Σ*mf* where *m* is any value within each group e.g. 5 × 8 + 15 × 14 + 25 × 21 + 40 × 17 or 1455, allowing one error **M1dep** for *their*1455 ÷ *their*60 (i.e. 8+14+22+16)	Can be implied from products Condone one error

Question			Answer	Marks	Part marks and guidance	
	(b)		$\dfrac{22}{60}$ oe	2	**M1** for 8 + 14 or 22 or **SC1** for $\frac{14}{60}$	
	(c)		[0].38	1		
	(d)	(i)	23	2	**M1** for attempt at area eg *their 2.3* × *their 10* implied by 23	
		(ii)	$\dfrac{39}{47}$ oe	4	**M3** for (*their 23* + 1.6 × 10) ÷ (*their 23* + 1.6 × 10 + 0.2 × 10 + 0.3 × 20) condoning one error or **M2** for their 23 + 1.6 × 10 or *their 23* + 1.6 × 10 + 0.2 × 10 + 0.3 × 20 or 39 or 47 or **M1** for an attempt at either 39 or 47 with one error	accept 82.9….% or 83% isw conversions
	(e)		Two correct different comments such as the average distance travelled by firm A is greater than firm B and more than half of A travel over 20 miles whereas more than half of B travel less than 20 miles	2	**B1** for one correct comment e.g. same spread but different skew	Actual figures are unnecessary but they are here in case you see them used: means: A= 24.25 B=13.7 It is possible to put the two comments together as one comment.
13			50.2 to 50.3	3	**M2** for cos $^{-1}$(16 ÷ 25) or **M1** for cos[… =]16 ÷ 25	condone 50 as answer with correct working

Question			Answer	Marks	Part marks and guidance	
14			[x=] 5 [y=] −1	4	**M1** for multiplying first equation to get common coeffs. eg $12x - 8y = 68$ **M1** for multiplying second equation to get common coeffs. eg $12x + 9y = 51$ **M1** for correctly adding or subtracting to eliminate one variable	condone one error in each step
15	**(a)**		$x = \sqrt{\dfrac{y+4}{5}}$	3	**M1** for first correct step eg $y+4 = 5x^2$ **M1** for second correct step eg $\dfrac{y+4}{5} = x^2$ **M1** for square root to a maximum of 2 marks	
	(b)		$x = \dfrac{y+9}{2}$ oe	3	**M1** for first correct step eg $5x - x - 2y = 18$ **M1** for second correct step eg $4x = 2y + 18$ **M1** for division by coefficient of x to a maximum of 2 marks	
16	**(a)**		$(167 \times 84.5 + (312 - 167) \times 68.5) \div 1000$ $= 24.044$ oe	4	**M3** for $(167 \times 84.5 + (312 - 167) \times 68.5) \div 1000 = 24.044$ oe or **M2** for $167 \times 84.5 + (312 - 167) \times 68.5$ or the full calculation with at most one error or **M1** for 84.5 or 68.5 or $167 \times$ *their 84.5* $+ (312 - 167) \times$ *their 68.5*	For 84.5 allow any value in the range 84.47 to 84.5 and similar for 68.5 Allowing in kg *their* 84.5 could be 84 and *their* 68.5 could be 68
	(b)		The average weights may not be representative of the group of passengers	1	Accept any correct explanation e.g. children are lighter	Not all males or all females

Question			Answer	Marks	Part marks and guidance	
17			$(x - 4)^2 + 12$	3	**B1** for $(x - 4)^2$ **B2FT** for [+] 12	FT their $(x - 4)^2$
18	(a)		Angle ABD = angle DBC [given]	1		
			AB = BC	1		
			BD [is in both triangles or common]	1		
			SAS	1		
	(b)		ADB = CDB	1		
			both add to 180° oe	1	accept 180 ÷ 2	
19			17425[.3…] or 17425.4 or 17430 or 17400	6	**B2** for [height] of 30 cm (or top of 10 cm) or **M1** for attempt at similar triangles **and** **M3** for ⅓π×24²×30 − ⅓π×8²×10 or **M2** for either volume above or **M1** for attempt at volume of a cone with one error or subtraction of two volumes	

APPENDIX

Exemplar responses for Q 2b

Response	Mark
[solution oe] lies between a negative and a positive	**1**
0 comes between -1 and 7	**1**
It lies between x=1 and x=2 because y=-1 and y=7	**1 BOD**
if x=1 it equals -1, it is too small, which means it can't be any smaller. And if x=2 it's too big, meaning it can't be larger	**1 BOD**
The solution for one is -1 so it is close to 0 and the 7 does lie between but it too high	**1 BOD**
because there small numbers	**0**
Because the answer to this equation lies between these numbers	**0**
Because they are whole numbers	**0**
They are the closest to zero	**0**
They are the lowest integers possible to attain zero	**0**
Because it is where the points meet	**0**
because it can't be higher than 2 and less than 1, it has to be in the middle	**0**
0 comes between these numbers	**0**

Exemplar responses for Q3(c)(ii)

Response	Mark
A larger sample	**1**
record the results for more than one week	**1**

Exemplar responses for Q10(a)

Response	Mark
Multiplying by 2 gives an even number ….	**1**
2n is a multiple of 2 ….	**1**
2n is divisible by 2 ………	**1**
…… adding 1 to an even number gives an odd number	**1**

Exemplar responses for Q12(e)

Response	Mark
the average distance travelled by firm A is greater than firm B	**1**
more from A travel longer distances	**1BOD**
More in B travelled less than 20 miles …..	**1**
In A the most common distance is 20-30 and for B it is 0-10	**1**
More people in A travel longer than 20 miles than B	**1**

Exemplar responses for Q16(b)

Response	Mark
The average weights may not be representative of the group of passengers	**1**
If there are more (too many) males the maximum weight will be reached	**1**

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