OCR
Oxford Cambridge and RSA

GCSE

Mathematics B (Linear)

Component **J567/03:** Mathematics Paper 3 (Higher)

General Certificate of Secondary Education

Mark Scheme for June 2015

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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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 using a correct method and are not lost for purely numerical errors.
A marks are for an accurate answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
B marks are independent of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
SC marks are for special cases that are worthy of some credit.

MARK SCHEME

Question			Answer	Marks	Part marks and guidance	
1	(a)		200	2	**M1** for 240 ÷ (1+5) or 40 seen	
	(b)		77	2	**M1** for 22 ÷ 2 or 11 seen or 7 ÷ 2 or 3.5 seen	
2	(a)		68 **and** alternate [angle]	1	condone Z-angle penalise alternate and corresponding together and penalise alternate and opposite together	condone 'alternative' and 'alternating'. Allow 68 and corresponding providing 68 marked as opposite on diagram at B or D Allow 68 and [angles in a] four sided shape equals 360(angles must be marked on the diagram) Allow [angles in a] triangle equals 180 providing 95 is marked in the correct position
	(b)		95 one mark for each reason (maximum of **two)** from • angle[s] … triangle [add to 180] • angle[s] … quadrilateral [add to 360] • corresponding or allied [angles] • [vertically] opposite [angles] or angles round a point [add to 360] • angles… line [add to 180]	1 2	or FT 180 – 17 – *their(a)* condone F-angle condone X-angle	 accept 4 sided shape/trapezium

Question			Answer	Marks	Part marks and guidance	
3	(a)		92	3	**M2** for 80 × 1.15 or **M1** for 80 × 0.15 oe soi by 12 or *their* 10% soi by 8 **and** *their* 5% soi by 4 and **M1** for 80 + *their 12* or 80 + *their* 10% + *their* 5% oe accept correct alternative methods	If they do not get the correct values of 8 and 4 we need to see working e.g. for 10% we could see 80 ÷ 10 and for 5% we could see their 10% ÷ 2 Can be implied from a correct addition
	(b)		A or 30[g] or 23[p] **and** three correct valid comparisons eg cost for 300 g 230, 234, 240	3	**B2** for three correct valid comparisons with incorrect answer or no answer or A and three correct valid comparisons with at most one numerical error or **B1** for an attempt at converting two items to a common unit accept any correct comparison eg cost per 1g; 0.76[..] or 0.77, 0.78, 0.8[0] or amount per 1p; 1.3[…], 1.28[…], 1.25	they may do this in pairs
4	(a)		$10x + 15$ final answer	1		
	(b)		$3x(x – 4)$ final answer	2	**M1** for $3(x^2 – 4x)$ or $x(3x – 12)$	Condone omission of final bracket $(3x + 0)(x – 4)$ or $-3x(4 – x)$ scores 2, correct answer seen then spoiled is 1 mark

Question			Answer	Marks	Part marks and guidance	
5			complete correct net	3	**B2** for correct net with additional rectangles or 3 or 4 additional correct rectangles in the correct places or a correct outline with missing internal lines **B1** for 3 or 4 additional correct rectangles in the correct places with extra incorrect rectangles or for 1 or 2 additional correct rectangle(s) in the correct place(s)	Condone freehand and dotted internal lines, mark intent, ignore flaps
6	(a)	(i)	660 to 680	1		
		(ii)	330 – 340 mph or 5.5 – 5.7 mpm or [0].0916 - [0].095 mps	3	**B2** for answer of 330 – 340 or 5.5 – 5.7 or [0].0916 - [0].095 or FT *their (a)(i)* ÷ 2 correctly calculated or **M1** for 'a distance' ÷ 'a corresponding time taken' e.g. *their(a)(i)* ÷ 2 or 770 ÷ (2h 20m or 220 or 140 or $2\frac{1}{3}$ oe) and **B1** for the correct units for their answer If **0** scored award **B1** for units of mph with no working	We look at their number to indicate the units they are using They must use the outward journey Allow m/h, m/m or m/s
	(b)		11 50 [am] cao	1		
	(c)		[0]9 20[am] [and] 15 00	1,1	condone 14 55 – 15 00 or 2 55 – 3[00] pm for second time	15 00 pm scores **0**

7*	The correct final answer of R[osie] = 17, D[aisy] = 14, T[illy] = 12 and M[olly] = 8 with supporting algebraic working or at least one other numerical attempt seen. Correct spelling and grammar is used and the working is set out in a logical manner that makes it easy to follow.	**5**	
	The correct final answer is obtained with no other attempts seen.	**4 – 3**	Three correct algebraic expressions or three different numerical attempts are seen or the daughters are all in the correct order and clearly identified, in the final answer with Rosie as the oldest, then Daisy, then Tilly and then Molly as the youngest.
	Two correct algebraic expressions or two numerical attempts are seen or a realisation that Rosie is the oldest and Molly is the youngest.	**2 – 1**	One correct algebraic expression or one numerical attempt is seen or a realisation that Rosie is the oldest or Molly is the youngest.
	No worthwhile work attempted.	**0**	

Question			Answer	Marks	Part marks and guidance	
8	(a)		Four points correctly plotted	2	**B1** for two points correctly plotted	overlay gives guidance, the tolerance ±½ small square
	(b)		positive	1		ignore embellishments accept +ve
	(c)		the height increases as the width increases oe	1	accept any equivalent response	
	(d)	(i)	correct ruled line of best fit	1	Crossing on "w = 10" 3.5-7.5 and on "w=25" 12.5-17.5	use overlay to judge the validity of the line of best fit
		(ii)	12 - 18	1		
	(e)		(18, 3.5) indicated on the diagram	1		
9			127	4	accept any correct method	See additional guidance Mark the method which leads to the final answer
10	(a)		5.5 oe	3	**M1** for $7x - 3x + a = b$ oe or better ie correctly combining x's **M1** for $cx = 20 + 2 + dx$ oe or better ie correctly combining numbers **M1** for $x = f/e$ oe or better after $ex = f$ (e not 1) to a maximum of 2 marks	
	(b)		$r = \sqrt{A-4}$	2	**M1** for $A - 4 = r^2$ oe ie a correct first step or **B1** for answer of $r = \sqrt{f(A)}$ or answer of $\sqrt{A-4}$	Ignore signs in front of root accept a Must involve A

Question			Answer	Marks	Part marks and guidance	
11	(a)		it is a leading question	1	accept any correct reason	see appendix
	(b)		a suitable question including month with at least four response boxes covering all possibilities from 0 to at least 20 and with no overlaps	2	**B1** for a suitable question with response boxes and one error which would be either less than four boxes or not covering all the possibilities or with overlaps or correct boxes with no/incorrect question.	Can go past 20 condone 1≤5 as meaning 1 ≤ answer ≤ 5 Interpret 20+ as 20 or more Question must have month and imply journeys/trips/train
	(c)		C	1		
	(d)	(i)	Biased or e.g. people more likely to take the train	1	accept any correct explanation	Select best answer see appendix
		(ii)	there are people who will not be in the sample eg those at work	1	accept any correct explanation	Select best answer see appendix
12			translation $\begin{pmatrix}6\\0\end{pmatrix}$	3	**B2** for $\begin{pmatrix}6\\0\end{pmatrix}$ or **B1** for brackets missing or 6 right/in *x* direction **and** **B1** for translation After **B0** **M1** for two objects 6 units horizontally apart or one correct reflection in either $x = -1$ or $x = 2$	If more than one transformation stated scores **B0** Condone a point as an object

Question			Answer	Marks	Part marks and guidance	
13	(a)		[*x*=] 3 and [*y*=] 5 with correct algebraic working	3	**M1** for multiplying one or both equations to get equal coefficients with at most one error in each operation **M1 f**or correctly choosing the operation to eliminate one variable and adding or subtracting their equations with at most one error Accept any correct method, if substitution: **M1** for rearranging one equation to get x or y as the subject, allowing one error **M1** for substituting their expression into the other equation, allowing one error If **0** scored then **SC1** for both answers correct and no algebraic working	e.g. two of the three terms in each operation must be correct and these terms define the operation mark best attempt
	(b)		$(x – 5)^2$ - 15 final answer	3	**B2** for – 15 or FT their $(x \pm a)^2$ or **B1** for $(x – 5)^2$ If **0** scored award **SC2** for $(x – 5)^2$ - 15 in working	mark final answer and condone double signs eg + - 15
14	(a)		¯2	1		
	(b)		Correct smooth curve	3	**B2FT** for 6 or 7 points correctly plotted or **B1FT** for 4 or 5 points correctly plotted	points and curve tolerance ±1 mm, condone some fuzziness in places, penalise ruled line segments between *x* =-1 and *x* = +3
	(c)		¯0.5 to ¯0.3 2.3 to 2.5	1 1	If 2 not scored check graph and FT *their graph* for any wrong answers with tolerance ± 0.1	

Question			Answer	Marks	Part marks and guidance	
15	(a)		$\frac{2}{5}$ on first branch and $\frac{3}{4}$ and $\frac{1}{4}$ on second test top branches and $\frac{1}{3}$ and $\frac{2}{3}$ on second test bottom branches	2	**B1** for either $\frac{2}{5}$ on first branch or two of the four probabilities on the second test correct	Accept % or decimals correct to at least 2 sf
	(b)		$\frac{11}{20}$ oe or [0].55 or 55%	3	**M2FT** for 1 - $\frac{3}{5} \times \frac{3}{4}$ oe or **M1FT** for all three branches selected, or one branch correctly calculated isw incorrect simplification FT *their tree diagram* providing the probabilities are positive and < 1	e.g $\frac{3}{5} \times \frac{1}{4} + \frac{2}{5}$ or $\frac{3}{5} \times \frac{1}{4} + \frac{2}{5} \times \frac{1}{3} + \frac{2}{5} \times \frac{2}{3}$ scores **M2** check their tree diagram
16	(a)		55 opposite [angles of a] cyclic quadrilateral [add to 180] oe	1 1		
	(b)		63 alternate segment [theorem]	1 1		
17	(a)		$4^2 + 6^2$ or better $\sqrt{52}$ $\sqrt{4 \times 13}$ or $\sqrt{4} \times \sqrt{13}$ [= $2\sqrt{13}$]	1 1 1	soi by 52 soi by $\sqrt{4 \times 13}$ or $\sqrt{4} \times \sqrt{13}$ accept $\sqrt{2} \times \sqrt{2} \times \sqrt{13}$	

Question			Answer	Marks	Part marks and guidance	
	(b)		any two from *p* 1 2 3 4 5 6 *q* $4\sqrt{3}$ $3\sqrt{5}$ $2\sqrt{10}$ $\sqrt{33}$ $2\sqrt{6}$ $\sqrt{13}$	3	**B2** for one fully correct solution or for two correct solutions not fully simplified or **B1** for one correct solution not fully simplified If **0** scored **SC2** for both answers correctly simplified and reversed or **SC1** for one correctly simplified answer reversed	Unsimplified versions *p* 1 2 3 4 5 6 *q* $\sqrt{48}$ $\sqrt{45}$ $\sqrt{40}$ $\sqrt{33}$ $\sqrt{24}$ $\sqrt{13}$ or $2\sqrt{12}$ condone reduction to roots of prime numbers eg $\sqrt{33}=\sqrt{3}\sqrt{11}$ isw after correct unsimplified versions seen for max **B2**
18	**(a)**	**(i)**	$6.7[0000] \times 10^{5}$	**1**		
		(ii)	9.2×10^{-3}	**1**		
	(b)		the power of 10 should be 8	**1**	accept any correct statement and mark the best response	see appendix
19			$\frac{12}{37}$	**3**	**B2** for $\frac{324}{999}$ oe or **M1** for 1000n = $324.324....$ or $\frac{[0]\cdot 324}{[0]\cdot 999}$	We must have a proper fraction
20	**(a)**		x^6	**2**	**M1** for x^{12} or $(x^n)^{½} = x^{0.5n}$ eg $(x^6)^{½} = x^3$	
	(b)		$\frac{x+5}{x+3}$ final answer	**4**	**B2** for $(x+5)(x-3)$ or **B1** for $(x+a)(x+b)$ where $a+b=2$ or $ab=-15$ and **B1** for $(x+3)(x-3)$	

Question			Answer	Marks	Part marks and guidance	
21			$\overrightarrow{DE}$ = **b** – **a** oe	**B1**	could be $\overrightarrow{ED}$	Could be on diagram condone omission of arrows
			$\overrightarrow{CA}$ = 4**a and** $\overrightarrow{CB}$= 4**b**	**B1**	soi by correct $\overrightarrow{AB}$ or $\overrightarrow{BA}$	
			$\overrightarrow{AB}$= 4**b** – 4**a** oe	**B1**	could be $\overrightarrow{BA}$	
			$\overrightarrow{AB}$ = 4$\overrightarrow{DE}$ oe	**B1**	dep on **B3**	

APPENDIX

Exemplar responses for Q8(c)

Do not allow larger or bigger for height

Response	Mark
Taller trees have wider trunks	1
Thicker trees are taller	1
Trees with a bigger trunk are taller	1
The thicker the tree the higher the trunk	1
Both go up	1
The higher the wider	1BOD
The Smaller the width the shorter the tree	1
Positive [correlation]	0
The height and the width both change	0
Height is greater than the width	0
Bigger trees have bigger trunks	0
Smaller the width the taller the tree	0
The bigger the width the larger the tree	0
The height and width both change	0

Exemplar responses for Q11(a)

Response	Mark
it is a leading question	1
it is biased	1
you are telling them the answer	1
Do you agree is the wrong term to use (not enough)	0
there are only three boxes to tick	0
It doesn't say which part of public transport buses or trains	0
People may not have used public transport 5 years ago	0

Exemplar responses for Q11(d)(i)

Response	Mark
people more likely to take the train	1
it is only one location	1 BOD
not a wide range of people	1
Not representative of the population	1
Biased ….	1 BOD
People will be in a rush to catch the train	1
there will be too many people to ask	0
They have already taken the train	0

Exemplar responses for Q11(d)(ii)

Response	Mark
there are people who will not be in the sample	1
you will get mostly those people at home	1
Some people will be at work	1
you may get children answering	1
not everyone has a telephone/not in directory	1
only selects people with a telephone	1
not many may answer the telephone	1
People may refuse to answer	1
it is not a good way to ask questions	0
it is an invasion of privacy	0
Biased	0

Exemplar responses for Q18(b)

Response	Mark
the power of 10 should be 8	1
they should have subtracted the powers	1
two minuses make a plus in the powers	1
when you divide by a negative power you add them	1
when you divide by a number less than 1 the first number gets bigger	1

The answer should be higher than 6.8×10^5	**1**
The answer should be in the millions	**1**
when you divide by a decimal number it gets bigger	**0**
the power of 10 is not 2	**0**

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