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 2017

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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

Subject-Specific Marking Instructions

1. **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.

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 not from wrong working **full marks** should be awarded.

   Do not award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen and 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.

   - **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**.

6. 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'.

7. 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).

8. 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.

9. 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.

10. 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)		195 115 550 125 110 205	3	**B2** for 4 or 5 correct or **B1** for 2 or 3 correct	
	(b)		650 and 550 soi by e.g. 100 more	1	**FT** *their* table if M < F	Ignore any irrelevant data, see appendix
	(c)		325 is greater than a quarter of 1200 oe	2	**B1** for 325	See appendix
	(d)		$\frac{210}{650}$ or $\frac{21}{65}$ oe	2	**B1** for 210 in numerator or 650 in denominator	isw cancellation/conversion of fractions after an acceptable answer seen
2	(a)		174	3	**M1** for an attempt at 120 × 0.45 or 54 seen **M1dep** for 120 + *their* 45%	Fully correct method to find 45% of 120 with at most one error
	(b)		20 with some supporting working	3	**M2** for 100 –(100 ÷ 1.25) oe or (125 – 100) × 100 ÷ 125 oe or **M1** for 100 ÷ 1.25 oe or (125 – 100) ÷ 125 oe or answer of 20 with no supporting working or clear ×1.25 and ÷1.25 in a diagram	Accept any correct method e.g. **M1** for $a \times 1\frac{1}{4} = 1\frac{1}{4}a$ oe [decrease required = $1\frac{1}{4}a - a = \frac{1}{4}a$] **M1** for % decrease = $\frac{\frac{1}{4}}{1\frac{1}{4}}$ oe [= 20%]
3			9.4[0]	3	**M1** for 100×1+10×5+5×6+1×8 or 188 **M1dep** for *their* 188 ÷ 20	Implied by 100+50+30+8 allow one error in totals
4	(a)	(i)	correct diagram forming a triangle	2	**B1** for length AC = 4 cm(± 2 mm) or length BC = 6.5 cm(± 2 mm)	

Question			Answer	Marks	Part marks and guidance	
	(a)	**(ii)**	320 – 324	**2**	**M1FT** for (NCA=)36 – 40 or (SCA=)140 - 144	**FT** their diagram only if 2 not scored in (a)(i)
	(b)	**(i)**	246.5	**1**		
	(b)	**(ii)**	2549	**1**		
5	**(a)**		2 : 3	**1**		
	(b)		60	**3**	**M1** for 240 ÷ (3 + 5) soi by 30, 90 or 150 **M1** for 150 ─ 90 or (5 ─ 3) × 30	
6			$7n - 5$	**3**	**B2** for an answer of $7n \pm j$ or **M1** for any correct method to find the difference of 7 **B1** for an answer of $kn - 5$ ($k \neq 0$)	**M1** implied by the terms 9, 16, 23, 30 in the correct order
7			700 ÷ 20 = 35 or 680 ÷ 20 = 34	**2**	**M1** for one number correctly rounded eg 700, 680 or 20 seen or 600 ÷ 20 = 30	

8*	The correct answer of 17 with complete and correct working. The method is to show complete working to give an area of 326 and then divide by 20. The answer is then rounded up to 17. Correct spelling and grammar and the working is set out in a logical manner that makes it easy to follow.	**5**	
	For four marks the candidate may give an answer of 16.3 from correct working or they may get the correct area of 326 and show one other evidence from division of this area by 20 or rounding their final answer up. Otherwise they will achieve four of these elements listed in the 1 mark section or they will show methods to calculate two required areas and two other elements.	**4 – 3**	For three marks the candidate may get the correct area of 326 and make no further progress, or they will show an answer of 17 with no working at all. Otherwise they will achieve three of these elements listed in the 1 mark section or they will show methods to calculate two required areas and one other element.
	For two marks the candidate may give an answer of 16.3 with no working or they will achieve two of these elements listed in the 1 mark section or they will show methods to calculate two required areas.	**2 – 1**	There are four key elements, (i) working out the missing side(s), (ii) writing down a method for finding the areas which make up the shape, commonly this will be using two rectangles, (iii) dividing the total area by 20 to find how many packets are required and (iv) rounding the number of packets up to the nearest integer. For one mark the candidate will achieve one of these elements.
	No worthwhile work attempted.	**0**	

Question			Answer	Marks	Part marks and guidance	
9	(a)		$0.\dot{4}5\dot{3}$ or $0.\dot{4}\dot{5}\dot{3}$	1		
	(b)		$[0].\dot{6}\dot{3}$	2	allow [0].6363[63…] for **2** **M1** for an attempt to divide 7 by 11 and getting as far as 0.6… correctly or 7 × .0909[09…] or an answer of .63 or $.6\dot{3}$	
	(c)		$4\frac{2}{3}$	3	**M2** for $\frac{14}{5}\times\frac{5}{3}$ or $\frac{70}{15}$ oe or **M1** for $\frac{14}{5}$ or $\frac{5}{3}$	
10	(a)		correct reflection	2	**B1** for line y = -1 identified or correct reflection in y = 0 or y = 1	use overlay
	(b)		rotation [centre] (0,0) 90° clockwise oe	1 1 1	 Accept origin and O e.g. −90° or 270°[anticlockwise]	
	(c)		correct enlargement and in the correct place	2	**M1** for correctly sized enlargement but in the wrong place	use overlay
11	(a)		42 alternate segment	1 1		
	(b)		62 angle [in a] semicircle [equals 90°] angles [in a] triangle [add up to 180]	1 1 1	 Accept angle CDE marked as 90	

Question			Answer	Marks	Part marks and guidance	
12	(a)		−3	3	**M1** for a correct step e.g. $8x – 2x + 14 = – 4$ oe **M1** for another correct step e.g. $8x = 2x – 4 –14$ oe **M1** for $x = \frac{b}{a}$ from *their* $ax = b$ ($a \neq 1$) to a max of 2 marks	Must be equation throughout. i.e correctly collecting *x*'s, condone error in numbers i.e. correctly collecting numbers, condone error in x's do not allow embedded answers
	(b)		[*x* =] 6 [*y* =] -1 with algebraic working	4	**M1** for multiplying one equation allowing one error **M1** for multiplying the other equation allowing one error **M1 dep** (dep on a common coefficient) for adding or subtracting the equations allow one error **SC1** for correct answer with no algebraic working	note for **M2** we must have a common coefficient in either *x* or *y* for substitution **M1** for rearranging one equation **M1** for correct substitution **M1** for rearranging to leave x or y as the subject
13	(a)		16	1		
	(b)		12 - 13	2	**M1** for either 21 - 22 or 9	
	(c)		7 000	3	**M1** for 66 seen or attempt to read off at 24 **M1** for 80 – *their*66 or 14 **M1** for *their* 14 × 500 to a max of 2 marks	Condone use of 67 so answer of 13 × 50 = 6500 scores **3** marks
14	(a)		39	1		

Question			Answer	Marks	Part marks and guidance	
	(b)		5	**1**		
	(c)		$y = 5x + 6$	**2**	**B1** for $y = 5x + k$ or $y = kx + 6$ ($k \neq 0$) or $5x + 6$	
15			108	**2**	**M1** for $\times 3^2$ or $\times 9$ or $y = 3x^2$	
16	**(a)**		$(x - 2)^2 - 7$	**3**	**B1** for $(x - 2)^2$ **B2** for *their* -7 ft from their $(x - 2)^2$	
	(b)		2, -7	**2**	**B1** for each one, **FT** *their* '$(x - 2)^2 - 7$'	
17	**(a)**		2×5.5 [=11] oe	**1**		
	(b)		11 + 10 + 12 = 33 and $\frac{33}{60}$ (=) 55% compared to 50% so Yes or 33 compared to 30 or 27 so Yes	**3**	allow any correct method and condone counting frequencies on the diagram **M1** for 11 + '*their10*' + '*their12*' implied by 33 seen **M1** for $\frac{33}{60}$ implied by 55 seen or 30 or 27 seen	Allow alternative methods such as **M1** for (6 – 7) + 9 + 11 (=26 – 27) **M1** for $\frac{33}{60}$ or $\frac{34}{60}$ implied by 55 – 57 seen or 33 – 34 seen **A1** for a statement such as e.g. Yes + 33–34 compared to 26–27
18	**(a)**		Yes SAS No Yes RHS	**2**	**B1** for 2 'rows' correct for 'No' ignore reason	

Question			Answer	Marks	Part marks and guidance	
	(b)		AC [is] common AB = AD radii of the same circle oe BC = DC radii of the same circle SSS or AC [is] common angle BAC = angle DAC given AB = AD radii of the same circle oe SAS	**3**	**B1** for each correct statement from the first three of either to a max of 2 or for two correct statements without reasons	
19	**(a)**		$2x + 5$ and $(x – 2)(2x+5)$ or $2x^2 + 5x – 4x – 10$ oe or better, isw expansion of brackets after correct answer seen	**B1** **B1**	maybe in brackets correct or **FT** *their* '$2x + 5$' must be algebraic	
	(b)	**(i)**	$2x^2 + 5x – 4x – 10$ $2x^2 + 5x – 4x – 10 = 35$ or better $2x^2 + x – 10 – 35 = 0$	**2**	allow any correct method **M1** for their quadratic expression written equal to 35.	This can be done in (a).
	(b)	**(ii)**	$(2x – 9)(x + 5)$ 4.5 oe and –5	**2** **1**	**B1** for $(2x \pm 9)(x \pm 5)$ or for a pair giving two correct terms **FT** *their* pair of linear brackets	allow any correct method e.g complete the square or use of the formula
20	**(a)**		5	**2**	**B1** for x^{10} or $\frac{x^3}{x^{-2}}$ or x^5 as answer	
	(b)		$\frac{11x-13}{(x+1)(x-3)}$	**3**	**M2** for $\frac{6(x-3)+5(x+1)}{(x+1)(x-3)}$ oe or better or **M1** for $6(x – 3)$ or $5(x + 1)$ or better	allow $x^2 – 2x – 3$ for $(x + 1)(x – 3)$ even if seen as numerators

APPENDIX

Exemplar responses for Q1b

Response	Mark
650 and 550	**1**
there are 100 more females than men	**1**
There are 550 men and 650 women	**1**
[females] 650 and [males] 595 (FT incorrect total of males)	**1FT**
[females] 650 but [males] 695 (FT incorrect total of males but M > F)	**0**

Exemplar responses for Q1c

Response	Mark
325 is greater than 300	**2**
A quarter of the village is 300; there are 325 over 60s	**2**
13/48 is greater than 12/48	**2**
There are 325 people aged 60 and over and that isn't a quarter of 1200; 300 is a quarter of 1200	**2**
It is 27 − 27.1% which is more than quarter	**2**
there are 325 …	**B1**
Not true because 325 are 60 or over	**B1**
It's not true because 325 of the 1200 are over 60	**B1**
There are 325 people aged 60 and over and that isn't a quarter of 1200	**B1**

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