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 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.

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

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 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.

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.

MARK SCHEME

Question			Answer	Marks	Part marks and guidance	
1	(a)	(i)	Alternate [angles]	1		Condone Z [-angles] Do not accept 'alternative'
		(ii)	65°	2	**M1** for 120 – 55 Or 180 – 60 – 55 Or ∠EFB = 60 or ∠FBC = 60 **soi**	2 marks for 65 correctly positioned on diagram unless contradicted by answer line Implied by 180 – 120 = 60
	(b)		20°	2	**M1** for 360 ÷ 18 **oe** Or **B1** for 160 or 20 seen	Eg 180 – 180 × 16 ÷ 18
	(c)		26.5° final answer	1		

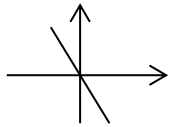
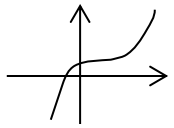
Question			Answer	Marks	Part marks and guidance	
2	(a)		11.6 or 11.58[…]	4	**B1** for midpoints **soi** [2.5, 7.5, 12.5, 17.5, 22.5, 27.5] **M1** for 2.5×12 + 7.5×15 + 12.5×16 + 17.5×9 + 22.5×5 + 27.5×3 **soi** Condone 1 error or omission **M1 dep** for *their* 695 ÷ *their* 60	Condone at least 4 correct midpoints FT their 'midpoints' where each midpoint is any point/endpoint in the interval 30 + 112.5 + 200 + 157.5 + 112.5 + 82.5 or 695 seen implies **B1M1** *Their* 60 is from attempt to sum frequencies Attempt to divide *their* sum by *their* 60 implied by correct answer to division after total seen, dependent on previous **M1** Allow 4 marks for 11.5 following correct division seen. ISW after 11.58 seen if 'estimation' attempted. Answer eg $10 < t \leq 15$ scores max 3 for working
	(b)		Correct frequency polygon with scale	3	**B1** for linear scale for frequency on vertical axis **B1** for at least 5 heights correct [12, 15, 16, 9, 5, 3] **FT** *their* linear scale or implied linear scale if no scale indicated **B1** for plots at midpoints and joined with straight lines **Max 2 marks if not completely correct**	Condone zero not marked, but scale must start from 0 Bar chart scores max 2 for scale and heights If frequency polygon and bar chart shown, mark best Ignore lines joining to origin, (30, 0) or first point to last, etc Clear intention of straight lines

Question			Answer	Marks	Part marks and guidance	
	(c)		$10 < t \leq 15$	**1**		Accept any clear indication of 10 to 15 group eg 10 – 15, third group etc
	(d)		No and 28[.3]% OR No, 25% of 60 is 15, and 17 wait more than 15 minutes	**2**	**M1** for 17 seen or $0.25 \times 60 = 15$ **soi**	For 2 marks need comparison of 17 with 15 or correct percentage seen **M1** implied by eg $1 - \frac{43}{60}$
3			41.16 or 41.2 final answer	**2**	**M1** for 4.9×8.4 **oe** with no further calculation	
4	**(a)**		2.38	**2**	**M1** for 2.37 or 2.378[…] or 2.379 seen Or *their* value seen correctly rounded to 3 sig figs OR **SC1** for answer 2.50 or 5.29	Any of these values seen Both unrounded and rounded value must be seen
	(b)	**(i)**	5	**2**	**B1** for 32 or 256 or 2^8 seen	
		(ii)	[p =] 6 [q =] 1	**2**	**B1** for any pair of values that satisfy $pq = 6$, other than $p = 3$, $q = 2$ or for $\frac{15}{5p} = \frac{q}{2}$ **oe**	**B1** for eg $p = 2$ and $q = 3$ $p = 1.5$ and $q = 4$ Accept decimals and negatives for **B1** if pq = 6 satisfied
5	**(a)**	**(i)**	0.32 **oe**	**2**	**M1** for 0.24 + 0.12 + 0.2 + 0.04 + 0.08 Or **SC1** for answer 0.72	**M1** implied by 0.68 seen
		(ii)	0.36 **oe**	**1**		isw for attempted conversion or interpretation

Question			Answer	Marks	Part marks and guidance	
	(b)		40	**2**	**B1** for answer any multiple of 40 or for $\frac{1}{8}$ **oe** seen or $\frac{7}{8}$ **oe** seen or for $\frac{16}{40}$, $\frac{4}{40}$ **and** $\frac{15}{40}$	Eg **B1** for $\frac{35}{40}$ or $\frac{5}{40}$
6	**(a)**		$3x(2y - 3x)$ final answer	**2**	**M1** for partial factorisation eg $3(2xy - 3x^2)$ or $x(6y - 9x)$ or $6(xy - 1.5x^2)$ or $3x(2y - 3x)$ seen	Condone missing final bracket Condone $(3x + 0)(2y - 3x)$ for 2
	(b)		4.2 or $\frac{21}{5}$ **isw**	**3**	**B1** for $3x + 21$ AND **M1FT** for collecting terms $8x - 3x = 21$ AND **M1** for $x = \frac{b}{a}$ after $ax = b$ seen **Max 2 marks if answer incorrect**	$a \neq 1$ or 0 and $a \neq b$ and $b \neq 0$ Decimals correct to at least 3sf
	(c)		$x > 6$	**2**	**M1** for $2x > 5 + 7$ or better or for $x > \frac{b}{a}$ after $ax > b$ seen, $a \neq 1$, $b \neq 0$ OR **SC1** for answer 6 or $x \ldots 6$ with any incorrect equality or inequality symbol or answer $2 \times 6 - 7 > 5$ or $2 \times 6 - 7 = 5$	Condone use of = or incorrect inequality symbol for method mark Decimals correct to at least 3sf condone e.g. '6 or more' as answer for **SC1**

Question	Answer	Marks	Part marks and guidance
7	Yes, with fully correct calculation of time taken to fill tank and comparison with 10 minutes. Calculations clearly annotated	5	Volume = $\pi \times \left(\frac{0.44}{2}\right)^2 \times 1.2 = 0.182\ m^3 = 182000\ cm^3$ (3sf) Time = $\frac{0.182 \times 1000}{20}$ = 9.12 minutes
	P Correct calculations for volume **and** time with no final answer/comparison seen OR **Q** Clearly annotated calculations with comparison with 10 minutes and FT correct decision with max one arithmetic error	4-3	For lower mark **P** Correct volume with units: 0.182 m^3 or 182000 cm^3 or 182 litres OR **Q** Correct formula for volume of cylinder used and attempt at time for *their* volume eg ÷ 20 or 20000 (units may be inconsistent) OR **R** Correct use of *their* volume to find time and has compared *their* time appropriately with 10 minutes
	P Correct volume calculation seen, ie $\pi \times 0.22^2 \times 1.2$ or $\pi \times 22^2 \times 120$, condone inconsistent units OR **Q** Correct evaluation of *their* volume ÷ 20, 0.02 or 20000 OR **R** 200 litres in 10 minutes or 200000 cm^3 in 10 minutes or 0.2 m^3 in 10 minutes Or **S** Has at least two of 1P, 1Q, 1R, 1S, 1T, 1U, 1V	2-1	For lower mark **P** Correct volume formula ($\pi r^2 h$) **soi** OR **Q** Works out the area of cross section (circle) correctly as 0.15[2] or 1500 or 1520 OR **R** Attempt at *their* volume ÷ 20 or 20000 OR **S** Amount of water in 10 minutes: 20 × 10 or *their* 20000 × 10 OR **T** Correct conversion of *their* volume to litres OR **U** Converting 20 litres to 20000 cm^3 **and** (0.44 m to 44 cm **or** 0.22m to 22cm **or** 1.2 m to 120 cm) OR **V** Diagram of cylinder with height 1.2 and diameter 0.44 labelled

Question			Answer	Marks	Part marks and guidance	
8	(a)		4, 1	1	Both correct	
	(b)		Ruled straight line from (–3, 4) to (6, 1)	2	**B1** for correct ruled short line Or at least two points plotted correctly **FT** their table	Tolerance 2mm radially by eye for plots
	(c)		Ruled straight line from (0, 5) to (5, 0)	2	**B1** for at least two pairs of values fitting $x + y = 5$ **soi**	Tolerance 2mm radially by eye for plots Ignore line outside this range
	(d)		$x = 3$, $y = 2$	2FT	**B1** for one value correct, **FT** intersection of their two graphs	Tolerance 2mm by eye If more than one point of intersection award **B1** for one correct pair of values
9	(a)	(i)	31.68	2	**B1** for 4.32 OR **M1** for 36 × 0.88 or 36 – 36×0.12 **oe**	For non-calc method need to see 10% = 3.6 and 2% = 0.72 etc correct and subtraction from 36, condone arithmetic errors
		(ii)	27.5[0]	3	**M2** for 24.20 ÷ 0.88 **oe** Or **B1** for 0.88 or 88% seen	Implied by $\frac{88}{100}$ or $\frac{100}{88}$ seen
	(b)		73.71	3	**M2** for 65 × 1.08 × 1.05 **oe** or 1.134 **soi** Or **M1** for 1.08 or 1.05 **soi**	Implied by 70.2 or 65 + 5.2 or 68.25 or 65 + 3.25 seen, may be as part of a longer calculation

Question			Answer	Marks	Part marks and guidance	
10	(a)		(6, 5)	1		
	(b)		0.5 **oe**	1		
	(c)		4 : 1	2	**B1** for 1 : 4 or 2^2 **seen** Or **M1** for ratio equivalent to 4 : 1	
11	(a)			1	Any line negative gradient through origin	Clear intention Ignore arrows on lines
	(b)		Increasing cubic graph crossing *x*-axis only once when x ≤ 0 eg 	2	**B1** for any cubic graph	
12	(a)	(i)	£26.1[0] £26.35 £26[.00]	**B1** **B1** **B1**		
		(ii)	High one week, then low the next repeatedly	**B1**	Or equivalent comment	See list
		(iii)	Decreasing	1	Or equivalent comment	See list
	(b)	(i)	50 to 70	1		
		(ii)	Decreases	1	Or equivalent comment	See list Mention of a specific group scores 0

Question			Answer	Marks	Part marks and guidance	
13			15.6[2…]	3	**M2** for 25 tan 32 or $\frac{25}{\tan 58}$ Or **M1** for tan 32 = $\frac{h}{25}$ or tan 58 = $\frac{25}{h}$ **soi**	Or $\frac{25\sin 32}{\sin 58}$ Or $\frac{h}{\sin 32} = \frac{25}{\sin 58}$ oe
14			∠BOC = 70° [Angle at] centre twice [angle at] circumference ∠OBC = 55° [Angles in] isosceles [triangle =] 180°	**B1** **B1** **B1** **B1**	 **FT** (180 – *their* 70)/2	Angles may be marked on diagram *Their* 70 must be acute 180 may be in calculation
15	**(a)**		128 or 128.2 to 128.3	2	**M1** for $\frac{1}{3}\pi \times 3.5^2 \times 10$	
	(b)		Use of 185 and 52.5 leading to 792.5	3	**B1** for 185 **or** 52.5 seen And **M1** for 4 × *their* 185 + *their* 52.5	 *Their* 185 in range 170 to 190 *Their* 52.5 in the range 45 to 55 **M1** implied by answer in range 725 to 815 after *their* 185 and *their* 52.5 seen
16	**(a)**		84100 × 1.02^t **oe**	2	**B1** for 1.02^t seen **oe** **SC1** for 84100 × 1. 2^t	Eg 2 for $84100\left(1+\frac{2}{100}\right)^t$ **B1** for $\left(1+\frac{2}{100}\right)^t$ Condone any letter in place of *t*
	(b)		94710 or 94700	1		Condone 94710.2[…] or 94710.3

Question			Answer	Marks	Part marks and guidance	
17	(a)		$\frac{1}{x-2}$ final answer	3	**M2** for $(x + 4)(x – 2)$ seen Or **M1** for $(x \pm 4)(x \pm 2)$ or pair of factors giving two correct terms when expanded, seen or implied in table	Accept eg $(x + 8)(x – 1)$ for **M1**
	(b)		$x^2 + 6x + 14 = (x + 3)^2 + 5$	3	**B2** for 6 or 5 correctly positioned Or **M2** for $x^2 + 6x + 9$ seen Or **M1** for $x^2 + 6x + 9$ with 2 terms correct	Condone $3x + 3x$ for $6x$ for **M2** and **M1**
18			155[.4…]	4	**B3** for 24.6[0…] seen OR **M2** for $\sin L = \frac{17\sin 59}{35}$ Or **M1** for $\frac{\sin L}{17} = \frac{\sin 59}{35}$ **oe** AND **M1** for 180 – their L	*Their* L in range $0 < L < 90$ and resulting from trig

Question			Answer	Marks	Part marks and guidance	
19			$x = 1.29$, $y = 4.13$ $x = –9.29$, $y = 35.87$	5	**M2** for $x^2 + 8x – 12$ [= 0] Or **M1** for attempt to equate Eg $8 – 3x = x^2 + 5x – 4$ AND **M1FT** for substitution into quadratic formula $\frac{-8 \pm \sqrt{8^2 - 4 \times -12}}{2}$ **A1** for $x = 1.29$, $x = –9.29$ AND **A1** for $y = 4.13$, $y = 35.87$ After **A0** allow **SC1** for one pair of x and y values correct or for both y values correctly FT their x values substituted into $y = 8 – 3x$	FT *their* quadratic equation, condone one error dependent on at least **M1** Allow A marks if solutions are clear in working, but transferred to wrong places on answer lines

APPENDIX

Exemplar responses for Q.12(a)(ii)

Response	Mark
Up and down each week	**1**
With a small decrease and occasional small increase	**1**
It varies and there is no pattern	**0**
Every other week Nathan spends more money on food than the previous one	**1**
The moving average becomes cheaper	**0**
It increases and decreases every other week	**1**
The amount Nathan spends increases on odd weeks	**1**
It increases and decreases each week, no definite pattern	**1**
It increases or decreases very slightly	**1**

Exemplar responses for Q.12(a)(iii)

Response	Mark
It decreases by £1 [*spoilt by £1*]	**0**
The trend is that the moving average is decreasing slowly apart from week 5 to 6 where the price has increased	**1**
Every other week is more expensive so 1, 3, 5, 7	**0**
The trend is consistently the same	**0**
It goes down by about £1 each week	**0**
Negative	**0**

Exemplar responses for Q.12(b)(ii)

Response	Mark
People are spending less each year	**1**
It has decreased slowly	**1**
Money is being spent less	**1**

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