OCR
Oxford Cambridge and RSA

GCSE

Mathematics B (Linear)

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

General Certificate of Secondary Education

Mark Scheme for June 2016

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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.

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.

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 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.

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)		[0].15 or $\frac{15}{100}$ oe	2	**M1** for 1 – 0.38 – 0.47 oe	do not accept just 15
	(b)		[0].2 or $\frac{1}{5}$ oe	2	**M1** for 1 ÷ (1 + 4) soi by 0.8 or 0.2% or **SC1** for two probabilities seen adding to 1(not $\frac{1}{2}$ and $\frac{1}{2}$)	do not accept just 20

2(a)*	Two correct comparative comments of different aspects with four pieces of correct supporting evidence, This is communicated in a clear, correct and coherent way.	**6**	*There can be one piece of evidence for A and one piece of evidence for B but they must be from the same statistical measure, e.g. the median for A must be compared to the median for B.*
	A fully correct response except that it has only one correct comparative statement and four pieces of correct evidence or two correct comparative statements of different aspects and only three pieces of correct evidence.	**5 – 4**	Two correct comparative statements of different aspects and two pieces of correct evidence or one correct comparative statement and three correct pieces of evidence or four pieces of correct evidence.
	Two correct comparative statements of different aspects and one piece of correct evidence or one correct comparative statement and two correct pieces of evidence or three pieces of correct evidence.	**3 – 2**	Two correct comparative statements of different aspects or two correct pieces of evidence of different aspects or one correct comparative statement and one piece of correct evidence.
	One correct comparative statement or one correct piece of evidence.	**1 - 0**	No worthwhile work attempted.

Question			Answer	Marks	Part marks and guidance	
2	(b)	(i)	3.7	1		
		(ii)	11	1		Condone 11 out of 23 but not $\frac{11}{23}$
		(iii)	positive	1		Ignore embellishments
		(iv)	correct ruled line of best fit	1		the line must be from 1 to 3.5 and it must cross through 'mass = 1' between and including 126 and 136 and through 'mass = 3.5' between and including 155 and 166.
		(v)	2.6 – 3.4	1	if not in this range then FT their **ruled** line of best fit ± 0.05 and the line must go from 1 to 3.5	
3	(a)		1.4 or $\frac{7}{5}$ or $1\frac{2}{5}$	2	**M1** for 1.96 or 9.5	
	(b)		61.34	2	**M1** for 72.9 or 11.56	
4			7.7 first correct result of a trial of a value of *x* between 7 and 8 second correct result of a trial of a value of *x* between 7 and 8	1 1 1	The result of each trial can be rot to at least 2 sf e.g. for x = 7.2, the result could be 410, 420, 416, 416.4, 416.5 etc Allow trials to more than 1 decimal place e.g. *x* = 7.65 gives 493.59… so we allow 490, 493, 494 and so on	7.1 400.51 7.2 416.45 7.3 432.82 7.4 449.62 7.5 466.88 7.6 484.58 7.7 502.73 7.8 521.35 7.9 540.44

Question			Answer	Marks	Part marks and guidance	
5			1.7	**6**	**M1** for 0.03 × 680 or 20.4[0] oe **M1** for 0.01 × 74 or [0].74 oe **M1** for 0.005 × 88 or [0].44 oe **M1** for 680 + 320 + 112 + 88 + 74 or 1274 **M1** for '*their* 21.58' × 100 ÷ '*their* 1274' **A1** for 1.7 If **A0** and not **M5,** then **SC1** for their answer to more than 1 dp correctly rounded to 1 dp.	Accept any correct method Note: 21.58 scores **M3** or 1.69[…] scores **M5** *their* 21.58 is the sum of three numbers
6			70.85 ─ 70.9 or 71	**4**	**M1** for 8 × 12 or 96 and **M2** for $\frac{1}{2} \times \pi \times 4^2$ or 25.1[…] or **M1** for $\pi \times 4^2$ or 50.2[6…] or 50.3 or 50.27 If **0** scored **SC1** for $\frac{1}{2} \times \pi \times 8^2$ soi by 100.53…	Look out for use of circumference.
7			B with three correct figures which can be compared	**3**	**M2** for two correct figures which can be compared or **M1** for a correct attempt to make at least two figures comparable	

Question			Answer	Marks	Part marks and guidance	
8			54.7	5	**M2** for $\sqrt{their(51.2\div 2)^2+9.6^2}$ or 27.3[4…] or **M1** for (*their* 51.2÷2)^2 + 9.6^2 or 747.52 and **M1** for *their* 27.3[4…] × 2 **A1** for 54.68[…] Note: 54.68[…] scores **4** marks If **0** scored then award **SC1** for a Pythagorean statement e.g . $\sqrt{a^2+b^2}$ where *a* and *b* are numbers. If **A0** then **SC1** for their answer to more than 3 sf correctly rounded to 3 sf.	Alt. method : **M3** for $\sqrt{51.2^2+19.2^2}$ or **M2** for '*their correct Pythagoras' statement*' $\sqrt{51.2^2+their(9.6\times 2)^2}$ or **M1** for '*their correct partial Pythagoras' statement*' eg 51.2^2 + (*their* 9.6×2)^2 **A1** for 54.68[…]
9	**(a)**		57 corresponding [angles]	**1** **1**	allow any correct method e.g. if they mark the opposite angle and give alternate angles award the mark for reason	condone F-angles for corresponding angles (and Z-angles for alternate)
	(b)		85	**2**	**B1** for 95 seen or 180 ─ 63 ─ 32 or angle GHJ = 63° or angle HKJ = 85°	angles may be on diagram
	(c)		angle ABO = 42°or angle AOB = 96° 'angles [in a] triangle [add up to 180]' or 180 [in a] triangle or isosceles [triangle] [*x* =] 48 angle [at the] centre is twice [the angle at the] circumference' oe	**B1** **B1** **B1** **B1**	may be on diagram and implied by the correct answer may be on diagram	Note: the correct answer scores **B2** or angle [at the] circumference is half [the angle at] the centre

Question			Answer	Marks	Part marks and guidance	
10	(a)		$\frac{18}{8}$ oe or 2.25 oe	3	**M1** for $12x - 4x - 3 = 15$ oe or better **M1** for $12x = 4x + 15 + 3$ oe or better **M1** for $x = \frac{b}{a}$ from $ax = b$ ($a \neq 1$) to a maximum of 2 marks	ISW any attempt to simplify a correct answer
	(b)		$9n + 3$	2	**B1** for [+]$9n$	condone use of other letters
11			175[.42…] or 175.43	5	**B2** for fully correct annotated sketch, condone unlabelled points. or **B1** for correctly orientating the three points. and **M2** for $\frac{[...]}{\sin 150} = \frac{120}{\sin 20}$ oe or better If **0** or **B1** scored **SC1** for a correct sin rule equation from *their* annotated diagram.	Points A, B and C with lines AB and BC drawn and at least angles 30 or 150 at A and 10(at B) or 20(at B or C) or 200(at B) marked in the correct place and side 120 marked. Assume that north is 'directly upward' unless they indicate otherwise. Scale drawing can score a max. of **3** marks, **B2** for a totally accurate diagram within tolerance **(**±2 mm, ± 2°) or **B1** for a diagram with at most one error and **SC1** for answer in the range 170 to 180(including 170 and 180)
12	(a)		([0] + 3 + 8 + 4) ÷ 4 or 15 ÷ 4	1	0 not required if division by 4 seen	
	(b)		[0].75	2	**M1** for ($^{-}$3 + 2 + 3 + 1) ÷ 4	
	(c)		[temperatures] rise [in the day] and fall [at night]	1	accept any correct statement	Select best attempt unless they contradict each other

Question			Answer	Marks	Part marks and guidance	
	(d)		falling or decrease	**1**		Select best attempt unless they contradict each other
13			66.65 ─ 66.81 or 67	**5**	**M2** for 5.2 × tan 47 or 5.57[…] or 5.58 oe or **M1** for tan 47 = [ ] ÷ 5.2 oe and **M2** for $\tan^{-1}$ ('*their* 5.57' ÷ 2.4) oe or **M1** for tan [*x*] = *their* 5.57 ÷ 2.4 oe	Accept any correct method e.g. sin rule i.e. $\tan^{-1}$(2.323….).
14	**(a)**		3860	**3**	**M2** for 4025.98 ÷ 1.043 oe or **M1** for 1.043 or 104.3	e.g. $\frac{4025.98\times100}{104.3}$ accept 1.043^n
	(b)		2020 with some correct supportive working e.g at least two correct values from table	**3**	**M1** for each of two correct values from the table given which can be rot to at least 3 figures (they do not have to be linked to a number/year) **Note:** Answer of 2020 with no correct supportive working scores **SC1** Answer of 2020 with only the correct value for 2020 scores **SC2**	2015 5948.800 2016 6186.752 2017 6434.222 2018 6691.591 2019 6959.255 2020 7237.625 Alternative method if seen: $5720\times1.04^n = 7000$ $1.04^n = 7000 \div 5720$ or 1.223… scores **M1** *n* = log(their 1.223…) ÷ log 1.04 or 5.14… scores **M1**

Question			Answer	Marks	Part marks and guidance	
15	(a)		– 8.5 oe	3	**M1** for first correct step eg $8x + 5 = 3(2x – 4)$ or better **M1** for collecting *their x*'s correctly eg $8x$ – *their* $6x + 5$ = *their* (– 12) oe or better **M1** for collecting *their* numbers correctly eg $8x$ = *their* $6x$ – *their* $12 – 5$ **M1** for $x = \frac{b}{a}$ from $ax = b$ ($a \neq 1$) to a maximum of 2 marks	better means finished ISW any attempt to simplify a correct answer
	(b)		$x = \sqrt{\frac{y+15}{4}}$ oe	3	**M1** for $4x^2 = y + 15$ oe **M1** for $x^2 = \frac{\textit{their}\ (y+15)}{4}$ oe **M1** for $x = \sqrt{f(y)}$ to a maximum of 2 marks Note: **B2** for $\sqrt{\frac{y+15}{4}}$ as answer	Ignore any signs in front of the square root sign Square root must be below line
16			803.8 ─ 804.4 cm^2	2 1	**M1** for $4 \times \pi \times 8^2$ oe or better	condone 256π for **2** marks accept $\frac{22}{7}$ for **M** marks allow other area units provided they have made the correct conversion but ISW for an incorrect conversion

Question			Answer	Marks	Part marks and guidance	
17			[0].18 and ¯1.85	4	**B3** for both correct fuller solutions or one correct answer or **B2** for one fuller solution or **M2** for $\frac{-5\pm\sqrt{5^2-4\times3\times-1}}{2\times3}$ oe condone one error or **M1** for the formula with two errors **A1** for each correct answer	Fuller solutions are 0.180[46…] and -1.847[12…] i.e. $\frac{-5\pm\sqrt{37}}{2\times3}$ oe
18	(a)		180	2	**M1** for [20 ×] 3^2 or **B1** for [y =] $5x^2$	
	(b)		xy = 72 oe	3	**M1** for $xy = k$ oe **A1** for [k =]72 if **0** scored **SC2** for $xy \propto 72$ oe or **SC1** for $xy \propto k$ oe	Allow any letter for k except x and y
19			55[.08…] or 55.1 124[.91…] or 124.92 or 125	1 1	 If **0** scored award **SC1** for two reasonable answers adding to 180	 Reasonable means not 0, not negative and not 90

Question			Answer	Marks	Part marks and guidance	
20			$(\frac{1}{2}, -\frac{1}{2})$ and $(^{-}6, ^{-}33)$	**6**	**M2** for $2x^2 + 11x - 6 = 0$ or **M1** for $2x^2 + 16x - 9 = 5x - 3$ soi and **M2FT** for $(2x - 1)(x + 6)$ or **M1FT** for two linear factors which give two correct terms, or use of quadratic formula award (**FT** *their quadratic equation* equal 0) **M2FT** for the correct use of the formula condoning one error or **M1FT** for the formula with two errors **A1** for two correct x values or a correct pair of x and y values **A1** for two correct y values	**M1** could be other way round and implied by $2x^2 + 11x - 6$ [$= y$] FT their quadratic equation Accept any correct method especially forming a quadratic equation in y.

APPENDIX

Exemplar responses for Q12(c)

Response	Mark
[temperatures] rise [in the day] and fall [at night]	1
up and down	1
Down and up	1
Low during the night, high during the day	1
Increase and decrease	1
Warms up and cools down	1
Warmest at 2pm and coldest at 2 am	1
Keeps decreasing	0

Exemplar responses for Q12(d)

Response	Mark
falling	1
going down	1
getting colder	1
decrease	1
Negative [correlation]	0
Up and down	0
Negative trend	0

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