F

GCSE (9–1)

Mathematics

J560/02: Paper 2 (Foundation tier)

General Certificate of Secondary Education

Mark Scheme for November 2019

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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.

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.

   - **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 and applies as a default.
   - **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. In questions with no final answer line, make no deductions for wrong work after an acceptable answer (ie **isw**) unless the mark scheme says otherwise, indicated by the instruction 'mark final answer'.

7. In questions with a final answer line following working space,

   (i) if the correct answer is seen in the body of working and the answer given on the answer line is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.

   (ii) if the correct answer is seen in the body of working but the answer line is blank, allow full marks. Place the annotation ✓ next to the correct answer.

   (iii) if the correct answer is seen in the body of working but a completely different answer is seen on the answer line, then accuracy marks for the answer are lost. Method marks could still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation × next to the wrong answer.

8. In questions with a final answer line:

   (i) If one answer is provided on the answer line, mark the method that leads to that answer.

   (ii) If more than one answer is provided on the answer line and there is a single method provided, award method marks only.

   (iii) If more than one answer is provided on the answer line and there is more than one method provided, award zero marks for the question unless the candidate has clearly indicated which method is to be marked.

9. In questions with no final answer line:

   (i) If a single response is provided, mark as usual.

   (ii) If more than one response is provided, award zero marks for the question unless the candidate has clearly indicated which response is to be marked.

10. 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.

11. 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.

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.

Question			Answer	Marks	Part marks and guidance	
1	(a)		103	1		
1	(b)		357	2	**M1** for any correct complete method shown	For M1 condone 1 arithmetic error
2	(a)		9 or −9	1		
2	(b)		4	1		
3	(a)		10	1		
3	(b)		7	1		
3	(c)		5	1		
4	(a)		15 or 15000**g** clearly identified	2	**M1** for figs 18 ÷ 6 [×5] **oe**	May be implied by 3 [×5]
4	(b)		3.51 or 351p clearly identified	1		
4	(c)		[0].03 oe	1		accept trailing zeros eg 0.030…
5	(a)		$\frac{3}{10}$	1	Accept equivalent fractions	Isw further attempts to cancel
5	(b)		[0].25	1		accept trailing zeros eg 0.250…
6			0.61 5.099 5.9 5.977 5.98	2	**B1** for 4 in correct order	Use “cover up” method and accept trailing zeros eg 5.980
7	(a)		$2\frac{1}{4}$	1	Accept equivalent fractions	Isw further attempts to cancel Do not accept $1\frac{5}{4}$

Question			Answer	Marks	Part marks and guidance	
7	(b)		$\frac{3}{16}$	1	Accept equivalent fractions	Isw further attempts to cancel
7	(c)		$\frac{1}{6}$	1	Accept equivalent fractions	Isw further attempts to cancel
8	(a)	(i)	13	2	**M1** for ordering at least the first 3 or the last 3 values	11, 11, 13, 22, 58
8		(ii)	47	2	**B1** for only 11 and 58 identified.	
8	(b)		17	3	**M2** for 6 × 22 –(13 + 58 + 22 + 11 + 11) **oe** or **M1** for 6 × 22 or for 13 + 58 + 22 + 11 + 11 oe	 May be implied by 132 May be implied by 115
9	(a)		22	2	Accept 21.2 to 22.8 **M1** for 5.3 to 5.7 [cm] seen Or 53 to 57 [mm] seen	 May be seen on diagram or on the answer line
9	(b)		063 to 067	1		Condone eg 65
9	(c)		Lighthouse indicated correctly 4.3 to 4.7 cm from P and on bearing of 198 to 202 from Q	2	**M1** for either condition correct	Allow unambiguous indication if a cross is not seen For M1 allow an arc/circle centre P with radius 4.3 to 4.7 cm Use overlay as a guide
10			~~44~~	3	**M2** for 66 ÷ (15 ÷ 5) [×2] oe or **M1** for 15 ÷ 5 or 5 ÷ 15 or 5 × 66 oe	Ignore units throughout May be implied by 22

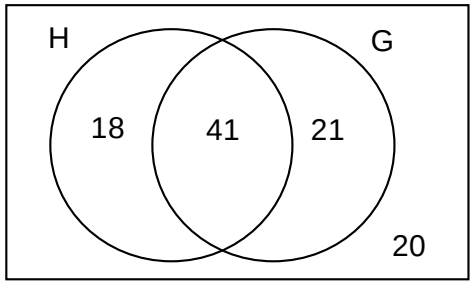
Question			Answer	Marks	Part marks and guidance	
11	(a)		20	3	**M2** for $\frac{216-180}{180}$ [$\times 100$] **oe** or **M1** for $\frac{216}{180}$ [$\times 100$] **oe** or 216 – 180 **oe**	eg $\frac{36}{180}$ or $\frac{3600}{180}$ or 0.2 or $\frac{1}{5}$ M1 implied by 1.2 or 120 or $\frac{6}{5}$
11	(b)		1.17	1		
12	(a)		Shows 85% and 76%	2	**M1** for 85% or 0.85 or $\frac{85}{100}$ or 76% or 0.76 or $\frac{76}{100}$ If 0 scored **SC1** for both 85 and 76 **seen**	Condone both stated as equivalent decimals or both stated as fractions over 100 for 2 marks.
12	(b)		80 nfww	3	**M2 for** $\frac{17+19}{20+25}$ x 100 **oe** OR **M1** for $\frac{17+19}{20+25}$ **oe** **M1 dep** for $\frac{4}{5}$ or $\frac{8}{10}$ or $\frac{80}{100}$	$\frac{85\% + 76\%}{2}$ or $\frac{85+76}{200}$ or leading to an answer of 80 scores 0. Allow 36 out of 45
13	(a)	(i)	*y* = 2 sketched correctly with 2 indicated on *y*-axis as y-intercept	2	**M1** for a horizontal line	Condone good freehand
13	(a)	(ii)	*y* = *x* + 1 sketched correctly with 1 indicated as *y*-intercept	2	**M1** for any straight line with positive gradient or for *y*- intercept at 1	Condone good freehand

Question			Answer	Marks	Part marks and guidance	
13	(a)	(iii)	*y*-value where they cross has to be 2 **oe**	1		Isw extra statements. Accept eg (2, 3) is not on y = 2 as the y coordinate is 3 they cross at (1, 2) they cross when x = 1 See AG
13	(b)		Should go through (0, 0) **oe** Should be a curve **oe** No numbers on axis/axes **oe** It is symmetrical **oe**	2	**B1** for each to a max of 2	If more than two comments, mark the best two See AG
14	(a)	(i)	4 : 5	1		Accept 1 : 1.25 or 1 : $\frac{5}{4}$ or 0.8 : 1 or $\frac{4}{5}$: 1
14	(a)	(ii)	1 : 7 final answer	3	**B1** for 2100 [ml] or 0.3[l] seen **M1** for correct partial simplification of *their* ratio	A correct partially simplified ratio in the same units implies B1 M1 eg 100 : 700
14	(b)		2 nfww	3	**B1** for sin 30 = ½ oe **B1** for tan 45 = 1	B marks can be implied if seen on the correct side of a ratio

Question			Answer	Marks	Part marks and guidance	
15			$10 \times 6 \times 8$	**M1**		May be implied by 480
			Makes use of rounding 8.95 to 9 or 19.99 to 20	**M1**		May be implied by use in a calculation but must be used correctly
					Alternative Method	
			60×9 **oe** or 12×20 **oe**	**M1**	**M1** for 60×9 **oe** or 10×20 **oe**	
			1260	**A1**	**A1** for 1220	
			$1000 + 60 \times 5$ **oe**	**M1**		May be implied by 1300
			Correct decision for 1300 and their estimated costs	**B1**		Their estimated costs means 8.95 **and** 19.99 not used
16	(a)		She added the terms **oe** $2a^3$	**1** **1**		In all 3 parts any incorrect statement treat as choice Allow correct descriptions of what Martina should have done in each part See AG
16	(b)		She divided the powers **oe** x^8	**1** **1**		See AG
16	(c)		She squared $(\frac{1}{2} \times 6 \times 5)$ **oe** 75	**1** **1**		See AG

Question			Answer	Marks	Part marks and guidance	
17			Line drawn parallel to AB, 1.8 to 2.2 cm away that meets AD and *their* bisector of angle BCD	**M1**		Condone dotted lines throughout Use overlay as a guide If no angle bisector *their* horizontal line must at least touch the left hand boundary of angle bisector overlay
			Bisector of angle BCD drawn with correct arcs	**M2**	**M1** for correct bisector with no/incorrect arcs	±2°
			Arc centre D with radius 2.8 to 3.2 cm	**M2**	**M1** for any arc centre D	Arc must meet AD and DC for 1 or 2 marks
			Correct region shaded	**A1**	Dep on **M1 M1 M2**	Accept region clearly identified
18			$(x + 4)(x + 5)$	**M2**	**M2** for $(x + 4)$ and $(x + 5)$ or **M1** for $(x + a)$ and $(x + b)$ where $ab = 20$ or $a + b = 9$ or $x(x + 4) + 5(x + 4)$ or $x(x + 5) + 4(x + 5)$ If **M0** scored **SC1** for $x + 4 = 0$ and $x + 5 = 0$	For M2 or M1 condone omission of final bracket .
			-5 and -4 nfww	**B1**	**STRICT FT** *their* factors dep on two brackets in factors. If 0 scored **SC1** for answers ±5 and ±4	

Question			Answer	Marks	Part marks and guidance	
19			300	5	**M4** for 36 ÷ 0.12 **oe** or **M1** for 0.3 x 0.4 **oe** **A1** for 0.12 **oe** OR **M1** for 36 ÷ 0.3 **oe** **A1** for 120 **M1** for *their* 120 ÷ $\frac{2}{5}$ **oe** seen **A1FT** for *their* 120 ÷ $\frac{2}{5}$ **oe** correctly evaluated seen to nearest integer or better	eg Answer 420 from 300 + 120, gets M1A1M1A1
20			Select a pencil from the bag and record results **and** put it back in the bag **oe**	1		Steps may be combined together
			Repeat trial at least 10 times	1		Accept many, a lot etc clearly implied
			Find rel frequency or prob	1	eg $\frac{\text{no of red pencils}}{\text{no of trials}}$ **oe** or no of red pencils recorded and no of trials recorded or number of greens recorded oe	oe eg if number of trials = 20 and then number of reds × 5 or no of red pencils × $\frac{100}{\text{no of trials}}$ **oe** then allow both marks
			Rel freq × 100 **oe**	1		
21	(a)		Rhombus	1		Allow kite, parallelogram or trapezium Do *not* allow quadrilateral or polygon

Question			Answer	Marks	Part marks and guidance	
21	(b)		105	4	**M1** for DEA = 60 or AFB = 60 or any angle within either equilateral triangle identified as 60 **M2** for DAE = 15 or **M1** for *their* EAF ÷ 4 soi **B1FT** *x* = 180 – *their* AED – *their* DAE	Angles may be identified in working or seen on the diagram May be implied by 15 : 60 If final answer not 105, MAX of 3 marks
22	(a)			3	**B2** for 18 or 41 or 21 correctly placed. or **B1** for the total of H = 59 or the total of G = 62 or all 3 sections add up to 80	Do not accept a blank region to represent 0
22	(b)		$\frac{39}{100}$ **oe**	2	**FT** (*their* 18 + *their* 21)/100 **M1** for *their* 18 + t*heir* 21 If 0 scored, **SC1** for answer $\frac{80}{100}$ **oe**	*their* 18 + *their* 21 must be < 100 for 2 or 1 mark
23			*y* = 4*x* + 1 final answer	3	**B2** for final answer 4*x* + 1 OR **M2** for using (1, 5) correctly in *y* = 4*x* + *c* **oe** or **M1** for *y* = 4*x* + c **oe** or *y* = 4*x* + k **oe** k any numerical value	Allow equivalent 3 term equation for 3 marks If y = 4x + c and y = mx + 4 are seen, mark as choice

Exemplar responses for Q13aiii

	Response	Mark
1	y = 2 won't go higher than 2 to cross at 3 (implies y values)	**1**
2	Her answer wouldn't be accurate because y = 2 so wouldn't cross the point of 3	**1**
3	the first graph only equals to two (it shows y = 2) the x = 1	**1**
4	y = 2 only goes through y = 2 not y = 3 so not (2,3)	**1**
5	Because it needs to go through x = 1 (can BOD imply the x coordinate is 1)	**BOD 1**
6	y = 2 will not show a cross at (2,3) due to not being 1 and being y = 2	**0**
7	Because they are not on the same graph – they are both on different graphs	**0**
8	Y is in y axis meanwhile y = x+1 does not = to (2,3) coordinates	**0**
9	she added 2+1 = 3 and used 2 for x (if they had also stated 'instead of y' it would score 1)	**0**

Exemplar responses for Q13b

	Response	Mark
1	Its meant to be a smooth curve	**1**
2	He hasn't placed the numbers on the graph	**1**
3	The curve is not a perfect curve.	**1**
4	The curve isn't accurate as it has edges.	**1**
5	it doesn't flow, has used a ruler to connect his points.	**1**
6	His lines are not curvy they are crooked	**1**
7	It's not an actual curve	**1**
8	"central point isn't on O"	**1**
9	The bottom should start at zero as there is no numbers for it to pass through	**1**
10	It doesn't touch the centre of the graph ('origin' implied)	**1**
11	it is sketched with a ruler.	**1**
12	He has used a ruler so it will affect the reliability (this is ok to imply 'it is not a curve')	**1**
13	The line should be drawn freehand not with a ruler (BOD implies a curve)	**BOD 1**
14	There are pointy sides with each coordinate ('pointy sides' implies 'not a curve')	**BOD 1**
15	The line he makes was meant to be round and his was a straight line (BOD 'straight line' rather than ' straight lines')	**BOD 1**
16	does not fully meet the x axis and lines are not fully straight (they are)	**1, 0**
17	The curved line (U) is not touching the x-axis	**0, 1**
18	The curve is symmetrical ('it is not a curve but it is symmetrical' scores 1,1)	**0, 1**
19	the line is too blacky and show a stiff movement of the graph ('stiff movement' unclear)	**0, 0**
20	The bottom of the arch needs to be on the line ('arch' is wrong way up, 'on the line' could be x axis or y axis therefore choice)	**0, 0**
21	Each side is the same (the sides are 'mirror images' would score)	**0**
22	It is a curve (it's not)	**0**
23	No marking on the graph ('marking' not enough to imply scale/numbers)	**0**
24	This sketch is not one line they have not done one single line what flows ('single line' will not score, 'single curve' will)	**0**
25	Should be a smooth line ('smooth line' does not imply curve)	**0**
26	The sketch does not start at the point O	**0**
27	He was accurate with the shape of the graph as it should look like a 'U' ('wasn't accurate' in this statement would be fine)	**0**
28	He has joined each point together ('with straight lines' missing)	**0**
29	connected the points instead of a fluient line ('with straight lines' missing)	**0**
30	It doesn't match y = x squared (needs to state why)	**0**
31	It is not going fully around, it stops	**0**

Exemplar responses for Q16a

	Response	Mark
1	She did not multiply [the terms]	**1**
2	She added up all the a	**1**
3	She added [to] the 2a's	**1BOD**
4	She hasn't multiplied the a's	**1**
5	it is × not +	**1**
6	she would be right if they were plus signs and not times	**1**
7	Not 2a + a + a	**1**
8	a would equal 2a + a + a. When you times you add them 2a x a x a = $2a^3$	**1**
9	She added a to the multiplication instead of using index laws	**0**
10	She has added the 2a's then times by the 2a	**0**
11	She added the a's to the 2 instead of multiplying them	**0**
12	She added the 2a to the a x a	**0**
13	2a is different to a times a = a^2	**0**

Exemplar responses for Q16b

	Response	Mark
1	She divided the 10 and the 2/she divided the powers (must refer to 'numbers' or 'indices')	**1**
2	she done 10 ÷ 2 = 5	**1**
3	She should have done 10 – 2	**1**
4	She should take away the indices	**1**
5	She divided 10 by 2 instead of subtracting 2	**1**
6	Laws of indices it should be taken away	**1**
7	Divided the numbers	**1**
8	She divided instead of taking away ('indices' implied by referring to division **and** subtraction)	**1**
9	She has used division	**0**
10	She divided it when it should be timesd	**0**
11	She didn't use the laws of indices	**0**

Exemplar responses for Q16c

	Response	Mark
1	didn't do the power first	**1**
2	She did 5 x 6 and then x ½ but the ² is near the 5^2 not all of it	**1**
3	She should have squared 5 first and then divide 6 by 2 and times them together	**1**
4	She didn't do the 5^2 bit first	**1**
5	She didn't square 5 and times 6 by 25	**1**
6	She hasn't squared the 5	**1**
7	Doing 15^2 she needs to do 5^2	**1**
8	She did 15^2	**0**
9	She halved 30 when she meant to halve 6 earlier in the equation	**0**
10	She didn't square the number 5 correctly nor did she times by 6 or halve it by half	**0**
11	She square after, when you square before	**0**
12	She halved 6 before multiplying by 5^2	**0**
13	Didn't use BODMAS	**0**
14	6 x 25 = 150	**0**

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