OCR
Oxford Cambridge and RSA

H

GCSE (9–1)

Mathematics

J560/05: Paper 5 (Higher tier)

General Certificate of Secondary Education

Mark Scheme for November 2021

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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 available in RM Assessor. These **must** be used whenever appropriate during your marking.

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
BP	Blank page
SEEN	Seen

For a response awarded zero (or full) marks a single appropriate annotation (cross, tick, M0 or ^) is sufficient, but not required.
For responses that are not awarded either 0 or full marks, you must make it clear how you have arrived at the mark you have awarded and all responses must have enough annotation for a reviewer to decide if the mark awarded is correct without having to mark it independently.

It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

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. 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 e.g. 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**.
   - **soi** means **seen or implied**.
   - **dep** means that the marks are **dependent** on the marks indicated. You must check that the candidate has met all the criteria specified for the mark to be awarded.
   - **with correct working** means that full marks **must not** be awarded without some working. The required minimum amount of working will be defined in the guidance column and **SC** marks given for unsupported answers.

3. 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.

4. Unless the command word requires that working is shown and the working required is stated in the mark scheme, 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, i.e. incorrect working is seen and the correct answer clearly follows from it.

5. 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. 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.

   Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, e.g. FT 180 × (*their* '37' + 16), or FT 300 – √(*their* '52 + 72'). Answers to part questions which are being followed through are indicated by e.g. FT 3 × *their* (a).

6. In questions **with no final answer line**, make no deductions for wrong work after an acceptable answer (i.e. **isw**) unless the mark scheme says otherwise, indicated by the instruction 'mark final answer'.

7. In questions **with a final answer line and incorrect answer given**:

   (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 if there is no other method leading to the incorrect answer. 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. A correct step, value or statement that is not part of the method that leads to the given answer should be awarded **M0** and/or **B0**.

   (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 marks for the poorer response 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 marks for the poorer response 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. If a candidate corrects the misread in a later part, do not continue to follow through, but award **A** and **B** marks for the correct answer only.

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. If in any case the mark scheme operates with considerable unfairness consult your Team Leader.

Question			Answer	Marks	Part marks and guidance	
1			$2\frac{1}{2}$	3	Mark final answer **B2** for $\frac{175}{70}$ **oe** or **M1** for $\frac{25}{7}$ **seen**	
2	(a)		No oe and he has not written the answer in index form **oe**	1		e.g. it should be $2^3 \times 5$
2	(b)		$^{-}4$	1		
3			5000 [ml] or 0.45 [L] soi 9 × 450 oe Correct attempt to find 80% or 20% of 5000oe 4050 and 4000 or 950 **and** 1000 **and** [They are] correct **oe**	B1 M1 M1 A2	 or $\frac{9\times450}{5000}[\times100]$ **oe** or $\frac{5000-9\times450}{5000}[\times100]$ **oe** or 81% [and 80%] or 19% [and 20%] After A0 scored **B1** for 4050 or 4000 or 950 or 1000	Correct conversion at any stage Alternate approaches are possible M1 may be implied by 4000 or 1000 or 81% or 19% seen For A2 accept in other correct consistent units for comparison e.g.4.05[L] and 4[L]and must have no incorrect statement For B1 accept e.g. 4.05[L] or 4[L]
4	(a)		Four correct plots (70, 86) (44, 60) (37, 48) (38, 50)	2	**B1** for 2 or 3 correct plots	Overlay gives guidance, tolerance ±½ small square
4	(b)		Positive	1		Ignore embellishments

Question			Answer	Marks	Part marks and guidance	
4	(c)	(i)	Circles (30, 66) only	1		Accept any clear indication
4	(c)	(ii)	120	3	**M2** for $\frac{66-30}{30}[\times 100]$ **oe** or for $\frac{66}{30}\times 100$ [–100] **oe** or **M1** for $\frac{66}{30}$ **oe** or for 66 – 30 **oe**	For M2 and M1 FT *their* (c)(i), point must be chosen for FT (table or graph) M2 implied by 1.2 or 220 M1 implied by 2.2 or 36
4	(d)		No and line of best fit should not extend beyond data provided **oe**	1		eg only have data up to 70 marks. No one scored that high [so the trend may not continue]. He would need to extrapolate beyond the line of best fit. Do not accept e.g. the graph only goes up to 90 for the second test

Question			Answer	Marks	Part marks and guidance	
5			32	4	**M2** for correct method to find area of L shaped face e.g 6 × 3 – 5 × 2 or **M1** for finding one of the relevant partial lengths of 2 or 5 **M1** for *their* area × 4 OR **M1** for 3 × 4 × 1 **M1** for 5 × 4 × 1 **A1** for 12 or 20 OR **M1** for 6 × 3 × 4 **M1** for 2 × 5 × 4 **A1** for 72 or 40	M1 could be on diagram Treat extra volumes as choice A1 Implies M1 Mark as oe for other correct products if split into two different cuboids that make the solid Not 6 × 3 × 4 × 1 × 1 Treat extra volumes as choice A1 implies M1 unless 72 comes from 6 × 3 × 4 × 1 × 1
6	(a)		C	1		
6	(b)		D	1		
7	(a)		$x < 4$	3	Mark final answer **M1** for $4x - 12 < x$ or $x - 3 < \frac{x}{4}$ **M1** for correct step[s] to $ax < b$ FT *their* first step	For method marks, condone incorrect inequality sign or 'equals' sign e.g. Answer $x = 4$, $x > 4$ implies M1M1

Question			Answer	Marks	Part marks and guidance	
7	(b)		Correct representation of *their* (a) on number line	2	**Strict FT** *their* (a) dep on an inequality in (a) **B1FT** for *their* correct hollow or solid circle **B1FT** for *their* correct arrow direction	If e.g. 3 on answer line and x < 3 in working then allow FT from x < 3 If answer 4 in (a) then allow $x < 4$ here Both B1's must be with *their* value from part (a) If no arrow then *their* line must stretch to end of line
8	(a)		- 3	1		
8	(b)		Correct graph	3	Curves must not be joined or touch either axis **B2FT** for 7 or 8 correct plots Or **B1FT** for 5 or 6 correct plots	Mark in 50% zoom, use overlay, mark curve first For 3 marks, curve must pass through or touch circles on overlay Condone slight feathering, no ruled segments If curve incorrect, mark the plots use the overlay, plots must lie inside or touch circles. If large blob for plot, check centre of blob

Question			Answer	Marks	Part marks and guidance	
9			Shows actual increase is 21 [%] with correct working	5	**M3** for [*k* ×] 1.1 × 1.1 **oe** **A1** for 121[%] or for 1.21 OR **M1** for 1.1 **oe soi** **A1** for a correct evaluation of the first stage with *their* value If 0 scored **SC2** for answer 21[%] or **SC1** for 121% or 1.21 with no working	"Correct working" requires evidence of at least **M3** or alternate convincing approach Allow method marks if contained in correct method involving any invented starting price e.g. **M3** for 100 × 1.1 × 1.1 **oe** e.g. for M1A1 uses 80 as value then gives 88 in working
10			10 nfww	4	**M1** for 5 × 4 **M1** for 200 or 199 used **M1dep** for *their* 200 ÷ *their* area, **dep** on first M1	nfww for 4 marks no errors in calculating values and at least one of 5, 4, 200 or 199 used Allow for 20 or for 4.9 × 4.1 [20.09] or with one unrounded value [19.6 or 20.5] Allow for 198.5 ÷ (4.9 × 4.1)

Question			Answer	Marks	Part marks and guidance	
11			13 with correct working	7	**M1** for $\frac{BD}{10} = \sin 30$ **oe** **B1** for sin 30 = 0.5 **soi** **A1** for [BD =] 5 **M1** for *their* BD × 2.4 **oe** **A1** for CD = 12 **M1** for (*their* BD)^2 + (*their* CD)^2 [= BC^2] **oe** If 0 scored **SC3** for answer 13 with no working or **SC2** for CD = 12 with no working or **SC1** for BD = 5 with no working	"Correct working" requires evidence of at least M1 or B1 and M1M1 or alternate convincing approach Answer 12 gets A0 unless CD = 12 shown in working or on diagram SCs may be seen on the diagram
12	(a)		0.64	2	**M1** for 7.64 – 7 or 7 to 7.64	
12	(b)		45	2	**M1** for 0.75 × 60 **oe**	
12	(c)	(i)	Sam's mouse/median is longer than the box plot's median **oe**	1		With no incorrect statement Accept 'middle' for 'median' Accept 7.35 > 7.28 It is above the box plot median [7.28]
12	(c)	(ii)	Spread/range/IQR of Sam's lengths is not known **oe** or sample is too small **oe**	1		With no incorrect statement Accept 'He only measured the middle mouse' oe Accept 'Lengths of Sam's other mice are not known' oe Sam only has 5 mice which makes the data unreliable for comparison

Question			Answer	Marks	Part marks and guidance	
13	(a)		$0.\dot{2}\dot{7}$	2	**M1** for attempt to divide 3 by 11	For 2 marks accept 0.2727…. Implied by 0.27 to 0.28
13	(b)		$\frac{22}{45}$ final answer	3	**B2** for $\frac{44}{90}$ **oe** or **M1** for 4.88[8…] or 48.8[8...] **seen** or for 4/10 + 8/90 If 0 scored, **SC1** for answer $\frac{16}{33}$	B2 for e.g. $\frac{4.4}{9}$ For M1 accept any other decimal value[s] that would eliminate the recurrence when subtracted M1 implied by 44 and 90 (SC mark from 0.4848….)
14			400	2	**M1** for 2^3 **oe**	
15			$5\sqrt{5}$ final answer	3	**M2** for $2\sqrt{5}$ and $3\sqrt{5}$ or **M1** for $\sqrt{4\times5}$ or better or $\sqrt{9\times5}$ or better	

Question			Answer	Marks	Part marks and guidance	
16			$\frac{15}{27}$ **oe** with correct working	5	With *x* representing the number of smartphone and tablet: **B3** for [smartphone and tablet =] 15 may be on a Venn diagram **oe** or **M2** for [*x* =] 40 + 27 + 8 – 60 **oe** or **M1** for 40 – *x* + *x* + 27 – *x* + 8 = 60 **oe** or for Venn diagram with 40 – *x*, *x* and 27 – *x* correctly placed and **M1** for fraction $\frac{n}{27}$ or $\frac{15}{n}$ that leads to the answer If 0 scored **SC2** for $\frac{15}{27}$ **oe** with no working	isw cancelling/conversion to other forms For full marks "correct working" requires B3 ie [smartphone and tablet =] 15 with evidence of M1 or M2 or alternate convincing approach M1 FT *their* 15 provided < 27 For Venn diagrams, condone omission of universal set rectangle and 8 for M1, M2, B3 and full marks For M1 must be a proper fraction
17			$\frac{2(x-5)}{x+2}$ or $\frac{2x-10}{x+2}$ final answer	5	**M2** for 2(*x* – 5)(*x* + 5) or (2x – 10)(x + 5) or **M1** for 2(x^2 – 25) **M2** for (*x* + 2)(*x* + 5) or **M1** for *x*(*x* + 2) + 5(*x* + 2) or *x*(*x* + 5) + 2(*x* + 5) or for (*x* + *a*)(*x* + *b*) where *a* + *b* = 7 or *ab* = 10	For method marks condone omission of final bracket

Question			Answer	Marks	Part marks and guidance	
18			44 with correct working	5	**B3** for angle BCD = 110 with correct working or **M1** for angle BAD = 70 or for angle BDE = 180 – 70 or 110 **M1** for angle BCD = 180 – *their* angle BAD AND **M2** for *their* angle BCD ÷ 5 × 2 **oe** or **M1** for *their* angle BCD ÷ 5 **oe** If 0 scored **SC2** for answer 44 or **SC1** for angle BCD = 110	For full marks "correct working" requires evidence of at least M1 AND M1 ie at least a correct angle and some ratio work Ignore geometric reasons if given For B3 "correct working" requires at least M1 or alternate convincing approach Angles may be indicated on diagram for part marks May be seen on diagram
19			$x^2 + y^2 = 123$ final answer	4	**B2** for 123 or **B1** for 98 or **M1** for $5^2 + (7\sqrt{2})^2$ **oe** **B1** for $x^2 + y^2 = k$ as final answer	Accept '= k' or numeric value where $k > 0$

Question			Answer	Marks	Part marks and guidance	
20			$z = 17 - 2x^2$ final answer	4	**B3** for answer $17 - 2x^2$ OR **M3** for $7 = 4\left(\frac{x^2-5}{2}\right) + z$ **oe** or $2x^2 + z = 17$ **oe** or $x^2 - 2\left(\frac{7-z}{4}\right) = 5$ or better or **M2** for $y = \frac{2x^2-10}{4}$ **oe** or $y = \frac{7-z}{4}$ **oe** or $4y = 2x^2 - 10$ or $(2x^2 - 4y) + (4y + z) = 10 + 7$ **oe** or **M1** for $2x^2 - 4y = 10$ or $-2y = 5 - x^2$ or $4y = 7 - z$ or better	Correct unsimplified formula in x and z M2 sets up for substitution with y explicit or for method for elimination by equating coefficients of y and correct method to eliminate y M1 equates coefficients of y or first step in rearrangement to eliminate

Question			Answer	Marks	Part marks and guidance	
21			$20 + 8\pi$ final answer with correct working	6	**B3** for [angle at centre]= 144 with correct working or $\frac{4}{10}$ [of circle] **oe** or **M2** for $\frac{[360\times]40\pi}{\pi\times10^2}$ **oe** or **M1** for $\frac{\theta}{360}\times\pi\times10^2$ **oe** AND **M2** for answer $20 + k\pi$ where $k = \frac{their\vartheta}{18}$ or **M1** for $\frac{their\theta}{360}\times2\times\pi\times10$ **oe** or answer $20 + k\pi$ If 0 scored **SC2** for answer $20 + 8\pi$	For full marks "correct working" requires evidence of at least M1 AND M1 ie use of formulas for sector area and arc length or alternate convincing approach For B3 "correct working" requires at least M1 for use of formula for sector area M2 method for finding fraction of circle M1 Implied by 8π For M1 $k \neq 0$ May be on diagram

Question			Answer	Marks	Part marks and guidance	
22			$2n^3 + 2n^2 + 8n - 6$ or $2(n^3 + n^2 + 4n - 3)$	M5	**M3** for $2n^3 + n^2 - 6n^2 + 4n^2 + 2n - 12n - 3n - 6$ **oe** or better or condone one error in coefficients in simplified expression $2n^3 + 2n^2 + 8n - 6$ or **M2** for one correct expanded pair or **M1** for 3 correct terms out of 4 in expanded pair (term in n counts as 2 terms) **M1** for $3n^2 + 21n$	$2n^3 - n^2 - 13n - 6$ when simplified ie $2n^2 + n - 6n - 3$ or better or $2n^2 + 4n + n + 2$ or better or $n^2 + 2n - 3n - 6$ or better
			$2(n^3 + n^2 + 4n - 3)$	A1	Accept e.g. each term is divisible by 2 or $(2n^3 + 2n^2 + 8n - 6) \div 2 = n^3 + n^2 + 4n - 3$ Alt method Alt method for **6** marks Fully correct reasoning with even and odds for n and for each term when n is even and when n is odd $(2n + 1)$ $(n - 3)$ $(n + 2)$ and $3n(n + 7)$ e.g. if n is even , $(2n + 1)$ is odd etc or **M3** for fully correct reasoning with even and odds but only considering n is even or n is odd not both	Must include e.g. if n is even, $2n + 1$ is odd, $n - 3$ is odd, $n + 2$, is even then odd × odd × even = even and $3n$ is even and $n + 7$ is odd, even × odd = even , then even + even = even **and** repeat when n = odd

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