H

GCSE (9–1)

Mathematics

J560/04: Paper 4 (Higher tier)

General Certificate of Secondary Education

Mark Scheme for November 2020

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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.

1. 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

2.   **M** marks are for <u>using a correct method</u> and are not lost for purely numerical errors.
        A marks are for an <u>accurate</u> answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
        B marks are <u>independent</u> of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
        SC marks are for <u>special cases</u> that are worthy of some credit.

3.   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.

4.   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.

5.   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 <u>not from wrong working</u> **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.

6.   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).

7. 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'.

8. 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.

9. 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.

10. 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.

11.   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.

12.   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.

13.   Ranges of answers given in the mark scheme are always inclusive.

14.   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.

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

Question			Answer	Marks	Part marks and guidance	
1	(a)	(i)	6.5×10^3	1		In all parts condone trailing zeros
		(ii)	5.84×10^{-2}	1		
	(b)		7.56×10^3	1		
2			63	4	**M1** for 80 + 65 + 95 or 240 seen as total **M1** for *their* 240 × [0].6 or 144 **M1** for *their* 144 − 43 − 38 If **0** scored **SC1** for 0.6 × 95 or 57	condone $\dfrac{63}{95}$ for 4 marks and mark the method leading to *their* answer

Question	Answer	Marks	Part marks and guidance	
3	2 [h] 15 [m]	4	**M3** for a fully correct method e.g. $2.5 \times \dfrac{405}{270} \times \dfrac{3}{5}$ OR **M2** for three correct steps from $2.5 \times \dfrac{405}{270} \times \dfrac{3}{5}$ e.g. $2.5 \times \dfrac{405}{270} \times 3$ OR **M1** for one correct step e.g. $\dfrac{270}{2.5}$, $\dfrac{270}{150}$, $\dfrac{270}{3}$, 2.5×3, 150×3, $\dfrac{3}{5}$, $\dfrac{405}{270}$ or $\dfrac{405}{5}$ if **M0** or **M1** scored allow **SC1** for *their* final time as a decimal hour or *their* final time in minutes correctly converted to hours and minutes e.g. 2.3333[h] = 2[h] 20[min]	**M3** implied by 2.25, 2 [h] 25 [min] or 135 nfww note : (405 – 270 or 270 ÷ 2)= 135 = 2[h] 15[min] scores **M0** **M2** could be implied by 180, 11.25, 675 or 3 nfww **M1** could be implied by 108, 1.8, 90, 7.5, 450, 0.6, 1.5 or 81 allow alternative methods

Question			Answer	Marks	Part marks and guidance	
4			$\dfrac{20}{60}$ oe	5	**B3** for $x = 7$ OR **B1** for $x + 2x + x - 1 + 5x - 2$ or better **M1** for simplifying *their* linear equation to the form $ax + b = c$ or better e.g. $9x - 3 = 60$ **M1** for $x = (60 + 3) \div 9$ AND **M1** for $\dfrac{their\,20}{60}$ If **0** scored **SC1** for $\dfrac{3x - 1}{60}$	Equivalent includes $\frac{1}{3}$, .333[..] and 33.3...% e.g. $9x - 3$ *their* linear equation must include 60 FT *their* linear equation and show the steps to correctly solve it. third **M1 FT** *their* value of x so *their* 20 is *their* $(3x - 1)$ evaluated with *their* value of x
5	(a)		Accurate ruled angle B bisector with two pairs of correct arcs	2	**B1** for accurate ruled angle B bisector	Tolerance ± 2° e.g. one angle 49° to 53° and the line can be any length, must touch B and condone dotted line
	(b)		Accurate ruled perpendicular bisector of BC with two pairs of correct arcs	2	**B1** for accurate ruled perpendicular bisector of BC	Tolerance ± 2° e.g. angle 88° to 92° and ± 2mm e.g. 27mm to 31 mm and line can be any length, must touch BC and condone dotted line
	(c)		Correct region shaded	1 dep	**dep** on at least **B1** and **B1** and both bisectors intersecting	

Question			Answer	Marks	Part marks and guidance	
6			482	4	**M1** for 6×8×15 or 720 **M1** for $\sqrt[3]{their\,720}$ or 8.96… **M1** for [6 ×] $(\sqrt[3]{their\,720}\,)^2$	**M3** implied by 80.3[3...] or 481.99... **M2** implied by 8.96.. i.e [6 ×] (*their* 8.96…)^2
7	(a)		Any correct reason e.g. two points identified e.g (−2,−6) and (2,4) or a triangle drawn on the graph and [gradient =] e.g $\dfrac{4--6}{2--2}$ (could be marked on graph) $=\dfrac{10}{4}=(\dfrac{5}{2}$ or 2.5) oe	1		reason has to be fully correct condone triangle with base 1 and height 2.5 providing it is clear alternative 1: e.g. −6 = m(−2) + −1 leading to $m = (−6 + 1) ÷ −2 = \dfrac{-5}{-2} =($ $\dfrac{5}{2}$ or 2.5) alternative 2 : −6 = m(−2) + c 4= m(2) + c subtract −10 = m(−4) $\dfrac{-10}{-4}=(\dfrac{5}{2}$ or 2.5) oe
	(b)		$y = 2.5x − 1$	2	**B1** for $y = 2.5x + c$ $(c ≠ − 1)$	condone $\dfrac{5}{2}$ for 2.5

Question			Answer	Marks	Part marks and guidance	
8			46.77 to 46.84 or 47 nfww or (using 9) 47.45 to 47.5 or 48 nfww	6	**B2** for 9, 9.9, 9.975, 9.98 or 10 or **M1** for [faulty =] $\dfrac{6}{80}$ [$\times 133$] oe AND **M1** for [costs =] 133 × (32 + 7) + *their* 10 × 25 oe or *their* 5187 + *their* 10 × 25 **M1** for [income =] 133 × 60 **M1** for [percentage profit =] $\dfrac{their\,7980 - their\,5437}{their\,5437}$ [× 100] oe or $(\dfrac{their\,7980}{their\,5437} - 1)$ [× 100] oe	equivalents include 7.5% **M1** implied by 5412, 5434.5, 5436.375, 5436.5 or 5437 **M1** implied by 7980 numerator could be e.g. 2543 accept any correct method
9	(a)		Point accurately plotted and line drawn	1		for the '4' mark intent and 32 must lie between 30 and 35 and not on the lines, condone solid/dotty line
	(b)		Correct comment e.g. it peaks in Q1 or the lowest is in Q3	1		Condone winter/spring for Q1 and summer/autumn for Q3 and in (b)(c)(d) mark best comment unless contradictory
	(c)		Correct comment e.g. there is a slight rise in sales year on year	1		
	(d)		The trend in her sales will continue [at a similar rate] **oe**	1		Accept any correct relevant comment referring to general trend or quarter 1 trend isw extra statements

10			142.2[0] with correct working	6	**M1** for 36² or 1296	Correct working requires **M1** AND **M1** AND **M1**
					M1 for $k \times \pi \times 18^2$ oe where k = ½, 1, 1½ or 3 AND	**M2** implied by 2822 to 2823.02 or **M1** implied by 1526 to 1527.02, 1017 to 1018.008, 508 to 509.004, 3051 to 3054.024, 162π, 324π, 486π rot to at least nearest integer
					M1 for *their* area × 30	*their* area cannot be 36 and **M1** implied by 84660 to 84 690.6 or 84.66 to 84.7
					M1 for *their* mass ÷ 1000 and ÷ 10 or counting up in 10 000s to their mass AND	*their* mass is attempt at (rectangle and circle(s)) × 30, **M1** implied by 8.46 to 8.47
					M1 for *their* 9 × 15.8	*their* 9 **dep.** on fourth **M1** scored **with a rounding up to next integer**
					If **0, 1 or 2** scored instead award **SC3** for answer of 142.2[0] with insufficient working If **0 or 1** scored instead award **SC2** for 2822 to 2823.02 If **0** scored award **SC1 for** 1526 to 1527.02, 1017 to 1018.008, 508 to 509.004, 3051 to 3054.024, 162π, 324π, 486π rot to at least nearest integer	

Question			Answer	Marks	Part marks and guidance	
11	(a)		4.715 4.725	2	**B1** for each or both correct and reversed	
	(b)		7 25	5	**B4** for 7.41[0...] or 7.411 OR **B1** for 425 used **B1** for 57.35 or 57.349[9...] used If **B0** then **B1** for 425 and 57.35 seen AND **M2** for 425 ÷ 57.35 or **M1** for use of distance ÷ speed e.g 430 ÷ 57.3 If **4** or **5** not scored **SC1** for correctly changing *their* part hour to minutes	Condone use of 57.349[9...] for **M2** and for **M1** 420 ≤ distance ≤ 440 and 56 ≤ speed ≤ 58
12	(a)		Triangle at (−1,3) (−1,5) (−4,3)	2	**B1** for either a correct translation 6 left or a correct translation 2 up	See overlay and for accuracy mark intent (± 2 mm by eye), condone good freehand
	(b)		Rotation [centre] (0, 0) 90° clockwise or −90° or 270° anti-clockwise	1 1 1	if **0** or **1** scored **B1** for correct reflection in *y* = *x* on graph **B1** for correct reflection in *x*-axis on graph	mark to the candidate's advantage, for centre accept origin and O
13	(a)		Fully correct box plot	3	**B1** for median at 31 **B1** for highest at 38 and lowest at 15 **B1** for UQ at 35 and LQ at 24	Use overlay and tolerance ±½ small square, condone freehand lines
	(b)		16	2	**M1** for 21 or 37	

Question			Answer	Marks	Part marks and guidance	
	(c)		Accept "No" and any correct reasoning e.g. consistency is measured by [interquartile] range and Bev's range is higher so less consistent	2	**B1** for mention of [interquartile] range or spread or unclear acceptable statement	See appendix

Question			Answer	Marks	Part marks and guidance	
14			15.6[1..] with correct working	6	**M2** for [sin B =] $\dfrac{15 \times \sin 72}{18}$ oe or **M1** for $\dfrac{\sin B}{15} = \dfrac{\sin 72}{18}$ oe AND **M1** for 180 – 72 – *their* 52.4 implied by 55.6 or 55.57… and **M2** for [AB=] $\dfrac{18 \times \sin \textit{their} 55.57...}{\sin 72}$ oe or **M1** for $\dfrac{[...]}{\sin \textit{their} 55.57...} = \dfrac{18}{\sin 72}$ oe If **0** scored award **SC2** for 15.6… with insufficient working	Correct working requires evidence of at least **M1** AND **M1** **M2** implied by 0.7925… or 52.4… Alternative cosine rule (AB = *x*) **M3** for quadratic equation with coefficients evaluated **M2** for $x^2 + (-2 \times 15 \times \cos 72)x + (15^2 – 18^2)$ [=0] oe or **M1** for $18^2 = x^2 + 15^2 - 2 \times x \times 15 \cos 72$ AND **M2** for correct use of quadratic formula or **M1** for use of quadratic formula with at most two errors

Question			Answer	Marks	Part marks and guidance	
15	(a)		Correct reason e.g. the factors give +2x or factors are $(3x - 5)(x + 1)$ or the signs are the wrong way round	B1		See appendix
			$(3x - 5)(x + 1)$ and -1 and $\frac{5}{3}$ oe	B2	B1 for the correct factorisation or two correct solutions FT from their incorrect factorisation	
	(b)		Correct reason e.g. the $-b$ term should be in the numerator or $\dfrac{-(-8) \pm \sqrt{(-8)^2 - 4 \times 2 \times 3}}{2 \times 2}$	B1		allow [+] 8 for $-(-8)$ throughout this part see appendix
			$\dfrac{-(-8) \pm \sqrt{(-8)^2 - 4 \times 2 \times 3}}{2 \times 2}$ and 0.419 and 3.58	B2	B1 for $\dfrac{-(-8) \pm \sqrt{(-8)^2 - 4 \times 2 \times 3}}{2 \times 2}$ or 0.419 and 3.58 or 0.4188..., 0.4189 or 0.419 and 3.58[1...]	
16			$y = \dfrac{50}{x^2}$ final answer	3	M2 for $2 = \dfrac{k}{5^2}$ or better OR M1 for $y = \dfrac{k}{x^2}$ oe or B1 for [$k =$] 50	Condone proportionality symbol for equals in M1

Question			Answer	Marks	Part marks and guidance	
17			$x^3 + 2x^2 - x - 2$ final answer	3	**M2** for the correct expansion and simplification of any two of the given brackets e.g. $x^2 - 1$, $x^2 + 3x + 2$ or $x^2 + x - 2$ or **M1** for expansion of any two of the given brackets with three correct terms	the x term counts as two correct terms
18	(a)		$\dfrac{6}{-3}$ or -2 and $\dfrac{-1}{their - 2}$ $[= \frac{1}{2}]$ oe	1 1	accept any correct method	Only award full marks if no wrong working condone $\dfrac{-6}{3}$ for first mark
	(b)		$y = \frac{1}{2}x + 7\frac{1}{2}$ oe	2	**B1** for $y = \frac{1}{2}x + c$ or $y = mx + 7\frac{1}{2}$ or the equation of any line which goes through ($^-3$, 6)	where $m \neq 0$
19	(a)		975	3	**M2** for $(\dfrac{40 + 25}{2}) \times 30$ oe or $\frac{1}{2} \times 15 \times 30 + 25 \times 30$ or **M1** for one relevant area e.g. $\frac{1}{2} \times 15 \times 30$ or 25 × 30 or 40 × 30	Alternative: 40 × 30 $- \frac{1}{2} \times 15 \times 30$ for **M2**
	(b)	(i)	9	2	**M1** for $\dfrac{24 - 6}{4 - 2}$ oe	For **M1** condone one error in the figures
		(ii)	tangent drawn at $x = 4$ 12 nfww and dep on tangent drawn	1 3	**M1** for using two points on *their* line **M1** for use of $\dfrac{difference\ in\ y}{difference\ in\ x}$	Tangent should not cross the curve and should touch at 4, condone slight daylight between tangent and curve accept range of 11 to 13 for answer which should be checked from *their* tangent

Question	Answer	Marks	Part marks and guidance	
20	$[x =]$ -5 $[y =]$ -3 $[x =]$ 3 $[y =]$ 5 with some algebraic working	6	**M1** for $x^2 + (x +2)^2 = 34$ **M1** for expanding *their* square term e.g. $x^2 + 4x + 4$ **M1** for simplifying *their* quadratic expression e.g. $2x^2 + 4x + 4 = 34$ or better **M1** for correctly factorising *their* quadratic expression $ax^2 + bx + c = 0$ e.g. $(x + 5)(x − 3)$ or $(2x + 10)(x − 3)$ or use of quadratic formula with no more than two errors **B1FT** for either one correct point or two correct *x* values **B1FT** for the other correct point or two correct *y* values If insufficient working **B2** for 4 correct answers or **B1** for 2 correct answers	e.g. $x^2 + 2x − 15 = 0$ $a, b, c \neq 0$ Alternative : **M1** for $(y − 2)^2 + y^2 = 34$ or better **M1** for $y^2 − 4y + 4$ **M1** for $2y^2 − 4y + 4 = 34$ or better **M1** for $(y − 5)(y + 3)$ or use of quadratic formula with no more than two errors Both **B1**s are strict **FT** from *their* method to solve *their* quadratic equation e.g. they must FT correctly from *their* factorisation

APPENDIX

Exemplar responses for Q9(b)

Response	Mark
Number sold in the Q1 is the highest	1
Number sold in the Q3 is the lowest	1
Sales decreased **after** Q1 and increased **after** Q3	1
Goes down then goes up	0
Sales decreased during Q1 and increased during Q3	0
Sales increase in Q1 each year	0

Exemplar responses for Q9(c)

Response	Mark
Slight rise year to year	1
As years went on more umbrellas are sold	1
More sold in 2019 than in recent/previous years	1

Exemplar responses for Q9(d)

Response	Mark
The trend year to year will continue	1
The shop remains in business	**1 BOD**
Q1 increases by the same amount each year	1
Graph will follow the same pattern	1
More are sold in the first quarter	0
It will rain more in 2020	0

Exemplar responses for Q13(c)

Response	Mark
No + Ali is more consistent because his IQR is smaller	**2**
No + her data is more spread out	**2**
No + the median represents the average or middle value and not the range	**2**
No + median is just the middle mark	**2**
No+ the median does not measure consistency it is the range	**2**
No+ Kareem is wrong because Beth has the larger range	**2**
No + Beth is more consistent as her IQR/range is lower (1 for mention of IQR or range)	**1**
No + IQR shows consistency	**1**

Exemplar responses for Q15(a)

Response	Mark
the factors give +2x	**1**
factors are $(3x - 5)(x + 1)$	**1**
the signs are the wrong way round	**1**
Factorised incorrectly	**1 BOD**
$-\frac{5}{3}$ should be positive	**1 BOD**
$x - 1$ should be $x + 1$	**1**
the symbols are the wrong way round	**1 BOD**

Exemplar responses for Q15(b)

Response	Mark
the $-b$ term should be in the numerator	**1**
dividing line [in fraction] is not long enough	**1 BOD**

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