H

GCSE (9–1)

Mathematics

J560/04: Paper 4 (Higher tier)

General Certificate of Secondary Education

Mark Scheme for November 2019

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 <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.

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 <u>not from wrong working</u> **full marks** should be awarded.

    Do <u>not</u> award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen <u>and</u> 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.

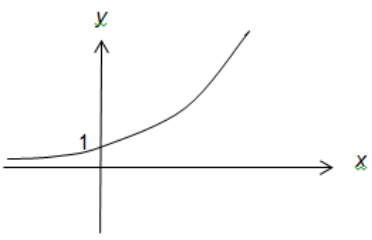| Question	Answer	Mark	Part Marks and Guidance	

1	Correct working leading to correct reason e.g.
	yes
	and 21.[3..] and 24
	  or 1280 and 1440
	  or [80 and] 90
	  or 2.6[..] or 2.7 [and 3]
	  or 7.[1..] and 8
		5	**M1** for unit calculation e.g. $48 \div 3$
			M1 for scale factor e.g. 80×16 *possibly in one stage*
			M1 for first conversion e.g. $1280 \div 60$
			M1 for second conversion e.g. 3×8 *possibly in one stage*
			A1 dep on M3 or **M4** for 'Yes' and two correct comparative figures
				Accept any correct method e.g.
				M1 for $48 \div 3$ soi by 16
				M1 for $80 \times$ *their* 16 soi by 1280
				M1 for *their* $1280 \div 60$ soi by 21.33…
				M1 for 3×8 soi by 24
				A1 for yes and 21.33… < 24
				
				Allow 21 hours 20 minutes

2	1.5×10^3	4	**B3** for 1500 or $1.50[0] \times 10^3$ or $1.48[9..] \times 10^3$ or 1.49×10^3 or **B2** for 1489.1… or **M1** for $\dfrac{5.8 \times 10^6}{\sqrt{4.1 \times 10^8 \times 3.7 \times 10^{-2}}}$ and **M1** for writing *their* answer correct to 2s.f. and in standard form	 implied by 3894.8… or 3894.9 need to see where *their* answer comes from e.g. longer figure or a simple fraction
3	11 45 [am]	4	**SC3** for 11 45 pm OR **B2** for LCM as 225 and **M1** for *their* LCM correctly converted to hours and minutes OR **M1** for $25 = 5 \times 5$ and $45 = 3 \times 3 \times 5$ and **M1** for [0] 8 00 plus *their* LCM OR **B1** for listing [0] 8:25, [0]8:50, [0]9:15... or 25, 50, 75.. and **B1** for listing [0]8:45, [0]9:30, 10:15… or 45, 90, 135..	condone 11 45 h[ours] or 11 h[ours] 45 m[ins] as answer implied by 3[h] 45 [m] including 1[h] 15[m] for 75 including 1[h] 30[m] and 2[h] 15 [m]

Question			Answer	Mark	Part Marks and Guidance	
4	(a)		50×30	1	Accept any correct method e.g.	watch for wrong method
			$\frac{50 \times 30}{1+2+3}$ [×1, 2 or 3]	1	**M1** for $\frac{2}{1+2+3} = \frac{2}{6}$ **M1** for $\frac{2}{6} \times 50$ or 50/3	$50 \times 20 = 1000$. $1000 \div 2 = 500$
			$2 \times 250 = 500$	1	**M1** for $\frac{50}{3} \times 30 = 500$ Alternative method **M1** for $30 \div 6 = 5$ **M1** for *their* $(30 \div 6) \times 2$ **M1** for $50 \times 10 = 500$	Mark to candidates advantage
	(b)		32	5	**M1** for $\dfrac{250}{25}$ or $\dfrac{500}{20}$ or $\dfrac{750}{15}$ **M1** for *their* $10 \times 5.5[0]$ or *their* $25 \times 2[.00]$ or *their* $50 \times 3.9[0]$ **M1** for *their* $10 \times 5.5[0]$ + *their* $25 \times 2[.00]$ + *their* $50 \times 3.9[0]$ **M1** for $\dfrac{396}{their\ 300}$ or $\dfrac{396 - their\ 300}{their\ 300}$ Alternative method **M1** for $\dfrac{\frac{30}{6} \times 1}{25}$ or $\dfrac{\frac{30}{6} \times 2}{20}$ or $\dfrac{\frac{30}{6} \times 3}{15}$ or $\dfrac{396}{50}$ **M1** for $5.5[0] \times their\ [0].2$ or $2[.00] \times their\ [0].5$ or $3.9[0] \times their\ 1$ **M1** for *their* $(5.5[0] \times [0].2)$ + *their* $(2[.00] \times .[0].5)$ + *their* $(3.9[0] \times 1)$ **M1** for $\dfrac{7.92}{their\ 6}$ or $\dfrac{7.92 - their 6}{their 6}$	**M1** may be implied by 10 or 25 *(no. of bags/part bags of cement, sand, stone)* **M2** may be implied by 55 and 195 *(cost of cement, sand, stone)* **M3** may be implied by 300 or 6 nfww *(total production cost)* **M1** may be implied by 0.2, 0.5 or 1 or 7.92 *(no. of bags/part bags of cement, sand, stone or price of 1 bag)* **M2** may be implied by 1.1[0], 1[.00] or 3.9[0] *(cost of cement, sand, stone for 1 bag)* **M3** may be implied by 6 nfww *(total production cost of 1 bag)*

Question			Answer	Marks	Part Marks and Guidance	
5			$4x^2 - 11xy - 3y^2$ final answer	3	**M2** for three correct terms from $4x^2 - 12xy + [1]xy - 3y^2$ oe or **M1** for two correct terms in the expansion above	**M1** implied by two correct terms in answer
6			$\dfrac{21}{50}$	3	**M1** for two ratios with a common number of sherberts e.g. 14 : 21 or 21 : 15 or 50 and **M1** for $\dfrac{their\ 21}{their\ (14+21+15)}$ only after valid attempt to create a triple ratio eg **0** for $\dfrac{3+7}{2+3+7+5}$ etc allow any correct method	Alternative : **M1** for $7 \div 3$ implied by 2.3[3…] oe or better and **M1** for $5 \div 2.3[3…]$ oe implied by 2.1428…… (exact $= \frac{15}{7}$) or $2 \times 2.3[3..]$ oe and e.g. 2 : 3 : $their\frac{15}{7}$ ($= 14 : 21 : 15$) or $their$ $\frac{14}{3}$: 7 : 5
7	(a)		2 points plotted correctly	1		tolerance ± ½ small square
	(b)		positive	1		Ignore embellishments
	(c)	(i)	acceptable ruled line	1		see overlay, it must be at least from $x = 10$ to $x = 45$ and between (10,4) to (10,12) and (45,40) to (45,50) if more than 1 line, both must be in tolerance, ignore horizontal and vertical lines.
		(ii)	35 to 44	1		for answers out of tolerance FT *their* ruled line with positive gradient with tolerance ± ½ small square
	(d)		42 or 41.7 or 41.66… or 41.67	4	**B1** for 5 **M1** for $\dfrac{their\ 5}{12}$ **M1** for $(their\frac{5}{12})\times 100$ If 0 scored **SC2** for answer of 30 from $\frac{3}{10}$ or 36[.36…] or 36.4 from $\frac{4}{11}$	*their* 5 must be less than 12 implied by [0].4166…

Question			Answer	Mark	Part Marks and Guidance	
8			[adult =] 12[.00] [child =] 4.5[0]	5	**B1** for 5a + 4c = 78 **B1** for 3a + 6c = 63 **M1** for multiplying/dividing both equations to get the coefficient of one variable equal (allow one error) **M1** for correctly adding or subtracting both equations to eliminate one variable (allow one error)	one error in total
9	(a)		6	3	**B1** for $3(k-4) = k$ oe **M1** for solving *their* equation to get k on one side and numbers on the other e.g. $3k - k = 12$	also $\frac{k}{3} + 4 = k$ condone use of other letters
	(b)		$\frac{y}{3} + 4$ oe	2	**M1** for ÷ 3 and + 4 e.g. $\frac{y+4}{3}$	
	(c)		16	2	**B1** for output of first function as 36 or $3(3(n-4)-4) = 96$ or better	e.g. $9n - 48 = 96$
10	(a)		165 000	1		
	(b)		3	1		
	(c)		165 000 × 1.03^7	1		
			202 929.1878 truncated or rounded to at least 3sf	1		

Question			Answer	Mark	Part Marks and Guidance	
11	(a)		Accept any correct reason e.g. No as lengths are unknown or lengths may be double each one or triangles are similar	1		See exemplars in appendix
	(b)		First correct reason	1	Reasons are Angle [I]G[H] = angle [L]J[K]	Reasons can be given in any order
			Second correct reason	1	GH = JK	Allow same angle, (36), but lines must be identified
			Third correct reason and SAS	1	GI = JL	
12	(a)		24	1		condone 24 000
	(b)		14 26 36 50 60	2	**B1** for complete table with three correct	
	(c)		28.5	5	**B1FT** for frequencies 14, 12, 10, 14, 10 with one error (allow FT table in (b)). **B1** for 5, 15, 25, 40, 65 (allow one error) **M1** for $\sum(their\ midpoint \times their\ frequency)$ **M1** for *their* $1710 \div 60$	implied by $70 + 180 + 250 + 560 + 650$ or 1710 *their* midpoint must be within the group range
	(d)		Acceptable answer e.g. for the mean the figures used are approximate	1		See exemplars in appendix

Question			Answer	Mark	Part marks and Guidance	
13	(a)		241.[1…]	3	**M2** for $90 \div 72^3 [\times 100^3]$ or **B1** for 72^3 or $373\,248$ or 100^3 or $1\,000\,000$	implied by e.g. 90 000 000
	(b)		392	3	**M2** for $8 \times 7 \times 7$ or **M1** for $8 \times 7 \times 8$ or 8, 7, 7 clearly identified (e.g. summed) if **0** scored award **SC2** for $8 \times 7 \times 6$ or **SC1** for $8 \times 8 \times 8$, $6 \times 7 \times 6$	e.g. 448 as answer implied by 336 implied by 512 or 252
14			25	5	**M1** for $m_1 = \dfrac{16}{-12}$ oe **M1** for $m_2 = \dfrac{-1}{their\ m_1}$ or $\dfrac{12}{16}$ oe **M1** for $y = (their\ \frac{12}{16})\ x + p$ **M1** for substituting (-12,16) into *their* equation accept any correct method	gradient of radius gradient of tangent
15	(a)		6.0[1…] or 6 nfww	3	**M2** for $DF^2 = 10^2 + 12^2 - 2 \times 10 \times 12 \cos30$ oe and allow one error or **M1** for $cos30 = \frac{10^2 + 12^2 - DF^2}{2 \times 10 \times 12}$, condone one error	nfww i.e. not $12 \times \sin 30$ **M2** implied by $DF^2 = 36.15$ to 36.16 if they draw a perpendicular from F to P on DG award **M1** for correct method to find both FP = 5 and PG= 8.6[6…] or 8.67 or 8.7 **M1** for correct use of Pythagoras' on triangle FPD
	(b)		57.3[…] or 57 nfww	4	**M2** for $[\sin B =] \dfrac{12.4 \times \sin 63}{12.8}$ or **M1** for $\dfrac{\sin B}{12.4} = \dfrac{\sin 63}{12.8}$ oe and **M1** for $180 - 63 -$ *their* 59.67	implied by [0].863… or 59.67 to 59.7

Question			Answer	Mark	Part Marks and Guidance	
16			$\dfrac{4(x-1)}{x^2-1}$ oe	M1	also allow method with denominator $(x^2-1)(x+1)$ e.g.	
			$x + 9 + 4x - 4$ or $5x + 5$	M1	M1 for $\dfrac{(x+9)(x+1)}{(x^2-1)(x+1)}$ or $\dfrac{4(x^2-1)}{(x^2-1)(x+1)}$ M1 for $x^2 + 9x + x + 9 + 4x^2 - 4$ or better	
			numerator $= 5(x+1)$	A1		
			denominator $= (x+1)(x-1)$	A1	If **0** scored **SC1** for $x^2 - 1 = (x+1)(x-1)$	
17				2	B1 for either an acceptable curve and no/incorrect y intercept marked or any curve with 1 marked at the y intercept	
18	(a)		330	2	M1 for $\frac{1}{2} \times 10 \times 6 \times 11$	
	(b)		$\tan [\ldots] = \frac{6}{10}$ oe	1	accept any correct method, equivalents include $\tan^{-1}(0.6)$	
			30.9[…]	1		
	(c)		$\sqrt{257}$ cao	4	M3 for $\sqrt{11^2 + 10^2 + 6^2}$ or better or M2 for $11^2 + 10^2 + 6^2$ or M1 for $11^2 + 10^2$ or $10^2 + 6^2$ or [FD =] $\frac{10}{cos31}$ or $\frac{6}{sin31}$	implied by 16.0[3…] implied by 257 implied by [FD =] $\sqrt{136}$ or 11.6 to 11.7 or [AC =] $\sqrt{221}$ or 14.8 to 14.9

Question	Answer	Mark	Part Marks and Guidance
19	1.0 to 1.4 dep. on a tangent drawn	4	**B3** for an answer within the given range with a slightly inaccurate tangent, i.e. touches curve in range $t = 4.5$ to 5.5 but not at $t = 5$ or an answer of 1.3 using a symmetric chord about $t = 5$ e.g. from $(4, 2)$ to $(6, 4.6)$. OR **B2** for an answer from using a symmetric chord about $t = 5$, e.g. from $(4, 2)$ to $(6, 4.6)$, with at most one error OR **M1** for an attempt to draw a tangent touching curve at $t = 5$ and **M2** for *their* distance ÷ *their* time e.g. $(7.4 - 1.2) ÷ (8 - 3)$ or **M1** for an attempt at *their* distance ÷ *their* time with one error or a correct attempt to find the gradient of *their* line which is not a tangent e.g. line from $(0, 0)$ to $(5, 3)$ which gives the average speed of $\frac{3}{5}$ or 0.6	Note: $5 ÷ 3 = 1.66\ldots$ scores 0

APPENDIX

Exemplar responses for Q11(a)

Response	Mark
No, lengths unknown	**1**
No, lengths may be different	**1**
No as triangles are similar	**1**

Exemplar responses for Q12(d)

Response	Mark
Because the median estimate is only affected by mistakes in measuring	**1**
Because the mean relies on assumption that all values lie at midpoint	**1**
Median is accurately read from graph, mean is estimated ….	**1**
Number of people earning each amount is not evenly spread out …..	**1(BOD)**
Mean has no exact values …	**1**
Accurate line graph instead of an assumption ….	**1(BOD)**

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