

GCSE

Mathematics (9-1)

Unit **J560/03**: Paper 3(Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2018

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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.

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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

- 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.
- 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 $180 \times (\text{their '37' + 16})$, or FT $300 - \sqrt{(\text{their '5^2 + 7^2'})}$. Answers to part questions which are being followed through are indicated by eg FT $3 \times \text{their (a)}$.

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).
 - **nfw** 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	Marks	Part marks and guidance	
1	(a)		isosceles	1		Condone poor spelling Accept any clear indication EG ringed in list
	(b)		8	1		Accept in words
2	(a)	(i)	3100	1		
		(ii)	0.03	1		
		(iii)	3	1		Accept +3
	(b)		-6	1		
	(c)		0.06 0.4 0.444 0.46 0.5	2	B1 for four in correct order	Use “cover up” method and accept all to 3 dp, eg 0.460
3	(a)		4	1		
	(b)		42.9 cao	2	B1 for 42.8 or 42.87[5] or 42.88 or 43 seen	
4	(a)	(i)	(4, 3)	1		
		(ii)	(-2, 3) plotted	1		Centre of mark within overlay around point
	(b)		$y = 3$	1		Accept any alternative form: EG $y - 3 = 0$, $3 - y = 0$, $-y = -3$ even $2y = 6$

Question			Answer	Marks	Part marks and guidance	
5			Correct unit cost for 20 or 24 biscuits linked to pack size	B1	<u>Examples</u> B1 for [20 bisc] 7.5 [each] then B1 for [24 bisc] 7.5 [each]	Unit may be 1 or equal multiples of 20 and 24.
			Correct unit cost for other number of biscuits consistent with first unit cost and linked to pack size	B1	OR B1 for [20 bisc] [60 cost] 4.50 then B1 for [24 bisc] [60 cost] 4.50	Condone wrong money notation
			Incorrect oe and both equal oe	B1dep	B1 dep on previous B2 If 0 scored SC1 for figs (7[5] or 8 or 13[3..] or 45 or 9) seen twice	For other costs method must be seen See AG
6	(a)		8	2	M1 for $5y = 4 \times 10$ oe	
	(b)		$\frac{4}{5}x$ or [0].8x final answer	1		Accept alternative fractions and forms such as $4x \div 5$
7	(a)	(i)	[A K Q] A Q K K A Q K Q A Q A K Q K A	2	B1 for 4 or 5 correct with repeats and/or errors or B1 for 2 or 3 correct with no repeats and/or errors	

Question			Answer	Marks	Part marks and guidance	
		(ii)	$\frac{\text{their } 2}{\text{their } 6}$ oe isw	1FT	Strict FT dep on at least 4 correct orders seen in (i)	Must be <i>their</i> total QK $\div$ <i>their</i> total orders Ignore attempts to cancel or convert to decimal/percentage Accept [0].33[3...] or 33[.3...]% or <i>their</i> correct decimal to 2sf Do not accept ratios
	(b)		$\frac{4}{6}$ oe with supporting evidence	4	Mark from one method only B3 for 5 more correct outcomes only or B2 for 4 more correct outcomes and up to one error or omission or B1 for 3 more correct outcomes and up to two errors or omissions OR B2 for $[2 \times 3 =]$ 6 outcomes B1 for [two above 8] 10 and 9 or [four below] 2, 4, 6, 7 If 0 scored SC1 for $\frac{4}{6}$ without working or $\frac{\text{their } 4}{\text{their } 6}$ from some working	Do not accept ratios Accept $\frac{2}{3}$, 0.66 to 0.67, 66% to 67% Mark fraction and ignore attempt to change form or cancel A complete list of outcomes is $3 - 1 = 2$ or 2 $3 \times 2 = 6$ or 6 $3 + 4 = 7$ or 7 $5 - 1 = 4$ or 4 5×2 or 10 Given in text $5 + 4 = 9$ or 9 Accept 5×2 and $5 + 4$ etc <i>Their</i> 4 from partial list, <i>their</i> 6 from partial list or stated total outcomes

Question		Answer	Marks	Part marks and guidance	
8	(a)	<div>[Diving] [5] [60]</div> <div>[Swimming] 10 [120]</div> <div>[Paddleboarding] 6 72</div> <div>[Kayaking] [9] [108]</div>	4	B3 for 2 correct B2 for 1 correct B1 for 12[° per person]	
	(b)	Correct pie chart with correct labels	2	B1 for all sector angles correct but: <ul style="list-style-type: none"> • wrongly labelled or • no labels or for one sector angle correct and correctly labelled	Allow $\pm 2^\circ$ Use protractor to check
	(c)	[Original] Swimming [New] Kayaking	1		
	(d)	[There may be] different numbers [of students] in the two groups or Pie charts show proportions [not numbers]	1		Allow any comment implying different numbers in groups, EG, fewer in B or number in B not known or proportions only See appendix
9		15.25 15.35	2	B1 for one correct or both correct but reversed	
10	(a)	12	1		

Question		Answer	Marks	Part marks and guidance	
	(b)	2 h 24 min nfw	4	<p>B3 for 2 h and 0.4×60 oe or 144[min] nfw</p> <p>or</p> <p>B2 for 2.4 h</p> <p>or</p> <p>M2 for $\frac{\text{their } 12}{5}$</p> <p>or</p> <p>M1 for converting <i>their</i> 2.4 hours correctly to hours and minutes</p>	<p>Working may all be in minutes so award comparable M and B marks oe may be $60 \div 10 (= 6) \times 4$</p> <p>B2 for answer space completed as 2.4 [hours] and 144 [minutes]</p> <p>2.4 may be $2\frac{2}{5}$ or equivalent fraction</p> <p>or <i>their</i> 144 minutes, if working in minutes</p> <p><i>their</i> 2.4 hours or <i>their</i> 144 minutes must come from some working</p> <p><i>Their</i> 2.4h not integer and > 1</p> <p><i>Their</i> 144 min not 60n and > 60</p>
11	(a)	<p>No</p> <p>and [butter] 500 [with 600] or [total] 1500 with 1800 or [total] [1.5 with] 1.8 or [total] 300 more [than 1500] or [total] [0].3 more [than 1.5]</p>	4	<p>B1 for a relevant unit conversion seen with unit given</p> <p>M1 for $(1500 \text{ or } 1.5) \div 6$ soi 250 or 0.25 or $(600 \text{ or } 0.6) \div 2$</p> <p>M1 for [butter=] <i>their</i> 250 oe $\times 2$ or [total=] <i>their</i> 300 oe $\times 6$ soi 1800 or 1.8</p>	<p>Must be used in solution EG $1.5[\text{kg}] = 1500\text{g}$ or $1800[\text{g}] = 1.8\text{kg}$ Accept equivalent methods See AG</p> <p>May be implied by [syrup=] 300 or 0.3</p> <p><i>Their</i> 300 is their mass of syrup May be <i>their</i> $300 \times 3 + \text{their } 300 \times 2 + \text{their } 300$ or $900 + 600 + 300$</p>

Question			Answer	Marks	Part marks and guidance	
	(b)		900	3	<p>M2 for $200 \times 3 \times 1.5$ oe</p> <p>or</p> <p>M1 for [oats =] 200×3 soi 600 or [oats =] $200 \div 10 \times 3$ soi 60 or [syrup =] $200 \div 10 \times 15$ soi 300 or $15 \div 10$ soi 1.5</p>	Accept in kg throughout oe may be $\frac{200}{10} \times 3 \times 15$ or $\frac{200}{10} \times 15 = 300$ then <i>their</i> 300×3 600g oats in 10 biscuits 60g oats in 1 biscuit 300g syrup in 15 biscuits May be seen as [...] $\times 3 \div 2$
12	(a)		$\begin{pmatrix} 15 \\ 20 \end{pmatrix}$	1		Do not allow fraction line in vector
	(b)		[h =] 1 [k =] -2	2	B1 for each or both correct but reversed	
	(c)	(i)	$\begin{matrix} 6 & -6 & 0 \\ [+ & [=] & \\ 0 & 8 & 0 \end{matrix}$	2	<p>B1 for $\begin{pmatrix} 6 \\ 0 \end{pmatrix}$ or $\begin{pmatrix} -6 \\ 8 \end{pmatrix}$</p> <p>or $\begin{pmatrix} 0 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 0 \end{pmatrix}$ as final vector</p>	Do not allow fraction line in vector
		(ii)	[Return to] the starting point oe	1		Do not accept "No movement" or a calculation
13	(a)	(i)	$6a + 10b$ or $2(3a + 5b)$ final answer	2	<p>M1 for $6(a + b) + 2 \times 2b$ oe</p> <p>If 0 scored SC1 for $3a + 5b$ as final answer</p>	M1 for EG $a + b + a + b + a + b + a + b + a + b + a + b + 2b + 2b$ or $2 \times (3a + 3b + 2b)$ etc
		(ii)	$6b(a + b)$ final answer	2	B1 for $6(ab + b^2)$ or $b(6a + 6b)$ or $3(2ab + 2b^2)$ or $3b(2a + 2b)$ or $2(3ab + 3b^2)$ or $2b(3a + 3b)$	

Question		Answer	Marks	Part marks and guidance	
	(b)	4 by 1 rectangle with $4a + 4b$ and $2b$ or 2 by 2 rectangle with $2a + 2b$ and $4b$ or 1 by 4 rectangle with $a + b$ and $8b$ stated or marked on rectangle	5	<p>B4 for $4a + 4b$ and $2b$ or $2a + 2b$ and $4b$ or $a + b$ and $8b$</p> <p>or</p> <p>B3 for rectangle drawn as (4 by 1) or (2 by 2) or (1 by 4)</p> <p>or</p> <p>B2 for one of $2a + 2b$ or $4a + 4b$ or $4b$ or $8b$</p> <p>or</p> <p>B1 for any rectangle of 3 or more tiles drawn with $a+b$ or $2b$ marked on individual tiles</p>	<p>Accept unsimplified throughout Once correct expression(s) seen, ignore incorrect simplification to answer line In answer space or intended as final length and width</p> <p>Must clearly be answer</p> <p>May be in attempt to factorise EG $4b(2a + b)$ Accept unsimplified EG $a+b + a+b$</p> <p>Only tiles that form the perimeter needed</p>
14	(a)	22	1		Condone extra correct terms beyond 22
	(b)	$4n + 2$ oe	2	B1 for $4n$	oe may be a form of $6 + 4(n - 1)$
	(c)	The numbers are even oe or 511 is odd oe or n is [a] decimal	1	Even must clearly refer to the terms Odd must refer to 511 (or "it")	See Appendix Only after <i>their</i> $4n + 2 = 511$ solved to a decimal (may be 127.25)

Question			Answer	Marks	Part marks and guidance	
	(d)		510	3	B2 for (127 or 514) as answer OR M1 for <i>their</i> $4n + 2 = 511$ or better soi 127.25 M1 for <i>their</i> 127.25 (rot) correctly substituted in <i>their</i> $4n + 2$ OR M2 for trials using <i>their</i> $4n + 2$ leading to $509 < \text{integer terms} < 513$ or M1 for two correct trials using <i>their</i> $4n + 2$ If 0 scored SC1 for 128 as answer	FT for method only if their (b) is of form $an + b$ where $a \neq 0$ and $b \neq 0$ Look back to 14b Rounded or truncated A trial is substituting a value for n in <i>their</i> $4n + 2$ (allow adding <i>their</i> 4 after first calculation) May be 22, 26, 30... 506, 510, 514 May be 22, 26, 30... but with errors
15			20	4	M2 for $500 \times \frac{100+25}{100}$ oe soi 625 or M1 for $500 \times \frac{25}{100}$ oe soi 125 AND M1 for $([1 -] \frac{500}{\text{their } 625}) [\times 100]$ oe soi [0].8 or 80 or [0].2 or 20	See AG for alternative methods 625 – 500 = 125 followed by $\frac{125}{625} [\times 100]$ scores M2 AND M1
16			18	3	M2 for $\sqrt{18.75^2 - 5.25^2}$ or $\sqrt{324}$ or M1 for $x^2 + 5.25^2 = 18.75^2$ oe	See AG

Question			Answer	Marks	Part marks and guidance
17			8, 8, 13 and 15	3	<p>B2 for 3 or 4 numbers with at least two conditions met out of:</p> <ul style="list-style-type: none"> At least two numbers are 8 The range is 7 The total is 44 <p>or</p> <p>B1 for 4 numbers with one condition met or 44 seen</p>
18			18 nfww	4	<p>B1 for [green] 36 or ratio(s) equivalent to 5 : 9 : 36</p> <p>AND</p> <p>M2 for $\frac{\text{their } 9}{\text{their } (5 + 9 + 36)} [\times 100]$ or</p> <p>M1 for <i>their</i> (5 + 9 + 36) soi</p>
					<p>Accept any order</p> <p>Examples: B2 for 8, 8, 10.5, 17.5 B2 for 8, 8, 8, 20 B2 for 8, 8, 28 B2 for 1, 8, 8 B1 for 8, 8, 8, 8 B0 for 8, 8</p> <p>For B1 accept 5 : 36 or 9 : 36 or ratio(s) involving a common term for blue eg 10 : 18 and 18 : 72 eg 1 : 1.8 : 7.2 eg $\frac{5}{9} : 1$ [: 4] (decimals should be accurate rot to 3 figs)</p> <p><i>Their</i> (5 + 9 + 36) must come from a ratio (or ratios) with a common term. 1 + 4 + 5 + 9 = 19 followed by $\frac{5}{19}$ scores 0.</p>

Question	Answer	Marks	Part marks and guidance	
19	$\frac{300 \times (7-3)}{60} = 20$ <p>AND</p> <p>it is close to 19.5 oe or 19.5 rounds to 20 oe or [Asha's estimate] is reasonable</p>	3	<p>B2 for 300, 7, 3 and 60 seen</p> <p>or</p> <p>B1 for two of 300, 7, 3 and 60 seen or 300, 4 and 60 seen or 300.0, 7.0, 3.0. 60.0</p> <p>AND</p> <p>B1dep for result 20 and correct conclusion following B1 or B2</p>	<p>Actual answer 19.475959...(may be rounded) scores 0</p> <p>Accept "Yes" or "She's right" or "It is" or equivalent comment</p>
20	(a)	2	<p>B1 for $[(a^3)^2 =] a^6$ or $a^3 \times a^3$</p> <p><u>Alternative:</u> B2 for $[a^5 \times (a^3)^2 =]$ $a \times a \times \dots \times a [= a^{11}]$ or B1 for $[(a^3)^2 =] a \times a \times a \times a \times a \times a$</p>	<p>a^{5+6} or a^{5+3+3} or intent to add indices stated or unambiguously indicated (eg 5 + 6, add indices etc)</p> <p>written in full with eleven a's.</p> <p>written in full with six a's May be implied by $(a \times a \times a \times a \times a \times a)$ seen within an incorrect lengthier product.</p>
	(b)	3	<p>B1 for $\left[\frac{1}{125} =\right] 5^{-3}$ or $[125 =] 5^3$</p> <p>B1 for 5^{18}</p>	

Question	Answer	Marks	Part marks and guidance
21	<p>angle $BCA = 44^\circ$ and angles [in a] triangle [= 180°] or angle $DCA = 56^\circ$ and angles [in a] triangle [= 180°]</p> <p>Best two statements from: (i) [side] AC is common (ii) [angle] $ACB =$ [angle] CAD (iii) [angle] $BAC =$ [angle] ACD (iv) angle $B =$ angle D or [angle] $ABC =$ [angle] CDA</p> <p>Conclusion and third statement [congruent because] ASA after stating (i), (ii), (iii) AAS after stating (i), (ii), (iv) or (i), (iii), (iv)</p>	<p>1</p> <p>2</p> <p>1</p>	<p>$C = 44$ (or 56) is not sufficient. Accept angles shown on diagram.</p> <p>0 if alternate angles is given as the reason unless the parallelogram has been justified</p> <p>Notation needed for these marks.</p> <p>$44 = 44$ is not sufficient. $56 = 56$ is not sufficient "angle" required if using just B or D</p> <p>Final mark needs a third statement (ignore superfluous ones) and the appropriate congruence conclusion.</p> <p>If 0 or 1 scored then, to a maximum total of 2 marks, allow: SC1 for angle $BCA = 44^\circ$ and angle $DCA = 56^\circ$ stated or on diagram and SC1 for a correct statement lacking precision eg "both triangles have a common side", "both triangles have an angle of 80°", "all the angles are the same"</p> <p>Possible marks (without SC): 1 + 2 + 1, 1 + 2 + 0, 1 + 1 + 0, 0 + 2 + 1, 0 + 2 + 0, 0 + 1 + 0, 0 + 0 + 0.</p>

Question			Answer	Marks	Part marks and guidance	
22	(a)		$\frac{4.44 \times 10^9}{1.47 \times 10^8}$ 30.2[0...] or 3.02[0...] $\times 10^{[1]}$	M1 A1	If 0 scored SC1 for $1.47 \times 10^8 \times 30 = 4.41 \times 10^9$ or $\frac{4.44 \times 10^9}{30} = 1.48 \times 10^8$	Accept in ordinary numbers $\frac{4\,440\,000\,000}{147\,000\,000}$ $\frac{147\,000\,000 \times 30 = 4\,410\,000\,000 \text{ or } 4\,440\,000\,000}{30} = 148\,000\,000$
22	(b)		Recognise other distances are possible	1	B1 for statement with distance oe and varies oe Mark the best bit if not contradictory	See appendix eg No information about other positions or [30] only for closest [distance]. Do not accept "It varies..."

Exemplars

5	Comment	Mark
	Wrong and Both biscuits are the same price	1
	Incorrect and The biscuits cost the same	1
	Wrong and They are the same price for each biscuit	1
	Wrong and They are both better value	1
	Not and Each individual biscuit is the same price from each packet <i>BOD "Not" or "No" for "Wrong"</i>	1
	Correct and	0

8d	Comment	Mark
	The number of students is not known	1
	There could be more in A (or B)	1
	Pie charts show proportions and not numbers	1
	There may be different group sizes	1
	We don't know how many students took diving <i>BOD "took diving" numbers unknown scores</i>	1
	Even if the angle is bigger there might be more students <i>Unclear whether "in total"</i>	0

12c	Comment	Mark
	Start and finish at the same point	1
	Come back to A	1
	It's a closed shape	1
	The numbers are easy to add up	0
	You can see it on the shape	0

14c	Comment	Mark
	It isn't an even number	1
	It's not a multiple of 2 <i>Same as "It is odd"</i>	1
	It's an odd number <i>In this context, "it" clearly refers to 511</i>	1
	Because $127 \times 4 + 2 = 510$ and $128 \times 4 + 2 = 514$ and there is nothing between.	1
	The sequence goes up in 4s and 11 isn't a multiple of 4 <i>True but ignores the constant in $4n + 2$</i>	0
	4 doesn't go into 511	0
	It goes up in the 4 times table and numbers in the 4 times table are even <i>Recognises "even" but for the four times table and not the sequence.</i>	0

22b	Comment	Mark
	This is the closest and it won't always be closest. <i>Recognises other distances are possible</i>	1
	Their distance from the sun varies	1
	When the Earth rotates round the sun its distance will change <i>BOD varies</i>	1
	The sun changes distance from the earth <i>BOD inverse statement</i>	1
	As it can change <i>"It" could refer to anything</i>	0
	The earth goes round the sun in an oval shape <i>Doesn't explain the effect of this on distance</i>	0

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