

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

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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. 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 <u>using a correct method</u> 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 <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.
- 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.

- 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 $\sqrt{(their\ '5^2 + 7^2)}$. 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.
- 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.
- 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'.
- 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).
- 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.

- 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.
- 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.
- 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.

Qu	estior	n	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)		<i>y</i> = 3	1		Accept any alternative form: EG y-3=0, $3-y=0$, $-y=-3$ even 2y=6

Que	estior	1	Answer	Marks	Part marks and guidance	
5			Correct unit cost for 20 or 24 biscuits linked to pack size	B1	Examples B1 for [20 bisc] 7.5 [each] then	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	B1 for [24 bisc] 7.5 [each] OR B1 for [20 bisc] [60 cost] 4.50 then B1 for [24 bisc] [60 cost] 4.50	Condone wrong money notation Number biscuits Using £ Using p 1 0.075 7.5 1 0.13[3] 13[.3] 60 4.50 450 120 9 900
			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	

Que	estion	1	Answer	Marks	Part marks and guidance	
		(ii)	their 2 their 6 oe isw	1FT	Strict FT dep on at least 4 correct orders seen in (i)	Must be their total QK ÷ their total orders Ignore attempts to cancel or convert to decimal/percentage Accept [0].33[3] or 33[.3]% or their 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 × 3 =] 6 outcomes B1 for [two above 8] 10 and 9 or [four below] 2, 4, 6, 7 If 0 scored SC1 for 4/6 without working or their 4/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

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Que	estion	1	Answer			Marks	Part marks and guidance	
8	(a)		[Diving] [Swimming] [Paddleboarding] [Kayaking]	[5] 10 6 [9]	[60] [120] 72 [108]	4	B3 for 2 correct B2 for 1 correct B1 for 12[° per person]	
	(b)		Correct pie chart wit	h correct la	abels	2	■ B1 for all sector angles correct but: • wrongly labelled or • no labels or for one sector angle correct and correctly labelled	Allow ±2° Use protractor to check
	(c)		[Original] Swimmii [New] Kayakin	•		1		
	(d)		[There may be] different numbers [of students] in the two groups oe 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	i		2	B1 for one correct or both correct but reversed	
10	(a)		12			1		

Qu	estior	า	Answer	Marks	Part marks and guidance	
	(b)		2 h 24 min nfww	4	B3 for 2 h and 0.4 × 60 oe or 144[min] nfww or B2 for 2.4 h or M2 for their 12 5 or M1 for converting their 2.4 hours correctly to hours and minutes	Working may all be in minutes so award comparable M and B marks oe may be $60 \div 10 (= 6) \times 4$ B2 for answer space completed as 2.4 [hours] and 144 [minutes] 2.4 may be $2\frac{2}{5}$ or equivalent fraction or <i>their</i> 144 minutes, if working in minutes their 2.4 hours or their 144 minutes must come from some working Their 2.4h not integer and > 1 Their 144 min not 60n and > 60
11	(a)		No 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]	4	 B1 for a relevant unit conversion seen with unit given M1 for (1500 or 1.5) ÷ 6 soi 250 or 0.25 or (600 or 0.6) ÷ 2 M1 for [butter=] their 250 oe × 2 or [total=] their 300 oe × 6 soi 1800 or 1.8 	Must be used in solution EG1.5[kg] = 1500g or 1800[g] = 1.8kg Accept equivalent methods See AG May be implied by [syrup=] 300 or 0.3 Their 300 is their mass of syrup May be their 300×3 + their 300×2 + their 300 or 900 + 600 + 300

Que	estior	า	Answer	Marks	Part marks and guidance	
	(b)		900	3	M2 for 200 × 3 × 1.5 oe or M1 for [oats =] 200×3 soi 600 or [oats =] 200÷10×3 soi 60 or [syrup =] 200÷10×15 soi 300 or 15÷10 soi 1.5	Accept in kg throughout oe may be $\frac{200}{10} \times 3 \times 15$ or $\frac{200}{10} \times 15 = 300$ then their 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)		(15) 20)	1		Do not allow fraction line in vector
	(b)		[h =] 1 [k =] -2	2	B1 for each or both correct but reversed	
	(c)	(i)	6 [+] -6 [=] 0 0 8 = 0	2	B1 for $\begin{pmatrix} 6 \\ 0 \end{pmatrix}$ or $\begin{pmatrix} -6 \\ 8 \end{pmatrix}$ or $\begin{pmatrix} 0 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 0 \end{pmatrix}$ as final vector	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	M1 for $6(a + b) + 2 \times 2b$ oe If 0 scored SC1 for $3a + 5b$ as final answer	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 $2b(3a + 3b)$	

Qu	estion	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	B4 for $4a + 4b$ and $2b$ or $2a + 2b$ and $4b$ or $a + b$ and $8b$ or B3 for rectangle drawn as (4 by 1) or (2 by 2) or (1 by 4) or B2 for one of $2a + 2b$ or $4a + 4b$ or $4b$ or $8b$ or B1 for any rectangle of 3 or more tiles drawn with $a+b$ or $2b$ marked on individual tiles	Accept unsimplified throughout Once correct expression(s) seen, ignore incorrect simplification to answer line In answer space or intended as final length and width Must clearly be answer May be in attempt to factorise EG 4b(2a + b) Accept unsimplified EG a+b + a+b Only tiles that form the perimeter needed
14	(a)	22	1		Condone extra correct terms beyond 22
	(b)	4n + 2 oe	2	B1 for 4 <i>n</i>	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)

Que	estion	Answer	Marks	Part marks and guidance	
	(d)	510	3	B2 for (127 or 514) as answer OR M1 for their 4n + 2 = 511 or better soi 127.25 M1 for their 127.25 (rot) correctly substituted in their 4n + 2 OR M2 for trials using their 4n + 2 leading to 509 < integer terms < 513 or M1 for two correct trials using their 4n + 2 If 0 scored SC1 for 128 as answer	FT for method only if their (b) is of form $an + b$ where $a \ne 0$ and $b \ne 0$ Look back to 14b Rounded or truncated A trial is substituting a value for n in their $4n + 2$ (allow adding their 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 -] $\frac{500}{their}$ 625) [× 100] oe soi [0].8 or 80 or [0].2 or 20	See AG for alternative methods $625 - 500 = 125 \text{ followed by}$ $\frac{125}{625} [\times 100] \text{ scores } \textbf{M2} \text{ AND } \textbf{M1}$
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	 B2 for 3 or 4 numbers with at least two conditions met out of: At least two numbers are 8 The range is 7 The total is 44 or B1 for 4 numbers with one condition met or 44 seen 	Accept any order 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
18	18 nfww	4	B1 for [green] 36 or ratio(s) equivalent to $5:9:36$ AND M2 for $\frac{their 9}{their (5+9+36)} [\times 100]$ or M1 for $their (5+9+36)$ soi	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) Their (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 .

Qu	estion	Answer	Marks	Part marks and guidance	
19		$\frac{300 \times (7-3)}{60} = 20$ AND it is close to 19.5 oe or 19.5 rounds to 20 oe or [Asha's estimate] is reasonable	3	B2 for 300, 7, 3 and 60 seen or 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 AND B1dep for result 20 and correct conclusion following B1 or B2	Actual answer 19.475959(may be rounded) scores 0 Accept "Yes" or "She's right" or "It is" or equivalent comment
20	(a)	$a^5 \times a^6 = a^{5+6} = a^{11}$ or $a^5 \times a^3 \times a^3 = a^{5+3+3} = a^{11}$	2	B1 for $[(a^3)^2 =] a^6$ or $a^3 \times a^3$ Alternative: B2 for $[a^5 \times (a^3)^2 =]$ $a \times a \times \times a [= a^{11}]$ or B1 for $[(a^3)^2 =] a \times a \times a \times a \times a \times a \times a$	a^{5+6} or a^{5+3+3} or intent to add indices stated or unambiguously indicated (eg 5 + 6, add indices etc) written in full with eleven a 's. written in full with six a 's May be implied by (a × a × a × a × a × a) seen within an incorrect lengthier product.
	(b)	5 ¹⁵	3	B1 for $\left[\frac{1}{125}\right]$ 5 ⁻³ or [125 =] 5 ³ B1 for 5 ¹⁸	

Question	Answer	Marks	Part marks and guidance	
21	angle BCA = 44° and angles [in a] triangle [= 180°] or angle DCA = 56° and angles [in a] triangle [= 180°]	1		 C = 44 (or 56) is not sufficient. Accept angles shown on diagram. O if alternate angles is given as the reason unless the parallelogram has been justified
	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	2	B1 for each to a max of 2	Notation needed for these marks. 44 = 44 is not sufficient. 56 = 56 is not sufficient "angle" required if using just <i>B</i> or <i>D</i>
	Conclusion and third statement [congruent because] ASA after stating (i), (ii), (iii) AAS after stating (i), (ii), (iv) or (i), (iii), (iv)	1	If 0 or 1 scored then, to a maximum total of 2 marks, allow: SC1 for angle <i>BCA</i> = 44° and angle <i>DCA</i> = 56° 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"	Final mark needs a third statement (ignore superfluous ones) and the appropriate congruence conclusion. 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.

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Que	Question		Answer	Marks	Part marks and guidance	
22	(a)		4.44×10 ⁹ 1.47×10 ⁸	M1	_	Accept in ordinary numbers 4 440 000 000 147 000 000
			30.2[0] or 3.02[0] × 10 ^[1]	A1	If 0 scored SC1 for $1.47 \times 10^8 \times 30 = 4.41 \times 10^9$ or $\frac{4.44 \times 10^9}{30} = 1.48 \times 10^8$	$\frac{147000000 \times 30 = 4410000000}{4440000000} = 148000000$
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	BOD "Not" or "No" for "Wrong"	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	BOD "took diving" numbers unknown scores	1
	Even if the angle is bigger there might be more students	Unclear whether "in total"	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	Same as "It is	s odd"	1
	It's an odd number	In this o	context, "it" clearly refers to 511	1
	Because $127 \times 4 + 2 = 510$ and $128 \times 4 + 2 = 514$ and there	is nothing betwe	en.	1
	The sequence goes up in 4s and 11 isn't a multiple of 4	True bi	ut ignores the constant in 4n + 2	0
	4 doesn't go into 511		-	0
	It goes up in the 4 times table and numbers in the 4 times tab	ole are even	Recognises "even" but for the four times	0
			table and not the sequence.	

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

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