



**General Certificate of Secondary Education  
2023**

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**Mathematics**

M2

Calculator Paper

Foundation Tier

**[GMC21]**

**FRIDAY 19 MAY, MORNING**

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**MARK  
SCHEME**

## GCSE MATHEMATICS

### Introduction

The mark scheme normally provides the most popular solution to each question. Other solutions given by candidates are evaluated and credit given as appropriate; these alternative methods are not usually illustrated in the published mark scheme.

The marks awarded for each question are shown in the right hand column and they are prefixed by the letters **M**, **W** and **MW** as appropriate. The key to the mark scheme is given below:

**M** indicates marks for correct method.

**W** indicates marks for working.

**MW** indicates marks for combined method and working.

The solution to a question gains marks for correct method and marks for an accurate working based on this method. Where the method is not correct no marks can be given.

A later part of a question may require a candidate to use an answer obtained from an earlier part of the same question. A candidate who gets the wrong answer to the earlier part and goes on to the later part is naturally unaware that the wrong data is being used and is actually undertaking the solution of a parallel problem from the point at which the error occurred. If such a candidate continues to apply correct method, then the candidate's individual working must be followed through from the error. If no further errors are made, then the candidate is penalised only for the initial error. Solutions containing two or more working or transcription errors are treated in the same way. This process is usually referred to as "follow-through marking" and allows a candidate to gain credit for that part of a solution which follows a working or transcription error.

### Positive marking:

It is our intention to reward candidates for any demonstration of relevant knowledge, skills or understanding. For this reason we adopt a policy of **following through** their answers, that is, having penalised a candidate for an error, we mark the succeeding parts of the question using the candidate's value or answers and award marks accordingly.

Some common examples of this occur in the following cases:

- (a) a numerical error in one entry in a table of values might lead to several answers being incorrect, but these might not be essentially separate errors;
- (b) readings taken from candidates' inaccurate graphs may not agree with the answers expected but might be consistent with the graphs drawn.

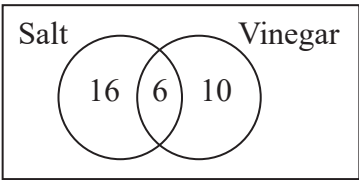
When the candidate misreads a question in such a way as to make the question easier only a proportion of the marks will be available (based on the professional judgement of the examining team).

## General Marking Advice

- (i) If the correct answer is seen in the body of the script and the answer given in the answer line is clearly a transcription error, full marks should be awarded.
- (ii) If the answer is missing, but the correct answer is seen in the body of the script, full marks should be awarded.
- (iii) If the correct answer is seen in working but a completely different answer is seen in the answer space, then some marks will be awarded depending on the severity of the error.
- (iv) Work crossed out but not replaced should be marked.
- (v) In general, 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 (with no solution offered on the answer line), mark the poorest answer.
- (vi) For methods not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work.
- (vii) Where a follow through mark is indicated on the mark scheme for a particular part question, the marker must ensure that you refer back to the answer of the previous part of the question.
- (viii) Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen, e.g. the answer in the mark scheme is 4.65 and the candidate then correctly rounds to 4.7 or 5 on the answer line. Allow full marks for 4.65 seen in the working.
- (ix) Anything in the mark scheme which is in brackets (...) is not required for the mark to be earned, but if present it must be correct.
- (x) For any question, the range of answers given in the mark scheme is inclusive.

			AVAILABLE MARKS
1	Offer 1 takes £45 off	MA1	3
	Offer 2 takes £60 off	MA1	
	Offer 2 because it takes the greatest amount off	A1	
	Accept correct comparisons of percentages or similar		
2	False	A1	3
	True	A1	
	True	A1	
3	$90 \times 30 (= 2700)$	MA1	2
	$(2700 \div 200 =) 13.5$	A1	
4	$18 + 25 + 23 + 29 + 36 + 24 + 31 + 20 + 21 + 33 = 260$	MA1	3
	$260 \div 10 = 26$	M1 A1	
5	(a) $100 \div 7.99 = 12.51\dots$	MA1	3
	12	A1	
	(b) 4.12	A1	
6	(a) $20 \times 11 + 45$	MA1	3
	265	A1	
	(b) 4 hours 25 mins	A1	
7	(a) $(-2, 3)$ plotted	A1	3
	$(2, -1)$ plotted	A1	
	(b) $(x, -1)$ where $2 < x \leq 5$	A1	

			AVAILABLE MARKS
<b>8</b>	<b>(a) (i)</b> $108^\circ (\pm 2^\circ)$	A1	5
	<b>(ii)</b> $18\,000 \div 360 \times 108$	MA1	
	5 400	A1	
	<b>(b) (i)</b> twice or two times	A1	
	<b>(ii)</b> half or 50%	A1	
<b>9</b>	$8 + 8 + 8 + 8 + 4 = 36$ hours worked	MA1	4
	$537.25 - 36 \times 11.50 = 123.25$	MA1	
	$123.25 \div 7.25$	MA1	
	17	A1	
<b>10</b>	any correct simplified fraction or percentage	MA1	4
	2 or 3 correct simplified fractions or percentages	MA1	
	$\frac{1}{2}, \frac{3}{10}, \frac{1}{2}, \frac{3}{4}$ or 50%, 30%, 50%, 75% all correct	MA1	
	No because face to face is highest	A1	
<b>11</b>	<b>(a)</b> $2a + 3 + 2a + 3 + b - 5$	MA1	5
	$4a + b + 1$	A1	
	<b>(b)</b> $30 - 9 - 1 = 20$ or $4a + 9 + 1 = 30$	MA1	
	$20 \div 4$ or $4a = 20$	MA1	
	5	A1	
<b>12</b>	<b>(a)</b> D or F	A1	3
	<b>(b)</b> A	A1	
	<b>(c)</b> B or C or E	A1	

		AVAILABLE MARKS	
<p><b>13 (a)</b> <math>1306 + 26 \text{ minutes} + 18 \text{ minutes}</math></p> <p><math>= 1350</math></p> <p>Has to wait 34 minutes</p>	<p>M1</p> <p>A1</p> <p>A1</p>	6	
<p><b>(b)</b> <math>1424 - 1509 = 45 \text{ mins } (\frac{3}{4} \text{ hr})</math></p> <p>Speed = <math>\frac{54}{\frac{3}{4}}</math>    <b>or</b>    54 miles in 45 minutes</p> <p style="padding-left: 100px;">18 miles in 15 mins [or 1.2 miles in 1 min]</p> <p><math>= 72</math></p>	<p>MA1</p> <p>MA1</p> <p>A1</p>		
<p><b>14</b> angle BFE = 50, alternate</p> <p>angle BEF = 80, angles on straight line add to 180°</p> <p>angle EBF = 50, angle sum of triangle, so triangle is isosceles</p>	<p>MA1</p> <p>MA1</p> <p>MA1</p>		3
<p><b>15</b> <math>180 - 54 = 126</math></p> <p><math>\frac{126}{180} \times 100</math></p> <p>70</p>	<p>MA1</p> <p>MA1</p> <p>A1</p>		3
<p><b>16</b> <math>4y + 8 = 22</math>    <b>or</b>    <math>(y + 2) = \frac{22}{4}</math></p> <p><math>4y = 14</math>        <b>or</b>    <math>y + 2 = 5.5</math></p> <p><math>y = 3.5</math></p>	<p>MA1</p> <p>MA1</p> <p>A1</p>		3
<p><b>17</b> 16 marked correctly on diagram</p>	<p>MA1</p>		3
<p><math>16 + 6 + 10 = 32</math></p> <p><math>40 - 32 = 8</math></p> <p><b>or</b></p> <p><math>22 + 10 = 32, \quad 40 - 32 = 8</math> (no 16 on diagram)</p>	<p>MA1</p> <p>MA1</p> <p>M1A1 MA1</p>		
			

			AVAILABLE MARKS
<b>18 (a)</b>	150 drinks cost 75 or $25 \times 3 = 75$ 180 crisps cost 36 or $15 \times 2.40 = 36$ 175 bars cost 35 or $35 \times 1 = 35$	M1	
	total cost = 146	MA1	
<b>(b)</b>	$115 \times 1.50 = 172.50$	MA1	
	$35 \times 80p = 28$ $65 \times 50p = 32.50$ $60 \times 30p = 18$	M1	
	total income = 251	MA1	
	$251 - 146 = 105$	A1	6
<b>19 (a)</b>	$\begin{array}{c cccccc} 2 & 3 & 3 & 6 & 7 & 8 \\ 3 & 2 & 6 & 7 & 8 & 8 \\ 4 & 0 & 2 & 5 & 6 & 7 & 9 & 9 \\ 5 & 1 & 3 & 8 & & & & \\ 6 & 2 & & & & & & \end{array}$ Key: $2 3 = 23$		
	M1 correct format for stem and leaf    A1 accuracy    A1 key		
<b>(b)</b>	Median will be lowered	A1	4
<b>20</b>	Option A: $4500 \times 0.035 = 157.50$ $4657.50 \times 0.035 = 163.01$ Interest = 320.51 or Amount = 4820.51	MA1 MA1	
	Option B: $4500 \times 0.05 = 225$ $4725 \times 0.02 = 94.50$ Interest = 319.50 or Amount = 4819.50	MA1 MA1	
	Option A by £1.01	MA1	5
<b>21 (a) (i)</b>	50	A1	
	<b>(ii)</b> gradient = $\frac{150}{2}$ (or equivalent) = 75	M1 A1	
<b>(b)</b>	The mini digger costs £75 a day to hire	A1	4
<b>22</b>	$6y^2 - 14y - 8y$	MA1 MA1	
	$6y^2 - 22y$	MA1	3

			AVAILABLE MARKS
<b>23 (a)</b>	$45 \times 24 \times 18$	M1	
	$= 19440 \text{ cm}^3$	A1 A1 (units)	
	<b>(b)</b> $45 \times 18 \times 2 = 1620$ $24 \times 18 \times 2 = 864$	MA1	
	$45 \times 24 = 1080$	MA1	
	$1620 + 864 + 1080 = 3564$	MA1	
<b>(c)</b>	$45^2 + 24^2 = 2601$	MA1 MA1	9
	$\sqrt{2601} = 51 \text{ cm}$	A1	
<b>24 (a)</b>	<b>(i)</b> $8 \times 7.5 + 3 \times 22.5 + 5 \times 37.5 + 4 \times 52.5 = 525$	MA2	6
	$= \frac{525}{20}$	MA1	
	$= 26.25$	A1	
	<b>(ii)</b> Only an estimate because the data is grouped so we do not know the exact times	A1	
<b>(b)</b>	Positive	A1	
<b>25</b>	Shaded $= \pi \times 6^2$	MA1	4
	$= 113.0973355$ (or $36\pi$ )	A1	
	Semicircle $= \frac{1}{2} \times \pi \times 12^2 = 226.1946711$ (or $72\pi$ )	MA1	
	Unshaded $= 226.1946711 - 113.0973355 = 113.0973356$ (or $72\pi - 36\pi = 36\pi$ )	MA1	
		<b>Total</b>	<b>100</b>