



*Rewarding Learning*

**General Certificate of Secondary Education  
January 2020**

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**Mathematics**

M3

Calculator Paper

Higher Tier

[GMC31]

**MONDAY 13 JANUARY, 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
<b>1</b>	$4.5 \times \pounds 13 = \pounds 58.50$	MA1	4
	$\pounds 92.31 - \pounds 58.50 = \pounds 33.81$	MA1	
	$\pounds 33.81 \div \pounds 4.90$	MA1	
	6.9 kg	A1	
<b>2</b>	<b>(a)</b> Sight of 0.16	MA1	5
	12.5	A1	
	<b>(b)</b> 216	A1	
	<b>(c) (i)</b> 19, 31 and no others	A1	
	<b>(ii)</b> 36, 1, 49 and no others	A1	
<b>3</b>	<b>(a)</b> 1, 5, 9	A1	3
	<b>(b)</b> At least 2 correct points plotted on the graph	MA1	
	correct line drawn	A1	
<b>4</b>	$3 \times 1.4 = 4.2$	MA1	3
	$11.13 \div 4.2$	MA1	
	2.65 m	A1	
<b>5</b>	$360 - (77 + 149 + 52)$	MA1	3
	82	MA1	
	$180 - 82 = 98^\circ$	A1	
<b>6</b>	Evidence of $\times 2$	MA1	4
	angles correct in the table, $130^\circ$ , $64^\circ$ , $92^\circ$ , $46^\circ$ , $28^\circ$	MA1	
	2 or 3 correct sectors drawn	MA1	
	all sectors correct and labelled	A1	

If answer is wrong allow MA1 for 3 correct entries  
and MA2 for 6 correct entries  
from

	Room only	B&B	Half board	
Single			1	
Twin	4			11
Family		3		
		8	10	25

3

8  $\frac{59}{86} \times 100$

M1

68.604...

A1

68.6 %

A1

3

9 (a)  $\pi \times 5^2$

MA1

78.5398...

A1

(b)  $5 \times 10$

MA1

50

A1

(c)  $100 \times 50 = 5000$

MA1

$$50 \times 78.5398 = 3926.99$$

MA1

$$5000 - 3926.99 = 1073.0091...$$

A1

7

10  $42 \times \text{£}2.40 = \text{£}100.80$

MA1

$$34 \times \text{£}3.60 = \text{£}122.40$$

MA1

$$(42 - 34) \times 18 = 144 \text{ left}$$

MA1

$$144 - 12 = 132 \text{ sold}$$

MA1

$$132 \times 35\text{p} = \text{£}46.20$$

MA1

$$(\text{£}122.40 + \text{£}46.20) - \text{£}100.80 = \text{£}67.80$$

MA1

6

			AVAILABLE MARKS
<b>11</b>	$12x + 3$	MA1	4
	$12x + 4$	MA1	
	$12x + 2$	MA1	
	Shape B	A1	
<b>12</b>	Mode = £5	A1	5
	Median = £10	A1	
	Mean = $\frac{5 \times 34 + 10 \times 26 + 20 \times 9 + 50 \times 7 + 100 \times 4}{80}$ ( $= \frac{1360}{80}$ )	MA1	
	= £17	A1	
	Mean makes her statement correct (with all above evidence)	A1	
<b>13</b>	$22 = \frac{w}{1.83^2}$		2
	$w = 22 \times 1.83^2$	MA1	
	$w = 73.7$ (73.6758)	A1	
<b>14</b>	$15x - 10 (= 7x + 4)$	MA1	3
	$15x - 7x = 4 + 10$		
	$8x = 14$	MA1	
	$x = \frac{14}{8}$ or $1\frac{3}{4}$	MA1	
<b>15</b>	$2 \times \pi \times 6 = 37.69911184$	MA2	6
	$\frac{3}{4} \times 37.69911184 = 28.27433388$	MA1	
	$6^2 + 6^2 = 72$	MA1	
	$\sqrt{72} = 8.485281374$	MA1	
	$28.27433388 + 8.485281374 = 36.75(961525)$	MA1	

16 3 and 16 12 and 48 12 and 16 24 and 16  
 or any factor of 48  $\neq$  1 and 48  
 (allow A1 for combinations of 2, 24 or 4, 12 or 6, 8)

A2

2

17  $p^2 - 6p + 2p - 12$

MA1

$p^2 - 4p - 12$

A1

2

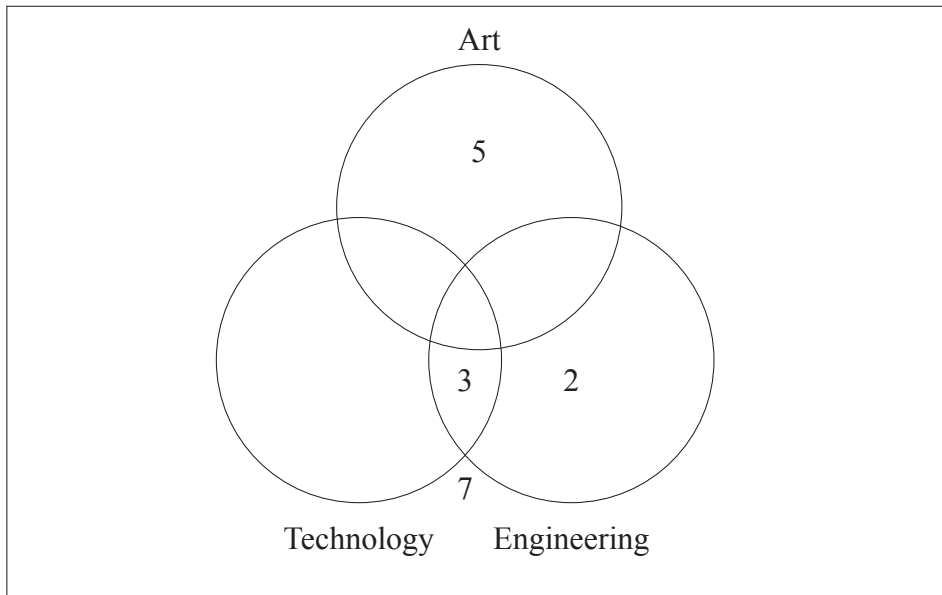
18 (a) 3 in T/E overlap  
 5 in single A section  
 2 in single E section  
 7 in outer box section

A1

A1

A1

A1



(b)  $\frac{6}{20} \times 100$

MA1

= 30%

A1

6

19 (6, -2)

A1 A1

2

20  $\pi \times 6^2 \times 15$

MA1

1696.46(0033) cm<sup>3</sup>

A1 A1 units

3

21 115% = £98.90

MA1

1% = £0.86 (or 100% = £86)

MA1

15% = £12.90 (£98.90 - £86)

MA1

3

			AVAILABLE MARKS
22	$\frac{x(x-2)}{3} \times \frac{6}{(x+4)(x-2)}$ $= \frac{2x}{x+4}$	MA2  A1	3
23	<p>(a) <math>m = \frac{6}{4}</math> or <math>\frac{3}{2}</math> or 1.5</p> <p><math>c = 6</math> <math>y = 1.5x + 6</math></p> <p>(b) Any line of the form <math>y = 1.5x + c, c \neq 6</math></p>	MA1  A1 MA1  A1	4
24	<p><math>\sin 24 = \frac{x}{16}</math></p> <p><math>x = 6.5 \text{ km}</math></p>	MA2  A1	3
25	<p>(a) All the raw data is still visible. (You can see all the test scores)</p> <p>(b) The main summary statistics are clear. (You can see the median and the quartiles)</p>	A1  A1	2
26	<p>(a) <math>84 = 2 \times 2 \times 3 \times 7</math> or <math>2^2 \times 3 \times 7</math> <math>154 = 2 \times 7 \times 11</math></p> <p>(b) <math>\text{HCF} = 2 \times 7 = 14</math></p>	A1 A1  MA2	4
27	<p>Graham <math>x - 1</math> Darren <math>x - 2</math></p> $x + \frac{1}{2}(x - 1) + \frac{1}{3}(x - 2) = 74$ $6x + 3(x - 1) + 2(x - 2) = 444$ $6x + 3x - 3 + 2x - 4 = 444$ $11x = 451$ $x = 41$ <p>Rory            41 golf balls Graham        20 golf balls Darren         13 golf balls</p>	MA1  MA1  MA1  A1  A1	5
		<b>Total</b>	<b>100</b>