



Rewarding Learning

**General Certificate of Secondary Education
2022**

Mathematics

M3

Calculator Paper

Higher Tier

[GMC31]

TUESDAY 24 MAY, MORNING

**MARK
SCHEME**

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.

COVID-19 Context

Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021-2022 only.

			AVAILABLE MARKS
1	$\frac{1}{4}$ of 120 = 30	MA1	
	40% of 120 = 48	MA1	
	$120 - (30 + 48) = 42$	MA1	
	$\frac{42}{120} \left(= \frac{7}{20} \right)$	MA1	
Alternative solution			4
	$25\% + 40\% = 65\%$ or $\frac{1}{4} + \frac{40}{100} = \frac{13}{20}$	M1 A1	
	$100 - 65 = 35\%$ or $1 - \frac{13}{20}$	MA1	
	$\frac{35}{100} \left(= \frac{7}{20} \right)$ or $\frac{7}{20}$	MA1	
2	$180 - 108 = 72$	MA1	3
	$180 - (72 \times 2)$	MA1	
	36	A1	
3	(a) $5^3 = 125$ indicated	A1	3
	(b) (i) 614.125	A1	
	(ii) 600	MA1	
4	(a) 110.4	A1	3
	(b) $110.4 \div 1.8 = 61.333\ldots$	MA1	
	62	A1	
	Alternative solution		
	$32.4 \div 1.8 = 18, 22.8 \div 1.8 = 12.67$ need 13	MA1	3
	$18 + 18 + 13 + 13 = 62$	MA1	
5	$360 \div 72 = 5$	MA1	4
	angles of 105, 60, 55, 140	A1	
	sectors correctly drawn	A1	
	sectors correctly labelled	A1	

6 Debbie: $10 \times 9.50 = 95$ or $6 \times 9.50 + 2 \times 19 = 95$

MA1

Robbie: $9 \times 12 = 108$ or $6 \times 12 + 2 \times 18 = 108$

MA1

Robbie, 13

MA1

AVAILABLE
MARKS

3

7

	T-shirt	Polo shirt	Total
Small	4		11
Medium	8		
Large		9	15
Total		21	

A1

	T-shirt	Polo shirt	Total
Small	4	7	11
Medium	8	5	13
Large	6	9	15
Total	18	21	39

A2

3

(allow A1 for any 2 of 6 missing values)

8 $\pounds 10 - \pounds 2.60 = \pounds 7.40$

MA1

$\pounds 7.40 - \pounds 0.80 = \pounds 6.60$

MA1

$660 \div 55 = 12$

MA1

3

9 (a) $2p + 3c$

A1

(b) $p + \frac{3}{4}c$

A1

(c) $p - 3 + c + 4 = p + c + 1$

A1

3

10 (a) no time period specified

A1

gaps in response section

A1

(b) her sample size is too small

A1

3

			AVAILABLE MARKS
11	$\frac{1}{3}$ of $2\frac{1}{2}$ hours = 50 minutes	MA1	3
	$\frac{1}{2}$ of 50 minutes = 25 minutes	MA1	
	$\frac{25}{150} = \left(\frac{1}{6}\right)$	MA1	
12	$5p - 15 = 20$	MA1	3
	$5p = 20 + 15$ $5p = 35$	MA1	
	$p = 7$	MA1	
	Alternative solution		
	$5(p - 3) = 20$ $p - 3 = 4$	MA1	
	$p = 4 + 3$	MA1	
	$p = 7$	MA1	
13	(a) $\pi \times 250$	MA1	6
	785.3981.....	A1	
	1785.3981.....	A1	
	(b) $2000 \div 14.5$	MA1	
	137.9310.....	A1	
	2 minutes 18 seconds	A1	
14	(a) $4(3x + 5)$	A1	2
	(b) $p(1 - p)$	A1	
15	(a) $\left(\frac{1}{2}, 2\right)$	A1 A1	5
	(b) $\frac{5 - (-1)}{2 - (-1)} = \frac{6}{3}$ or 2	MA1	
	$c = 1$	A1	
	$y = 2x + 1$	A1	

16	$34.2 \times 12 = 410.4$	MA1	3
	0.83×410.4	MA1	
	$= 340.632$	A1	
17	5% of 1600 = £80 → £1680	MA1	3
	5% of 1680 = £84 → £1764	MA1	
	5% of 1764 = £88.20 → £1852.20	MA1	
18	P must be 30	MA1	
	Multiples of 30 are 30 60 90 120 150		
	Multiples of 24 are 24 48 72 96 120 144 ...	MA1	
	LCM = 120	A1	
	Alternative solution		
	$24 = 2 \times 2 \times 2 \times 3$	MA1	
	$(30 = 2 \times 3 \times 5)$		
	LCM = $2 \times 3 \times 2 \times 2 \times 5$	MA1	
	$= 120$	A1	3
19	$x^2 + 5x - 3x - 15$	MA1	2
	$x^2 + 2x - 15$	MA1	
20	(a) Tariff B by £10	A1	6
	(b) (i) £20	A1	
	(ii) any valid comparison, e.g. £5 for 200 mins	M1	
	$= 2.5 \text{ p}$	A1	
	(iii) $T = 20 + 0.025m$	A2	

			AVAILABLE MARKS
21	(a) mid-point \times freq. = $(10 \times 31) + (30 \times 19) + (50 \times 10) + (70 \times 14) + (90 \times 12) + (110 \times 6)$	MA2	6
	Mean = $\frac{4100}{92}$	MA1	
	= 44.565(2173913043)	A1	
	(b) $0 < t \leq 20$	A1	
	(c) $20 < t \leq 40$	A1	
22	distances 44, 52	MA1	4
	$d^2 = 44^2 + 52^2$	MA1	
	$d^2 = 4640$	MA1	
	$d = 68.1(1754546)$	A1	
23	64% = 45360	M1	4
	100% = 70875 or 1% = 708.75	MA1	
	36% = 25515	MA1	
	$\frac{4}{5} \times 25515 = 20412$	MA1	
24	Max area = $85 \times 30.5 = 2592.5$ } Min area = $75 \times 29.5 = 2212.5$ }	MA1	2
	Steve not correct as outside range	MA1	
	Alternative solution		
	Jane $80 \times 30 = 2400$ is acceptable		
	Paula $75 \times 29.5 = 2212.5$ is acceptable	MA1	
	Steve $75 \times 25 = 1875$ is not acceptable as lower bound for width is 29.5 not 25	MA1	

25 Multiplying by 4

$$y + 3 - 8 = 2(3 - 2y)$$

MA1

$$y + 3 - 8 = 6 - 4y$$

MA1

$$5y = 11$$

MA1

$$y = \frac{11}{5} = 2\frac{1}{5}$$

MA1

Alternative solution

$$\frac{1}{4}y + \frac{3}{4} - 2 = \frac{3}{2} - y$$

MA1

$$\frac{1}{4}y + y = \frac{3}{2} + 2 - \frac{3}{4}$$

MA1

$$\frac{5}{4}y = 2\frac{3}{4}$$

MA1

$$y = 2\frac{1}{5}$$

MA1

4

26 $V = \frac{1}{3}\pi \times 3.75^2 \times 5$

MA1

$$= 73.6\text{m}^3$$

A1

2

27 (a) 6, 16, 41, 78, 110, 139, 166, 180

A1

(b) Plot all points correctly (30, 6) (60, 16) (90, 41) etc.
Line/curve through points

MA2

MA1

(c) (i) Reading from graph (approx. = 132)

MA1

(ii) Readings from graph subtracted (approx. $176 - 93 = 83$)

MA2

(d) On average pupils spend more time on their phones than staff
Pupils' results/data are more spread out
Max time spent by pupils a lot more than staff (240 mins compared to 160 mins)
(or any other valid comparisons)

A1 A1 A1

10

Total

100