GCSE MARKING SCHEME

SUMMER 2023

GCSE
MATHEMATICS – COMPONENT 2
(HIGHER TIER)
C300UB0-1

INTRODUCTION

This marking scheme was used by WJEC for the 2023 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

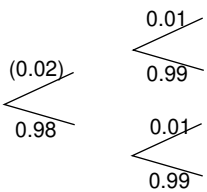WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

EDUQAS GCSE MATHEMATICS

SUMMER 2023 MARK SCHEME

Component 2: Higher Tier	Mark	Comments
1.*(a) $\dfrac{675}{45\times60}$ oe 0.25 (N/cm^2)	M1 A1	
1.*(b) $0.75 \times (45 \times 60)$ or 675×3 2025 (N)	M1 A1	FT 'their 2700' from (a) if necessary
	(4)	
2.*(a)(i) 2014 and 2016	B1	
2.(a)(ii) No and valid explanation e.g. one of the following: 'There is no data for 2009' 'The data is only for even-numbered years.' 'The lines joining the points on a time-series graph have no value.' 'The graph shows 'households' and Jane mentions 'people''	E1	Allow one of the following: 'There is no point on 2009' 'We can't tell the % exactly between the even years' 'It could be higher or lower between the plotted points'
2.(b)(i) All points correctly plotted	P1	Check overlay for tolerance Allow if plots are correct but incorrectly joined.
2.(b)(ii) 2018	B1	FT 'their plotted points' providing at least 5 points correctly plotted and a unique solution
2.(b)(iii) Comment that includes words indicating internet keeps on increasing whereas desktop ownership decreases (after 2014)	E1	A comment does not need to mention the years but must imply computer ownership **and** internet connection. Allow 'the county will follow a similar trend to Eduvale'
	(5)	
3(a) An appropriately worded question e.g. How much money do you spend each month on Pop? AND An appropriate set of response boxes (£)0 (£)1 – (£)3 (£)4 – (£)6 More than (£)6	B2	Question must include 'each month' oe, Allow 'how many bottles' A minimum of 3 response boxes which must cover all options including 0 AND 'no upper limit' AND no overlap Award B1 for an appropriately worded question with no more than 'one identified error' from above response boxes Award SC1 for question that includes 'per week' or 'per day' and fully correct set of response boxes.

3.(b)(i) $\frac{87}{200}$ or 0.435 or 43.5%	B1	
3.(b)(ii) $\frac{43}{200}$ or 0.215 or 21.5%	B1	
		Note: Allow SC1 for both answers correct but in incorrect form. i.e. '87 out of 200' AND '43 out of 200'
	(4)	
4.*(a) $8.2^2 - \pi \times \left(\frac{8.2}{2}\right)^2$ oe	M3	M2 for sight of (area of circle =) $\pi \times \left(\frac{8.2}{2}\right)^2$ $(= 52.81….)$ oe or M1 for sight of (area of square =) 8.2^2 (= 67.24) AND for (radius of circle =) 4.1 (look on diagram) May be embedded in an incorrect calculation
14.4 or 14.42 to 14.46 (cm²)	A1	Allow 14 only if from correct working
4.(b) 7 x 9.8 x 16	M2	M1 for 7 x 9.8 (=68.6)
1097·6 or 1098 (cm³)	A1	
	(7)	
5.*(a) $5x = 8$	B1	
$x = 1.6$ or $\frac{8}{5}$ ISW	B1	FT from $ax = 8$, $a \neq 1$ or $5x = b$ Accept $\frac{8}{a}$ or $\frac{b}{5}$ but if on FT either simplifies to an integer the answer must be given as an integer. '$x =$' can be omitted but must not be wrong if there. Correct answer implies first B1.
5.(b) (number of apples =) $x + 2$ si	B1	Not implied by use of numerical trials Note: do not award B1 for x + 2 = 545 oe
$30x + 25(x + 2) = 545$ oe	M1	FT 'their $x + 2$' providing binomial in x; brackets may be omitted
$55x + 50 = 545$ oe $x = 9$	m1 A1	Expands the brackets and simplifies CAO (no FT as needs to be an integer answer) If M0A0 award either: SC2 for an answer of 9 if unsupported or from trials. SC1 if 9 only seen in embedded working.
5.(c) $(x+1)(x+4)$	B2	B1 for a pair of brackets that expand to give $x^2 + 5x \pm a$ OR $x^2 \pm bx + 4$
	(8)	

6*(a) 3000×1.04^5	M1	Or equivalent full and complete method
$= (£)3649.95(87..)$ or $(£)3649.96$ or $(£)3650$	A1	
$\frac{3649.96 - 3000}{3000} (\times 100)$ oe AND $\frac{3 \times 190}{3000} (\times 100)$ oe OR $\frac{3649.96 - 3 \times 190}{3000}$ $(\times 100)$	M2	FT 'their 3649.96' provided M1 previously awarded M1 for either $\frac{3649.96 - 3000}{3000} (\times 100)$ or $\frac{3 \times 190}{3000} (\times 100)$ provided M1 previously awarded
A indicated AND 2.7(%) or 2.66...(%)	A1	FT. Allow 2(%) or 2.6(%) or 3(%).
Valid assumption e.g. 'Account A interest rate stays the same' 'Account A interest rate **does not** vary' 'Account A interest rate **does not** go up or down'	E1	Do not allow 'Account A, interest rate can vary' 'Account A interest rate is not guaranteed'
Alternative method *$1.04^5 \times 100 - 100$ oe*	*M2*	*$= 1.2166.... \times 100 - 100$* *M1 for 1.04^5*
21.7(%) or 21.66....(%)	*A1*	Allow 21(%) or 21.6(%) or 22(%)
$(3 \times 190) \div 3000 (\times 100) (=19\%)$	*M1*	*FT providing M1 previously awarded*
A indicated AND 2.7(%) or 2.66...(%)	*A1*	*FT providing M1 M1 previously awarded* Allow 2(%) or 2.6(%) or 3(%)
Valid assumption e.g. *'Account A interest rate stays the same'* *'Account A interest rate **does not** vary'* *'Account A interest rate **does not** go up or down'*	*E1*	*Do not allow* *'Account A - interest rate can vary'* *'Account A interest rate is not guaranteed'*
6.(b) Valid impact based on assumption e.g. 'Even if the interest rate went up, the answer would still be account A but the difference would be more.' 'If the interest rate went down, account A may not have the greater increase.' 'If the interest rate doesn't stay the same, then Account A could have even more money than B or less than B'	E1	If no valid assumption is made then this mark cannot be awarded. E0E1 not allowed. Allow 'the answer <u>could</u> be different'. Do not allow 'the answer could be wrong'.
	(7)	

7.		
Arc (of circle) centre *A* radius 5.5 cm	B1	± 2mm
Correct perpendicular bisector construction with appropriate arcs	B2	B1 for perpendicular bisector within tolerance (± 2°) without arcs or with invalid arcs
Correct area shaded or indicated	B1	FT provided at least B1 previously awarded for a closed region bounded by an attempt at a perpendicular bisector, with or without arcs, and the arc of a circle centre *A*
	(4)	
8.*		Degree symbol may be omitted throughout; lengths may be in metres throughout
Use of right-angled triangle with trigonometry with 3° or 87° correctly indicated with 2.5 used as a side.	S1	Angle may be marked on diagram; trig ratio used may not be correct at this stage
(vertical height =) 2.5 tan 3º or $\dfrac{2.5}{\tan 87^0}$	M2	M1 for $\tan 3^0 = \dfrac{?}{2.5}$ or $\tan 87^0 = \dfrac{2.5}{?}$
0.1(3...) (km)	A1	Not from wrong working e.g. 2.5sin(3)
		If units are stated, they must be correct but ISW any attempt at a unit change after a correct answer has been seen
		Unsupported 0.1(3…) is awarded S1 only
Alternative method		
Use of right-angled triangle with trigonometry with 3° or 87° correctly indicated with 2.5 used as a side.	*S1*	*Angle may be marked on diagram; trig ratio used may not be correct at this stage*
(vertical height =) $\dfrac{2.5 \times \sin 3}{\sin 87}$	*M2*	*M1 for* $\dfrac{2.5}{\sin 87} = \dfrac{x}{\sin 3}$ *oe*
0.1(3...) (km)	*A1*	*Unsupported 0.1(3…) is awarded S1 only*
	(4)	
9.(a)		
Correctly completes the tree diagram	B1	0.98 correctly placed

	B1	0.01 and 0.99 correctly placed on both pairs of branches
9.(b)(i)		
0.98 × 0.99	M1	FT 'their 0.98 and 0.99' from their tree diagram provided they are less than 1
0.9702 or $\dfrac{4851}{5000}$ oe	A1	FT Allow 0.97 from correct working (not if unsupported)
9.(b)(ii)		
(0.02 × 0.99) + (0.98 × 0.01)	M2	For M1 or M2, FT their probabilities from their tree provided they are less than 1
		M1 for either (0.02 × 0.99) or (0.98 × 0.01)
0.0296 or $\dfrac{37}{1250}$ oe	A1	FT Allow 0.03 from correct working (not if unsupported)
	(7)	

10.			
$(5x \times 4x)(x + 4x) = 172.8$ or better		M2	M1 for $5xy(x + y) = 172.8$ Allow M1 for one of the following: • $x + y \times 5xy = 172.8$ • $5xy \times x + y = 172.8$ • $20x^2 \times 5x$
$20x^2 \times 5x = 172.8$ or better		M1	FT 'their derived $(5x \times 4x)(x + 4x)$'
$x = 1.2$		A1	CAO
(Area patio =) 23.04 (m²)		B1	FT $(4 \times$ 'their 1.2')² provided at least 2 marks previously awarded
Alternative method			
$(5 \times \frac{y}{4} \times y)\left(\frac{y}{4} + y\right) = 172.8$ *or better*		M2	M1 for $5xy(x + y) = 172.8$ *Allow M1 for one of the following:* • $x + y \times 5xy = 172.8$ • $5xy \times x + y = 172.8$ • $\frac{5y^2}{4} x \left(\frac{y}{4} + y\right)$
$\frac{5}{4}y^2 \times \frac{5}{4}y = 172.8$		M1	*FT 'their derived* $(5 \times \frac{y}{4} \times y)\left(\frac{y}{4} + y\right)$'
$y = 4.8$		A1	*CAO*
(Area patio =) 23.04 (m²)		B1	*FT ('their 4.8')² provided at least 2 marks previously awarded*
		(5)	

11.			
			FT each step until second error
$a = 7x + 7y^5 + 2$		B1	Expand brackets
$a - 7x - 2 = 7y^5$		B1	Isolate $7y^5$
$\frac{a - 7x - 2}{7} = y^5$		B1	Isolate y^5
$y = \sqrt[5]{\frac{a - 7x - 2}{7}}$		B1	Mark final answer
Alternative method			*FT each step until second error*
$a - 2 = 7(x + y^5)$		B1	
$\frac{a-2}{7} = x + y^5$ *or* $a - 2 = 7x + 7y^5$		B1	
$\frac{a-2}{7} - x = y^5$ *or* $\frac{a-2-7x}{7} = y^5$		B1	
$y = \sqrt[5]{\frac{a-2}{7} - x}$ *or* $y = \sqrt[5]{\frac{a-2-7x}{7}}$		B1	*Mark final answer*
		(4)	

12			

Range	Median	LQ	UQ	IQR
34	174	168	186	18

B3	If IQR not 18, FT IQR from 'their UQ-LQ' B2 for 4 correct values OR B1 for correct values for any one of the following: • Range • Median and IQR • LQ and UQ
(3)	

13.(a) Valid explanation e.g. 'When the second reduction is made, it is not 15% of the original amount, so the reduction is less than 35%.' or 'The reduction is 32% not 35%.' or 'It is 15% of 80% not 15% of 100%'	E1	
13.(b) 306 000 $\div$ 0.85 oe, si $\div$ 0.8(0) oe, si (£)450 000	M1 M1 A2	Method marks can be awarded in either order Notes: M2 for $\div$ 0.68 OR $\div$ (0.8 × 0.85) M1 for $\div$ 0.8 × 0.85 OR × 0.85 $\div$ 0.8 unless the answer is (£)450 000 which is awarded M2 A2 A1 for sight of one of the following • 360 000 (from 306 000 $\div$ 0.85) • 382 500 (from 306 000 $\div$ 0.8) • 288 000 (from 306 000 $\div$ 0.85 × 0.8) • 325 125 (from 306 000 $\div$ 0.8 × 0.85) An answer of (£)450 000 which is awarded 4 marks unless incorrect working seen.
	(5)	
14.(a) (1 078 500 + 249 350 =) 1 327 850 (km^2)	B2	B1 for 1327300 < answer < 1328400
14.(b) 81 500 000 $\dfrac{81\,500\,000 \le \text{min pop} < 82\,000\,000}{1\,327\,850}$ 61(.377...) (people/km^2) ISW	B1 M1 A1	FT their (a) FT only for 81 500 000 $\div$ their (a)
	(5)	
15.(a) $-6 \le x \le 6$ or	B3	B2 for one of the following • $-6 \le x < 6$ • $-6 < x \le 6$ • $-6 \le x$ **or** $x \le 6$ • $-6 < x < 6$ B1 for one of the following: • $(x-6)(x+6)$ • $x \le 6$ • $x = \pm 6$
15.(b) Correct parabola starting at $(-6, 0)$ and ending at $(6, 0)$.	B2	B1 for correct parabola going through and extending beyond (-6, 0) and (6, 0). FT their (a) for B1 if possible.
	(5)	
16. (area sector =) $\dfrac{62}{360} \times \pi \times 15^2$ 121.7(3...) (area triangle =) $\dfrac{1}{2} \times 15 \times 8 \times sin(90 - 62)$ 28.17 or 28.168(2....) A sum of correct areas that rounds to 150 e.g. 121.7(3...) + 28.16(8...) = 149.9... (=150)	M1 A1 M1 A1 B1	 CAO; accept $\dfrac{155}{4}\pi$; allow 122 FT 'their derived 28°' but must use 15 and 8 m; allow 28 or 28.2 CAO; sight of 149.9(0…) implies 5 marks providing M1 M1 awarded Allow e.g. 122 + 28.2 = 150.2 but not 122 + 28 = 150
	(5)	

17.(a) $x^2 + \frac{1}{x} = 2x + 1$ $x^3 + 1 = 2x^2 + x$ Correct completion to $x^3 - 2x^2 - x + 1 = 0$	M1 M1 A1	
17.(b) $(x =)$ –0.8, 0.5 or 0.6, 2.2 or 2.3	B2	B1 for any two correct or for answers given as coordinates or for 3 correct values not rounded to 1dp (–0.8019…, 0.5549…, 2.246…)
	(5)	
18.(a) $f^{-1}(x) = \sqrt[3]{x}$	B1	$f^{-1}(x) =$ may be omitted
18.(b) $g(x) = 125x^3 - 75x^2 + 15x - 1$	B3	Mark final answer; $g(x) =$ may be omitted B2 for either of: A correct unsimplified answer $125x^3 - 25x^2 - 25x^2 + 5x - 25x^2 + 5x + 5x - 1$ OR $(25x^2 - 5x - 5x + 1)(5x - 1)$ expanded with three of the four terms correct OR $(25x^2 + 10x + 1)(5x -1) = 125x^3 +25x^2 - 5x -1$ B1 for attempt at expansion of $(25x^2 - 5x - 5x + 1)(5x - 1)$
	(4)	
19.(a) $(BC =) \frac{13}{sin67°} \times sin38°$ 8.7 or 8.69(4...) (cm)	M2 A1	Degree symbol may be missing throughout M1 for $\frac{BC}{sin38°} = \frac{13}{sin67°}$ Allow 9 from correct working
19.(b) $(EF =) \sqrt{6^2 + 11^2 - 2(6)(11)cos43}$ 7.77 to 7.8 (cm)	M2 A1	M1 for $EF^2 = 6^2 + 11^2 - 2(6)(11)cos43$ $(=60(.46...))$ Allow 8 from correct working
	(6)	
20.(a) 5040	B2	B1 for 7×6×5×4×3×2(×1) or 7!
20.(b) 720	B2	B1 for 6×5×4×3×2(×1×1) or 6! or 'their 5040' ÷ 7
20.(c) $\frac{4320}{5040}$ or $\frac{6}{7}$ oe; ISW	B1	FT $\frac{'their\ derived\ 5040 - 720'}{'their\ derived\ 5040'}$
	(5)	

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21.		
(Depth of water =) 15 (cm)	B2	May be embedded in later working B1 for $\frac{6}{20} \times 50$ oe
$\frac{1}{3}\pi \times 20^2 \times 50 - \frac{1}{3}\pi \times 6^2 \times 15$ $\underline{(20000\pi)}$ - $\underline{(540\pi)}$ oe $\quad\quad 3 \quad\quad\quad\quad\quad 3$ $20943.95102 - 565.4866776$	M2	FT provided B1 previously awarded for M2 M1 for $\frac{1}{3}\pi \times 20^2 \times 50$ or $\frac{1}{3}\pi \times 6^2 \times 15$
$\frac{19460}{3}\pi$ or 20378(.464...) si	A1	FT from M2 only
20378(.464...) ÷ 1000 × 10 oe	M1	FT 'their derived volume' providing at least 3 marks previously awarded
204 or 203.7 to 203.8 (seconds)	A1	CAO
Alternative method		
(Depth of water =) 15 (cm)	*B2*	*May be embedded in later working* *B1 for $\frac{6}{20} \times 50$ oe*
(Time to fill initial volume =) $\left(\frac{1}{3} \times \pi \times 6^2 \times 15\right) \div 1000 \times 10$	*M2*	*FT provided B1 previously awarded for M2* *M1 for $\frac{1}{3} \times \pi \times 6^2 \times 15$*
5.6548 (s) si	*A1*	*FT from M2 only*
$5.6548\ldots \times \frac{20^3}{6^3} - 5.6548\ldots$ *oe*	*M1*	*FT 'their derived volume' providing at least 3 marks previously awarded* *Must be a complete method to find the time needed*
204 or 203.7 to 203.8 (seconds)	*A1*	*CAO*
	(7)	
22.(a) +3	B1	Allow 'Plus 3' but not 3
22.(b)(i) Correct rearrangement to $x = \sqrt{\frac{2x+5}{x}}$	B1	Allow working back from $x = \sqrt{\frac{2x+5}{x}}$ to $x^3 - 2x - 5 = 0$
22.(b)(ii) $x_2 = \sqrt{\frac{9}{2}}$ or 2.12(...)	M1	
$x_3 = 2.08(\ldots)$ $x_4 = 2.09(\ldots)$ $x_5 = 2.09(\ldots)$	m1	Allow omission of $x_5 = 2.09...$; allow for $x_3 = 2.09$ $x_4 = 2.1(0)$ $x_5 = 2.09$ (from rounding consistently to 2dp)
$(x =) 2.1$	A1	Allow omission of $x_5 = 2.09...$, ignore extra iterations if listed; answer without/with incorrect working does not imply the method marks
	(5)	

23.		
Correct calculation for the area using 4 trapezia e.g. $\frac{1}{2} \times 3 \times (4 + 7)$ $+ \frac{1}{2} \times 3 \times (7 + 8)$ $+ \frac{1}{2} \times 3 \times (8 + 7)$ $+ \frac{1}{2} \times 3 \times (7 + 4)$ $\qquad (=16.5 + 22.5 + 22.5 + 16.5)$ or $2\left(\frac{1}{2} \times 3 \times (4 + 7) + \frac{1}{2} \times 3 \times (7 + 8)\right)$ $\qquad (=2(16.5 + 22.5))$	M3	May be embedded in further work Or equivalent correct calculation e.g. $\frac{1}{2} \times 3 \times (4 + 4 + 2(7 + 8 + 7))$ OR for the sum of the compounded areas (formed by splitting of the correct trapezia) e.g. (12+4.5)+(21+1.5)+(21+1.5)+(12+4.5) from using rectangles and triangles
		M2 for the sum of the 4 correct trapezium areas with at most one error (possibly repeated) in the y-values OR for the sum of the compounded areas (formed by splitting of the correct trapezia) with at most one error (possibly repeated) e.g. rectangles and triangles M1 for the sum of the 4 correct trapezium areas with at most 2 errors included (possibly repeated) errors in the y-values OR for the sum of the compounded areas (formed by splitting of the correct trapezia) with at most 2 errors (possibly repeated) Note: If including the volume, values are: 2(825 + 1125) = 3900 If including volume and cost, values are: 2(206250 + 281250) = 975000
78 (m²)	A1	CAO
78 × 50 × 250	M1	FT If no marks awarded FT 'their area' if in the range 76-80 providing answer derived from incorrect 'trapezia'
(£) 975 000	A1	FT
	(6)	