GCSE MARKING SCHEME

AUTUMN 2022

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

INTRODUCTION

This marking scheme was used by WJEC for the 2022 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

AUTUMN 2022 MARK SCHEME

Component 2: Higher Tier	Mark	Comment
1.*(a)(i) $\frac{5}{12}$	B1	ISW
1.(a)(ii) $\frac{18072}{12} \times 7$ (£)10542	M1 A1	FT 'their 2 + 3 + 7' from (a)(i) provided > 10
1.(b) $\frac{80}{32} (\times 100)$ or 2.5 (× 100) 250(%)	M1 A1	Mark final answer If no marks, award SC1 for an answer of 150(%) (using a profit of £48)
	(5)	
2.*(a) $(650 \times 8 + 750 \times 7 + 850 \times 4 + 950 \times 11)$ $\div 30$ 810 (grams)	M1 m1 A1	(= 24300)
2.(b) Valid comment e.g. 'Her answer will be an underestimate.' 'She is using the lowest values so the mean will be too small'.	E1	Allow answers that state that the calculated mean will be smaller or indicate that the lowest values do not represent the groups, e.g. 'Her method will give a smaller mean.' 'Because these values do not represent the entire range.' 'Because she ignored the distribution in each interval.' 'Because she is using the minimum masses making at an unfair estimate.' Do not allow e.g. 'She has used the smallest value in each group.' 'Because these values are the lowest bounds.' 'Because it is not as accurate as the midpoints.' 'It is better to use the midpoints'
	(4)	

3.*(a) Valid criticism e.g. 'There are no points above the line.' 'There should be some points above and below the line.' 'It does not follow the trend of the data.'	E1	Allow e.g. 'She has just joined the first point to the last.' 'It is not through the middle of the points.' 'It is not in between all the points.' Do not allow e.g. 'The line is in the wrong place.' 'It does not go through many points.'
3.(b) No indicated and valid comment e.g. 'Correlation does not imply causation.' or 'There could be another reason such as owning a dog for example would mean you took more exercise.'	E1	Allow e.g. 'There is no relationship between them, it is just a coincidence.' 'Owning a pet has nothing to do with going to the doctors.'
	(2)	
4.* $5000 \times 1.02^5 \times 1.013^4$ oe, si	M3	Method for M3 or M2 may be seen in stages M2 for use of ….$\times 1.02^5$ or ..$\times 1.013^4$ oe Note: $5000 \times 1.02^5 = 5520.40\ldots$ and $5000 \times 1.013^4 = 5265.11\ldots$ M1 for use of $\times 1.02$ or ..$\times 1.013$ oe Note: 5000×1.02 (= 5100) or 5000×1.013 (= 5065)
(£) 5813.11... or £5813.10 or (£)5813	A1	CAO A1 only from fully correct working.
	(4)	
5.*(a) 7 000 000 indicated	B1	
5.(b) $\frac{1}{2} \times (79 + 62) \times 30$ oe	B1	(= 2115)
$\pi(30 \div 2)^2$	B1	(= 706.858...)
(½ × (79 + 62) × 30 − π × 15^2) ÷ (π × 15^2)	M2	dep on at least B1 awarded; FT 'their area of circle' or 'their area of trapezium' for M2 or M1 (= (2115 – 225π) ÷ 225π)
OR ½ × (79 + 62) × 30 ÷ (π × 15^2) – 1		Award M1 for one of the following: • ½ × (79 + 62) × 30 − π × 15^2. (= 1408.1..) • ½ × (79 + 62) × 30 ÷ (π × 15^2). (= 2.99..) • (706.9 : 2115) = 1 : 2.9(9..) or 1 : 3
(k =) 1.9(921...) si	A1	CAO
(k =) 2	B1	FT 'their 1.99...' rounded to 1 sig fig, providing at least M1 previously awarded and a ratio obtained (not for rounding an area). An answer of (k =) 2 implies the previous A1 if no incorrect working seen e.g. 706.9 : 1408 = 1 : 2 *Note: unsupported answers of 1:2 or k = 2 or are awarded zero marks*
	(7)	

6.*(a) $5x - 2x = 6 - 4$ or $3x = 2$ oe $(x =)\ \frac{2}{3}$, ISW	B1 B1	Allow 0.67 or 0.666 but not 0.66 FT from $ax = 2$, $a \neq 1$ or $3x = b$ accept $\frac{2}{a}$ or $\frac{b}{3}$ but if on FT either simplifies to an integer the answer must be given as an integer. Correct answer implies first B1 unless incorrect working seen. **Maximum of 1 mark if not fully correct**
6.(b) $4x > 17 + 3$ oe $x > 5$	M1 A1	Mark final answer; no marks for use of "=", unless finally replaced to give $x > 5$ then award M1 A1.
6.(c) Method to eliminate an unknown e.g. equal coefficients and subtraction or rearranges one equation and substitutes into the other Finds one unknown Finds the other unknown	 M1 A1 A1	No marks for T&I; no marks for an unsupported answer. Allow one error in one term, not in the equated coefficients if appropriate CAO; $x = 2,\ y = -3$ FT 'their x' or 'their y' used in one of their equations
	(7)	

7.* Uses *EC* = 6 oe correctly in a trigonometric statement	S1	
(BC=) $\frac{6}{\cos 35}$ or $\frac{6}{\sin(90-35)}$	M2	Allow equivalent complete methods for M2 or M1 M1 for cos35 = $\frac{6}{BC}$ or sin(90 – 35) = $\frac{6}{BC}$ oe
(*BC* =) 7.3(246...) si	A1	May be implied by a correct expression for the perimeter e.g $\frac{24}{cos35}$ or $\frac{24}{sin55}$ oe
(perimeter =) 4 × 7.3(246...) si	M1	FT 'their derived *BC*' providing S1 previously awarded and their *BC* > 6
(perimeter =) 29.2(...) or 29.3 or 29 (cm)	A1	FT
	(6)	
8.(a) *t* 0 1 2 3 4 5 *h* 12 18 18 12 0 –18	B2	B1 for any two correct
8.(b) All 6 correct points plotted correctly and joined with a smooth curve	B2	Mark intent B1 for a smooth curve at least through 4 correct pairs of coordinates or for all of their 6 pairs of coordinates plotted correctly Allow 2 marks here if curve correct even if there is a slip in their table
8.(c)(i) 12 (metres)	B1	FT 'their *h*' when *t* = 0
8.(c)(ii) 4 (seconds)	B1	
8.(c)(iii) 1.5 (seconds)	B1	
8.(c)(iv) 18.75 (metres)	B1	Allow 18.5 to 19 inclusive (from their graph)
	(8)	

9. (Radius of cylinder =) 3 (cm) si	 B1	Multiplications can take place in any order May be implied by e.g. $d = 6$
(Number of cylinders in crate =) 80	B1	May be implied in later working
$\pi \times 3^2 \times 32$	M1	(288π or 904.7(7..) to 904.9 cm^3)
$\times$ 0.961	M1	(869.4 to 869.6(0…) g) FT 'their derived volume' providing it is a multiple of π. May use 0.000 961 (kg/cm^3); allow multiplication by figs 961 if a unit conversion error
$\times$ 80	M1	FT 'their 80' $\times$ 'their derived volume or mass'
= 69 552 to 69 569 (g)	A1	CAO
No indicated (with sight of 69(.) kg or 70 000 g)	A1	FT 'their 69 552 to 69 569 (g)' providing at least M2 previously awarded and no incorrect conversion to kg seen
Alternative method *(Radius of cylinder =) 3 (cm) si*	 *B1*	 *May be implied by e.g. d = 6*
(Number of cylinders in crate =) 80	*B1*	*May be implied in later working*
$\pi \times 3^2 \times 32$	*M1*	*(288π or 904.7(7..) to 904.9 cm^3)*
$\times$ 0.961	*M1*	*(869.4 to 869.6(0…) g)* *FT 'their derived volume' providing it is a multiple of π.* *May use 0.000 961 (kg/cm^3); allow multiplication by figs 961 if a unit conversion error*
= 869.5 to 869.7(g)	*A1*	*FT 'their 6 ÷ 2' and possibly figs 961* *Allow e.g. 870 if correct working seen*
70 000 ÷ 80 (= 875 (g))	*M1*	
No indicated (with sight of 869(.) g and 875 g)	*A1*	*FT 'their 869.5 to 869.7(g)' or 'their 870' providing at least M2 previously awarded*
	(7)	
10. (1 – 0.198) $\times$ (1 – 0.065) oe, si	 M1	 0.802 $\times$ 0.935 Allow one error in subtractions.
0.749 87 oe, si	A1	CAO; allow 75% following full and correct working
(1 – 0.749 87) $\times$ 100 oe, si	M1	FT 'their derived 0.749 87' providing < 1 and ≠ 0.802 or 0.935; allow for sight of 1 – 0.749 87 or 0.25013
25.013 (%)	A1	FT (1 – 'their 0.749 87') $\times$ 100 Allow 25% following full and correct working
	(4)	

<table>
<tr><td>11. (a)
Correct box plot with:
Median at 19.4
Lower quartile at 16.8
Upper quartile at 21.0
Left whisker to 15.2
Right whisker to 23.2</td><td>B3</td><td>B1 for UQ = 21(.0) si; may not be in a box plot
B1 for LQ, Median, UQ positioned correctly in a box plot,
B1 for correct whiskers</td></tr>
<tr><td>11.(b)(i)
Correct indicated and valid explanation e.g.
‘The median for group B is lower.’ or ‘The median (for group A is 19.4 and) for group B is 18.8.’</td><td>E1</td><td></td></tr>
<tr><td>11.(b)(ii)
Not correct indicated and valid explanation e.g.
‘The lower quartile for B is more than 17 but the lower quartile for A is less than 17.’</td><td>E1</td><td>Allow:
Not correct and ‘Group A had a lower quartile less than 17’</td></tr>
<tr><td></td><td>(5)</td><td></td></tr>
<tr><td>12.

One correct evaluation with $1 \le x \le 2$

Two correct evaluations with $1.55 \le x \le 1.75$ and one > 0, one < 0 si

Two correct evaluations with $1.65 \le x \le 1.75$ and one > 0, one < 0 si

1.7</td><td>

B1

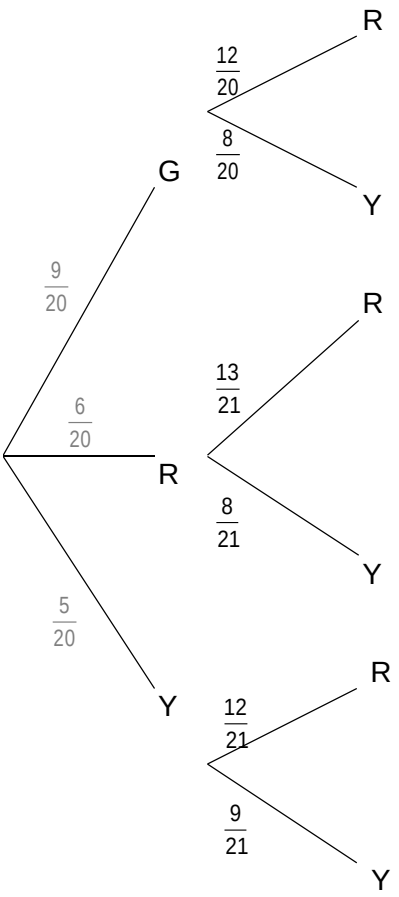
B1

M1

A1</td><td>Correct evaluation enough to imply > 0 or < 0; If evaluations not seen then may be implied by e,g, ‘too big’ or ‘too small’;
Mark solving $2x^3 + x^2 = 12$ equivalently

<table>
<tr><td colspan="2">x</td><td>$2x^3 + x^2 - 12$</td><td>or</td><td>$2x^3 + x^2$</td></tr>
<tr><td>1</td><td></td><td>–9</td><td></td><td>3</td></tr>
<tr><td>1.1</td><td></td><td>–8.128</td><td></td><td>3.872</td></tr>
<tr><td>1.2</td><td></td><td>–7.104</td><td></td><td>4.896</td></tr>
<tr><td>1.3</td><td></td><td>–5.916</td><td></td><td>6.084</td></tr>
<tr><td>1.4</td><td></td><td>–4.552</td><td></td><td>7.448</td></tr>
<tr><td>1.5</td><td></td><td>–3</td><td></td><td>9</td></tr>
<tr><td></td><td>1.55</td><td>–2.149...</td><td></td><td>9.850...</td></tr>
<tr><td>1.6</td><td></td><td>–1.248</td><td></td><td>10.752</td></tr>
<tr><td></td><td>1.65</td><td>–0.293...</td><td></td><td>11.706...</td></tr>
<tr><td>1.7</td><td></td><td>0.716</td><td></td><td>12.716</td></tr>
<tr><td></td><td>1.75</td><td>1.781...</td><td></td><td>13.781...</td></tr>
<tr><td>1.8</td><td></td><td>2.904</td><td></td><td>14.904</td></tr>
<tr><td>1.9</td><td></td><td>5.328</td><td></td><td>17.328</td></tr>
<tr><td>2</td><td></td><td>8</td><td></td><td>20</td></tr>
</table>

If no marks, award SC2 for a complete method with a final answer of 1.1 from
$(2x)^3 + x^2 - 12 = 0$ or $(2x)^3 + x^2 = 12$</td></tr>
<tr><td></td><td>(4)</td><td></td></tr>
</table>

13.(a) 2651.25 (mm)	B1	
13.(b) Max length + max length attempted 2.855 + 1.905 OR 2.85 + 1.90 + 0.01 4.76 (m)	S1 M1 A1	Allow for a + b where $2.85 < a \leq 2.855$ and $1.90 < b \leq 1.905$. May be in cm. May be in cm; implies S1 CAO
	(4)	
14.(a) Correct tree diagram e.g.  	B3	B1 for each pair of branches correct Allow equivalent fractions in all cases.
14.(b) $\left(\frac{6}{20}\times\frac{13}{21}\right)+\left(\frac{5}{20}\times\frac{9}{21}\right)$ oe $\frac{123}{420}$ or $\frac{41}{140}$ oe, ISW	 M2 A1	Check tree diagram FT 'their probabilities' for M2 or M1, providing at least B1 awarded in (a) M1 for sight of one correct product FT 'their tree diagram'
	(6)	

15.(a) $2x(3x+2)+4\times 2$ or $2(2x+4)+3x(2x)$ or $2 \times 4 + 2x \times 2 + 2x \times 3x$	B1	
$6x^2+4x+8=10$ or better	M1	
$6x^2+4x-2=0$ leading to $3x^2+2x-1=0$	A1	
15.(b) $(3x-1)(x+1)=0$	M2	The work for M2 A1 may be seen in (a). Allow the marks if this is the case. Allow '= 0' to be omitted If not M2, award M1 for $(3x...1)(x...1)=0$
$x=\frac{1}{3}$	A1	**Strict FT** from 'their pair of brackets' provided equivalent level of difficulty, with at least one answer a positive fraction; ignore any negative solution if stated
Correct perimeter calculation or expression e.g. $\frac{2}{3}+4+1+2+\frac{2}{3}+1+4+2$ oe or $2x+4+3x+2+2x+3x+4+2$ or $10x + 12$ oe	M1	FT 'their x' providing at least M1 previously awarded and $x > 0$. Also, if M0 previously awarded, allow the use of $x=\frac{1}{3}$ (from calculator use) for this M1 and possible A1.
$15\frac{1}{3}$ (m) oe	A1	FT
Alternative method: $(x=)\frac{-2\pm\sqrt{2^2-4(3)(-1)}}{2(3)}$	*M1*	The work for M2 A1 may be seen in (a). Allow the marks if this is the case. ***Substitution into the formula must be seen for M1, otherwise award M0 M0 A0.***
$(x=)\frac{-2\pm\sqrt{16}}{6}$	*m1*	*Can be implied from at least one correct value of x evaluated.*
$x=\frac{1}{3}$	*A1*	*ignore any negative solution if stated*
Correct perimeter calculation or expression e.g. $\frac{2}{3}+4+1+2+\frac{2}{3}+1+4+2$ *oe or* $2x+4+3x+2+2x+3x+4+2$ or *$10x + 12$ oe*	*M1*	*FT 'their x' providing M1 previously awarded and $x > 0$ or allow $x=\frac{1}{3}$ without working.*
$15\frac{1}{3}$ *(m) oe*	*A1*	*FT*
	(8)	

16.(a) $\mathbf{a} + \frac{1}{2}\mathbf{c}$	B1	
16.(b) $\frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{c}$ or $\frac{1}{2}(\mathbf{a} + \frac{1}{2}\mathbf{c})$	B1	FT 'their $\mathbf{a} + \frac{1}{2}\mathbf{c}$' from (a)
16.(c) $\frac{1}{2}\mathbf{a} - \frac{3}{4}\mathbf{c}$	B2	FT 'their **OE**' B1 for $-\mathbf{c} + \frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{c}$ oe
	(4)	
17. $\sqrt{56^2 + 33^2 + 72^2}$ or $\sqrt{56^2 + 33^2}\ (=65)$ **and** $\sqrt{65^2 + 72^2}$ or $\sqrt{72^2 + 56^2}\ (=\sqrt{8320} = 8\sqrt{130})$ **and** $\sqrt{8320 + 33^2}$ or $\sqrt{72^2 + 33^2}\ (=\sqrt{6273} = 3\sqrt{697}$ **and** $\sqrt{6273 + 56^2}$ 97 (cm)	M2 A1	M1 for $DF^2 = 56^2 + 33^2 + 72^2$ OR for one correct application of Pythagoras in 2D e.g. $\sqrt{56^2 + 33^2}$ or $\sqrt{72^2 + 56^2}$ or $\sqrt{72^2 + 33^2}$; implied by finding e.g. *DB* = 65 Allow 96.98 to 97 from earlier rounding
	(3)	
18.(a)(i) Reflection in *y*-axis Correct coordinates seen or scale marked	B1 B1	Ignore coordinates for this mark; graph must be in 1st quadrant, starting at origin and ending at a point on the *x*-axis *A*(3, 0) and *B*(1, 1)
18.(a)(ii) Translation through $\begin{pmatrix} 0 \\ k \end{pmatrix}$ where $k > 0$ Correct coordinates seen or scale marked	B1 B1	Ignore coordinates for this mark; graph must be in 2nd quadrant, but mark intent for the end points to have the same *y*-coordinate *A*(–3, 2) and *B*(–1, 3)
18.(b) *C*(17, 0)	B1	Allow for sight of $x = 17$ provided $y = 0$ is not contradicted; may be seen on diagram Do not allow for 17 alone or c = 17
	(5)	

19. An explicit calculation for $\sin BCA$ e.g. $\sin BCA = 7 \times \frac{\sin 61}{9}$	M2	M1 for any correct implicit form e.g. $\frac{\sin BCA}{7} = \frac{\sin 61}{9}$
$BCA =$ 42.86… si	A1	Accept 43
($B\hat{C}D$ = 180 − 42.86... =) Answer in range 137.1° to 137.2° inclusive	B1	FT 'their 42.8 to 43' providing at least M1 previously awarded. Accept 137 following complete working; degree symbol may be omitted
	(4)	
20.(a) $\frac{55}{360} \times \pi \times 12^2$ oe	B1	
$\frac{1}{2} \times 12^2 \times \sin 55$ oe	B1	
$\frac{55}{360} \times \pi \times 12^2 - \frac{1}{2} \times 12^2 \times \sin 55$ or better	M1	(= 22π − 72sin55); FT their difference of areas providing at least B1 previously awarded
10.1(36....)	A1	CAO Accept answers in the range 10.1 to 10.15; accept 10 following correct working
20.(b) $\sqrt{12^2 + 12^2 - 2(12)(12)\cos 55}$ oe OR $\frac{12\sin(55)}{\sin(62.5)}$ OR $2(12\sin(27.5))$	M2	M1 for sight of $12^2 + 12^2 - 2(12)(12)\cos 55$ oe OR $\frac{[...]}{\sin(55)} = \frac{12}{\sin(62.5)}$ oe OR $\sin(27.5) = \frac{\frac{1}{2}[...]}{12}$ oe
11(.0819…)	A1	
$\frac{11}{3}\pi$ oe	B2	B1 for $\frac{55}{360} \times 2 \times \pi \times 12$ oe
22.6(01...)	B1	FT providing at least M1 B1 previously awarded
	(10)	

21.(a) $y = \frac{x+1}{4}$ leading to $4y - 1 = x$ or $x = \frac{y+1}{4}$ leading to $4x = y + 1$	M1	Changes the subject fully or swops the variables and requires one step only to change the subject; must be derived not found from the given equation; allow other variables e.g. h = ...
$h^{-1}(x) = 4x - 1$	A1	Allow $y = 4x - 1$
$2x^2 = 4x - 1$ leading to $2x^2 - 4x + 1 = 0$	A1	
21.(b) $\frac{-(-4) \pm \sqrt{(-4)^2 - 4(2)(1)}}{2(2)}$ or better	M1	Allow if this work seen in (a) **Substitution into the formula must be seen for M1, otherwise award M0 A0.** Allow one slip in substitution but not in the formula If completing the square used award for sight of $2(x - 1)^2 \pm \ldots$
$\frac{4 \pm \sqrt{8}}{4}$ oe, si	A1	Implied by 1.707 10..., 0.292 89...
1.71, 0.29	B1	
	(6)	
22.(a) Reasonable tangent drawn at t = 3.5	S1	
Calculates $\frac{\text{vertical diff}}{\text{horizontal diff}}$	M1	FT 'their tangent' provided S1 awarded
Correct gradient	A1	FT 'their $\frac{\text{vertical diff}}{\text{horizontal diff}}$'; must be negative
22.(b) Correct calculation for the area using 3 trapezia and 2 triangles oe e.g. $\frac{1}{2} \times (1) \times 15 + \frac{1}{2} \times (1) \times (15 + 35) + \frac{1}{2} \times (1) \times (35 + 32)$ $+ \frac{1}{2} \times (1) \times (32 + 25) + \frac{1}{2} \times (1) \times 25$	M3	Allow 14 to 15 and 24 to 25 for v at t =1 and t=4 M2 for a correct calculation with one error (possibly repeated) in a v value or M1 for a sum of 5 areas using strips of equal width with at most 2 errors
107 (metres)	A1	FT Accept answer in range 105 to 109 inclusive with working; ignore any units if stated
	(7)	