GCSE MARKING SCHEME

AUTUMN 2021

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

INTRODUCTION

This marking scheme was used by WJEC for the 2021 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 2021 MARK SCHEME

GCSE (9-1) Mathematics Component 2: Higher Tier	Mark	Comment
1.*(a) $6x - x = 5 + 1$ oe	B1	
$x = \frac{6}{5}$ oe, ISW	B1	FT from $ax = 6$, $a \neq 1$ or $5x = b$ accept $\frac{6}{a}$ 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. Final answer of $x = \frac{-6}{-5}$ is B0. **Maximum of 1 mark if not fully correct**
1.(b) A correct equation e.g. $2x + 10 = 116$ $2(x + 5) = 116$ $x + 5 = 58$ $x = 116 \div 2 - 5$ 53	B2 B1	B1 for $2(x + 5)$ or $2x + 10$
		If no marks award: SC2 for $x = 55.5$ following $2x + 5 = 116$ SC1 for $2x + 5 = 116$
	(5)	
2.* 130×1.06^{10}	M2	May be seen in stages. M1 for sight of 130×1.06 (= 137.8)
(£)232.81	A1	CAO An answer of (£)208 (simple interest) from use of $130 \times 0.06 \times 10 + 130$ is awarded M1 A0
	(3)	
3.* (radius =) $\frac{40.841}{2\pi}$ (= 6.50…)	B2	B1 for $2\pi r = 40.841$ or $\pi d = 40.841$ or $\frac{40.841}{\pi}$ or 13.0
(Area =) $\pi \times \left(\frac{40.841}{2\pi}\right)^2$ (= $\pi \times 6.5^2$)	M1	FT 'their derived radius'
132.7(...) or 133 (cm^2)	A1	CAO correct answer implies all previous marks
	(4)	

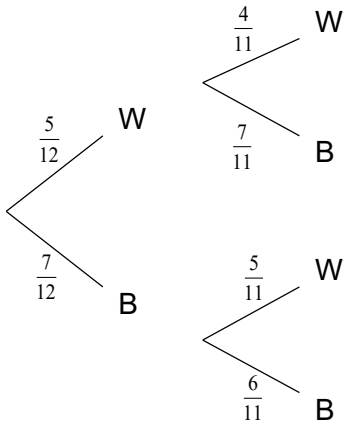
4.*(a) $\sin^{-1}\left(\frac{0.5}{6}\right)$	M2	M1 for $\sin(\ ) = \frac{0.5}{6}$
4.7(8...)	A1	Unsupported 4.7(8…) is awarded no marks
4.(b) $\sqrt{1.8^2 - 0.6^2}$ (= 1.69705....)	M2	M1 for $1.8^2 - 0.6^2$ or $x^2 + 0.6^2 = 1.8^2$
$\frac{\sqrt{1.8^2 - 0.6^2} \times 0.6}{2}$	M1	Allow FT from use of $\sqrt{1.8^2 + 0.6^2}$ (= 1.897….)
$\times$ 2.5	m1	
1.27(…) or 1.28 or 1.3 (m^3)	A1	CAO
5.*(a)(i) $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$	B2	B1 for sight of $\begin{pmatrix} 3 \\ -5 \end{pmatrix} + \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ Allow B1 for $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$ written incorrectly e.g. $\left(\frac{6}{-1}\right)$
5.(a)(ii) Correct shape *B* drawn at (2, 1), (2, 4), (3, 4), (3, 2), (4, 2), (4, 1),	B2	or correct FT; FT 'their $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$', B1 for a translation attempted with at least 4 vertices correct or shape *A* correctly translated by $\begin{pmatrix} 6 \\ y \end{pmatrix}$ where $y \neq -1$ or $\begin{pmatrix} x \\ -1 \end{pmatrix}$ where $x \neq 6$ If no marks in (a) then award SC1 for a clear attempt to translate by $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$ and $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$.
5.(b) Reflection (in the line) $y = x$	B2	B1 for either stating a reflection or giving the equation $y = x$ Award no marks if more than one transformation indicated If no marks then award SC1 for a correct diagram with the line $y = x$ drawn.
	(6)	

6.* $a + 4c = 16.30$ and $2a + 3c = 19.10$	B1	May use other letters or words throughout
Method to eliminate an unknown e.g. equal coefficients and subtraction or rearranges one equation and substitutes into the other	M1	FT their equations provided one is correct and the other is linear in the same pair of unknowns Allow one error in one term, but not in the equated coefficients
Finds one unknown	A1	CAO a = 5.5(0) or c = 2.7(0)
Finds the other unknown or finds 16.3(0) + 19.1(0) – 6 × 2.7(0)	A1	FT 'their a' or 'their c' used in one of their equations
(£)19.2(0)	B1	FT 3('their derived a') + ('their derived c') or 35.4 – 6 × 'their derived c' provided at least one mark previously awarded. Unsupported 19.2(0) is awarded no marks
	(5)	
7.(a) $7x^2 + 5x - 42x - 30$	B2	B1 for any three terms correct; $nx^2 - 37x + m$ implies two terms correct if not from wrong working
$7x^2 - 37x - 30$	B1	Implies previous B2. FT for equivalent level of difficulty, providing 4 terms to consider and like terms to collect
7.(b) $(y-2)(y+4)$	B2	B1 for $(y$ .... $2)(y$ .....$4)$
	(5)	
8.(a) Midpoints 30, 60, 90, 125	B1	
30 × 68 + 60 × 186 + 90 × 238 + 125 × 108 (2040 + 11160 + 21420 + 13500 = 48120)	M1	FT 'their midpoints' provided at least 3 of 'their 4 midpoints' lie within the appropriate group, including lower and upper bounds for the last 3 marks
÷ 600	m1	
80.2(minutes) oe	A1	Note: final answer 79.3 follows from using the midpoints 30, 60, 90, 120 to find $\frac{47580}{600}$.
8.(b) (Best estimate) 77.2(minutes) oe OR for a clear explanation that we cannot tell e.g. 'We do not know how many values will change group' or 'Slightly less as a few will move to the group below'.	B1	FT 'their 80.2' – 3 Do not award the mark if the explanation is contradicted by 'the mean will be higher'.
	(5)	

9.(a) -4	B1	
9.(b) All 7 correct points plotted correctly and joined with a smooth curve	B2	Tolerance $\pm$ a small square; FT 'their points' and 'their curve' for 2 marks provided the curve is reasonably parabolic B1 for a smooth curve at least through 4 pairs of coordinates or for all of 'their 7 pairs of coordinates' plotted correctly
9.(c) -1, 3	B1	Must be exact as values given in the table. Do not award for (-1, 0) and (3, 0)
9.(d) The line $y = 1$ drawn $x = -1.2$ to -1.3 $x = 3.2$ to 3.3	B1 B1 B1	Allow for appropriate marks on the curve at $y = 1$ for at least one intersection FT 'their curve' provided there are at least 2 intersections; if their curve has more than 2 intersections with $y = 1$, they must give all their solutions for B2. Allow these marks for calculated solutions e.g. $x = -1.2360...$ and $x = 3.2360...$ Award B1 only if both solutions are given as coordinates e.g.(-1,2, 1) and (3.2, 1)
	(7)	
10.(a)(i) 82	B1	
10.(a)(ii) $8\sqrt{2}$	B1	
10.(b) $n^2 + n$ oe	B2	Accept unsimplified e.g. $n \times n + n$ B1 for $n^2 + kn + c$ where k and c are not both 0
10.(c) $2n + 2$ and $2n + 4$ $(2n + 2n + 2 + 2n + 4 =) 6n + 6$ Convincing statement of divisibility by 6 e.g. $= 6(n + 1)$ or 'both terms divide by 6'	B1 B1 E1	oe FT $2n$ + 'their $2n + 2$' + 'their $2n + 4$' oe
	(7)	

11. Sight of (1 – 0.38 =) 0.62 and (1– 0.16 =) 0.84 OR ((1– 0.38)(1– 0.16)=) 0.5208 oe	B1	
(6510 ÷ 0.84) oe	M1	FT 'their 1– 0.16' or 'their 1 – 0.38'; implied by sight of 7750 or 10 500
÷ 0.62 oe	M1	Division may be done in either order M2 for sight of 6510 ÷ 0.5208; FT 'their (1 – 0.38)(1 – 0.16)'
(£)12 500	A1	CAO If no marks award SC1 for an answer of (£)14 152(.17) from a reduction of 54%
	(4)	
12.		Correct evaluation enough to imply > 40 or < 40; If evaluations not seen then may be implied by e,g, 'too big' or 'too small'; Solving $x^3 + x - 40 = 0$ should be marked equivalently
One correct evaluation with $3 \le x \le 4$	B1	
Two correct evaluations with $3.25 \le x \le 3.45$ and one > 40, one < 40 soi	B1	
Two correct evaluations with $3.25 \le x \le 3.35$ and one > 40, one < 40 soi	M1	Providing at least B1 awarded allow this M1 for a clear statement of the solution, e.g. between 3.3 and 3.4.
3.3	A1	
	(4)	

x		$x^3 + x$	or	$x^3 + x - 40$
3		30		–10
3.1		32.891		–7.109
3.2		35.968		–4.032
	3.25	37.578...		–2.421...
3.3		39.237		–0.763
	3.35	40.945...		0.945...
3.4		42.704		2.704
	3.45	44.513...		4.513...
3.5		46.375		6.375
3.6		50.256		10.256
3.7		54.353		14.353
3.8		58.672		18.672
3.9		63.219		23.219
4		68		28

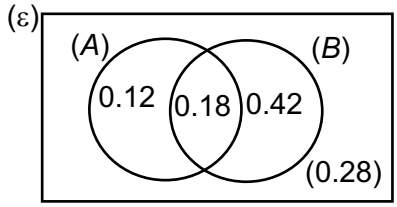
13.(a) Correct tree diagram e.g.  	B3	B1 for left hand branches correct FT 'their $\frac{5}{12}$ or $\frac{7}{12}$' B1 FT for top right branches correct B1 FT for bottom right branches correct Allow equivalent fractions in all cases. If rounded decimals used here e.g. 0.42, 0.58, 0.36, 0.64, 0.45 and 0.55 award B1 here and FT in (b) and (c) for M marks only.
13.(b) $1-\frac{7}{12}\times\frac{6}{11}$ or $\frac{5}{12}\times\frac{4}{11}+\frac{5}{12}\times\frac{7}{11}+\frac{7}{12}\times\frac{5}{11}$ oe $\frac{90}{132}$ or $\frac{15}{22}$ oe	M1 A1	Check tree diagram FT 'their probabilities' providing at least B1 awarded in (a) FT 'their tree diagram' If no marks award SC1 for the correct sum of two of the required products e.g for: $\frac{5}{12}\times\frac{7}{11}+\frac{7}{12}\times\frac{5}{11}=\frac{70}{108}$ oe
13.(c) $\frac{5}{12}\times\frac{7}{11}\times\frac{6}{10}+\frac{7}{12}\times\frac{6}{11}\times\frac{5}{10}$ oe $\frac{420}{1320}$ or $\frac{7}{22}$ oe	M2 A1	Check tree diagram M1 for either product CAO
	(8)	
14.(a) 28 000	B1	
14.(b) (end of 2024). $1.12^3\times28\,000$ (= 39 337.984) (end of 2025) $1.12\times39\,337(.984) = 44\,058(.54...)$ or 44059 or 44 057(.44) (44 058.54... – 39 337.984 =) 4720 or 4721	M1 M1 A1	Allow values to be consistently rounded or truncated FT '$1.12^3\times$(their 28 000)'; may be seen in stages (end of 2021) $1.12\times28\,000$ (= 31 360) (end of 2022) $1.12\times31\,360$ (= 35 123.2) (end of 2023) $1.12\times35\,123(.2)$ (= 39 337.984) FT 'their 39 337….' Interpretation of the formula as e.g. $25\,000(1.12)^5 - 25\,000(1.12)^4$ implies M1 M1
14.(c) Finds (end of 2026 =) 49 345(.56....) or (end of 2027 =) 55 267(.03....) Yes indicated and sufficient work to show the population is both below and above 50 000 during 2017	S1 B1	FT 'their 44058(..) if a step-by-step method used Accept 49 343 to 49 346 Accept 55 264 to 55 268 Allow for appropriate use of 25000×1.12^n where n is a decimal between 6 and 7 FT 'their 44058(..) and the correct FT conclusion If no marks award SC1 for the correct conclusion following incorrect work in (b)
	(6)	

15.(a) (Height of pyramid removed =) 4 (cm)	 B1	**Mark using one method only, to the candidate's advantage**
$\frac{1}{3}\times 24\times 12^2 - \frac{1}{3}\times 4\times 2^2$ (= 1152 – 5.33…)	M2	FT 'their 4' provided < 24 M1 for $\frac{1}{3}\times 24\times 12^2$ or $\frac{1}{3}\times 4\times 2^2$
$\frac{3440}{3}$ or 1146.6(66…) or 1146.7	A1	FT 'their 4' Allow 1147 from correct working
(Mass =) $0.9 \times \frac{3440}{3}$	M1	FT 'their $\frac{3440}{3}$'
1032 (grams)	A1	CAO Award for 1031.9(4) to 1032.3
Valid assumption e.g. 'No wax is lost when the wax is cut.' or 'The mass of the wick is negligible.' or 'The wick can be ignored.' or 'The volume of the wick is negligible.' or 'The wick has the same density as the wax.'	E1	
Alternative Method 1 for first 6 marks (difference of masses): *(Height of pyramid removed =) 4 cm*	*B1*	
$\frac{1}{3}\times 24\times 12^2$ *or* $\frac{1}{3}\times 4\times 2^2$	*M1*	*(1152 or 5.33…)* *'FT their 4'*
$0.9\times\frac{1}{3}\times 24\times 12^2$ *and* $0.9\times\frac{1}{3}\times 4\times 2^2$	*M2*	*FT 'their 4' for M2 or M1* *M1 for* $0.9\times\frac{1}{3}\times 24\times 12^2$ *or* $0.9\times\frac{1}{3}\times 4\times 2^2$*;* *(1036.8 or 1037) (4.77 or 4.8)*
$\left(0.9\times\frac{1}{3}\times 24\times 12^2\right) - \left(0.9\times\frac{1}{3}\times 4\times 2^2\right)$	*M1*	
1032 (grams)	*A1*	*CAO* *Award for 1031.9(4) to 1032.3*
Alternative Method 2 for first 6 marks (scaling the volume):		
$\frac{1}{3}\times 24\times 12^2$	*M1*	*(=1152)*
$0.9\times\frac{1}{3}\times 24\times 12^2$ *or* $\frac{1}{6^3}\left(\frac{1}{3}\times 24\times 12^2\right)$	*M1*	*(1036.8 or 1037) or (4.77 or 4.8)*
$0.9\left(\frac{1}{3}\times 24\times 12^2 - \frac{1}{6^3}\left(\frac{1}{3}\times 24\times 12^2\right)\right)$ oe	*M3*	*or M2 for sight of* $\frac{1}{3}\times 24\times 12^2 - \frac{1}{6^3}\left(\frac{1}{3}\times 24\times 12^2\right)$ oe *or M1 for sight of* $\frac{1}{6^3}\left(0.9\times\frac{1}{3}\times 24\times 12^2\right)$ oe
1032 (grams)	*A1*	*CAO* *Award for 1031.9(4) to 1032.3*

15.(b) Valid impact following their assumption e.g. 'The volume of the wax may be a little less so the mass will be less.' or 'The density of the wick is likely to be less than the density of the wax, so in fact the mass of the candle is likely to be a bit less.'	E1	Must have stated an assumption in part (a).
	(8)	
16. $\frac{\text{smallest miles}}{\text{greatest litres}}$ oe	S1	Allow $187 \leq d < 187.5$ and $4.8 < l \leq 5.2$
$187.25 \div 5$ (= 37.45)	M2	M1 for one value correct in a division
Correct unit conversion	B1	At some stage; e.g. $299.6 \div 5$ implies S1 M2 B1
59.92 (km/l)	A1	CAO; allow an answer of 60 from correct working only. If many attempts are offered without a method or answer being identified, then mark final attempt
	(5)	
17.(a) 40 320	B2	B1 for sight of 8! or equivalent product
17.(b) 10 080	B2	B1 for sight of $4 \times 7 \times 6 \times 5 \times 4 \times 3$ or equivalent
	(4)	
18.(a) 0 (cm per year)	B1	
18.(b) Gradient of the chord joining (10, 145) to (15, 168) $\frac{168-145}{15-10}$	M2	M1 for the gradient of a chord with one point correct
4.6 (cm per year)	A1	CAO
	(4)	

19. $7(x+2)+4(3x+1)=(3x+1)(x+2)$	M2	soi M1 for $\frac{7(x+2)+4(3x+1)}{(3x+1)(x+2)}\ (=1)$ soi
Expands the brackets and collects all terms on one side: $7x+14+12x+4=3x^2+6x+x+2$ $3x^2-12x-16=0$	M2	FT for possible M2 or M1 here, only if of equivalent difficulty; For M2 and M1 allow one error in expansion or collection; M1 for expansion not equated to zero e.g. $7x+14+12x+4=3x^2+6x+x+2$ leading to 'their $19x+18$' = 'their $3x^2+7x+2$'
Applies the quadratic formula: $\frac{-(-12)\pm\sqrt{(-12)^2-4(3)(-16)}}{2\times3}$ or better	M1	FT 'their derived 3-term quadratic' (even if it does not result in real roots); allow one slip in substitution; formula must not be clearly incorrect; allow attempt to complete the square with at most one slip
Simplifies: $\frac{12\pm\sqrt{336}}{6}$ or $\frac{6\pm2\sqrt{21}}{3}$ or equivalent	A1	FT 'their derived 3-term quadratic'; may be implied by correct decimal values $-1.05505...$, $5.05505...$
-1.06, 5.06	A1	CAO
	(7)	

20.(a) Correct justification e.g. 360 – 150 – 161 (= 49°) or 180 – 161 + 30 (= 49°)	B1	or equivalent; check diagram; NB method must be seen as answer is given Allow 30 + 19 (= 49)
20.(b) $\frac{1}{2}\times 50\times 72\times \sin 49$ 1358(.4772...km^2)	M1 A1	
20.(c) PR^2 = 2960(.37.....) PR = 54.4(... km) cosPRQ = $\frac{54.4^2+72^2-50^2}{2\times 54.4...\times 72}$ or sinPRQ = $50\times\frac{\sin 49}{54.4...}$ or cosQPR = $\frac{54.4^2+50^2-72^2}{2\times 54.4...\times 72}$ or sinQPR = $72\times\frac{\sin 49}{54.4...}$ or PRQ = 44° or QPR = 87° Bearing is (360 – 44 – 19 =) 297° or (180 + 30 + 87 =) 297°	M2 A1 M2 A1 A1	M1 for $PR^2 = 50^2 + 72^2 - 2(50)(72)\cos 49$ soi; accept 54 km FT 'their 54.4....' for M2 or M1 M1 for $50^2 = 54.4...^2 + 72^2 - 2(54.4...)(72)\cos PRQ$ or for $\frac{\sin PRQ}{50} = \frac{\sin 49}{54.4...}$ soi; may be inverted or for $72^2 = 54.4...^2 + 50^2 - 2(54.4...)(72)\cos QPR$ or for $\frac{\sin QPR}{72} = \frac{\sin 49}{54.4...}$ soi; may be inverted CAO; Accept 43.9(...) or 87.0(...) FT 'their derived 44' or 'their derived 87'
Alternative method using area *PR^2 = 2960(.37.....)* *PR = 54.4(... km)* *sinQRP = $\frac{1358\times 2}{54.4...\times 72}$ or* *sinQPR = $\frac{1358\times 2}{54.4...\times 50}$* *PRQ = 44° or QPR = 87°* *Bearing is (360 – 44 – 19 =) 297° or* *(180 + 30 + 87 =) 297°*	*M2* *A1* *M2* *A1* *A1*	*M1 for $PR^2 = 50^2 + 72^2 - 2(50)(72)\cos 49$* *soi; accept 54 km* *FT 'their 1358' and 'their 54.4....' for M2 or M1* *M1 for $\frac{1}{2}\times 54.4...\times 72\times \sin QRP = 1358$ or for* *$\frac{1}{2}\times 54.4...\times 50\times \sin QPR = 1358$* *CAO; Accept 43.9(...) or 87.0(...)* *FT 'their derived 44' or 'their derived 87'*
	(10)	

21.(a) Correctly completed Venn diagram e.g.  or 0.12 + 0.42 or 0.3 + 0.6 – 2(0.18) or equivalent	B2	B1 for sight of a correct method to find the intersection e.g. 0.3 + 0.6 – 0.72 or $0.3 - x + x + 0.6 - x = 0.72$ or sight of 0.18
0.54	B1	FT 'their 0.12 + 0.42' or 0.3 + 0.6 – 2('their 0.18'); correct answer implies B2 B1
21.(b) 1 – $P(A \cup B)$ or equivalent or correct region on Venn diagram indicated	S1	
0.28	B1	implies S1 FT 'their Venn diagram'
	(5)	