GCSE MARKING SCHEME

AUTUMN 2020

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

INTRODUCTION

This marking scheme was used by WJEC for the 2020 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 2020 MARK SCHEME

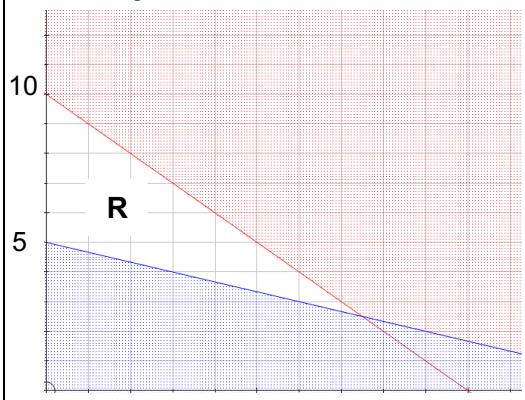
GCSE (9-1) Mathematics **Component 2: Higher Tier**	**Mark**	**Comment**
1(a) $\frac{6500-5720}{6500} \times (100)$ or $(1-\frac{5720}{6500})\times(100)$	M1	
= 12(%)	A1	If no marks, award SC1 for an answer of 88%
1(b) $8495 \times (1-0.16)^{11}$	M2	May be seen in stages M1 for sight of 8495×0.84 (=7135.8) oe
(£)1248.06(0…) or (£)1248	A1	ISW Allow (£)1248.1(0)
	(5)	
2*. (Interior angle of the heptagon =) 180 – 360 ÷ 7 OR (7 – 2) × 180 ÷ 7 OR (7 × 180 – 360) ÷ 7	M1	
=128.6(°) or 128.57(…)(°)	A1	May be seen on diagram. FT 'their derived 128.6'
(Unique angle in triangle =) (360 – 90 – 90 – 128.6 =) 51.4(28…°)	B1	May be seen on diagram
Working to show that x = 64.3 to 1 d.p. (180 – 51.4(28…)) ÷ 2 = 64.285 to 64.3	B1	CAO
Alternative method 1 working from 64.3 *(Unique angle in triangle =)* *(180 – 64.3 – 64.3) = 51.4*	*B1*	*FT 'their 180 – 64.3 – 64.3'*
(Interior angle of the heptagon =) *(360 - 90 - 90 - 51.4) =128.6*	*B1*	*Only awarded if this is clearly the interior angle of the heptagon*
(*Interior angle of the heptagon =)* *180 – (360 ÷ 7)* *OR (7 – 2) × 180 ÷ 7* *OR (7 × 180 – 360) ÷ 7*	*M1*	
=128.6 or 128.57(…°)	*A1*	
Alternative method 1a for final 2 marks *(Sum of the interior angles of a heptagon=)* *(7 – 2) × 180 o.e* *AND 128.6 × 7*	*M1*	*M0 for 'their 128.6 × 7' = 900(.2) alone*
900	*A1*	*Allow for 900 and 900.2*
Alternative method 2 using exterior angles *Exterior angle (of the heptagon) =* *360 ÷ 7*	*M1*	*Method must be seen*
= 51.4(28…°)	*A1*	
(Unique angle in triangle =) *(360 – 90 – 90 – (180 - 51.4(28…°)))* *= 51.4(28…°)*	*B1*	*May be seen on diagram.* *FT 'their derived 51.4(28…)*
Working to show that *(x =) (180 – 51.4(28…))÷ 2 = 64.3*	*B1*	*May be seen on diagram.* *CAO*
	(4)	

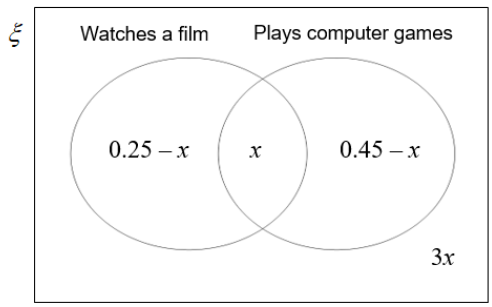
3.* (1 – 0.8(0)) × 40 OR 40 – 0.8(0) × 40 OR (0.15 + 0.05) × 40 OR 0.15 × 40 + 0.05 × 40 8	M2 A1	M1 for sight of one of the following: • 1 – 0.8(0) • 0.15 + 0.05 • 0.2(0) • 0.8(0) × 40 • 32 • 0.15 × 40 • 0.05 × 40 CAO
	(3)	
4.* $(h =) \frac{500}{\pi \times 3.5^2} = 500/38.4(8..)$ (h =) 12.98(…) to 13 (cm)	M2 A1	M1 for $500 = \pi \times 3.5^2 \times h$ CAO Not from wrong working If no marks award SC1 for an answer of: 25.97 to 26(.0) from $500 = \frac{1}{2}\pi \times 3.5^2 \times h$ OR 38.96 to 39(.0) from $500 = \frac{1}{3}\pi \times 3.5^2 \times h$
	(3)	
5(a) Any valid reason e.g. '10 years is too far ahead to predict' 'the paper might not be produced if sales continue to fall' 'the change each time is not consistent'	B1	If a satisfactory reason is given ignore further spurious comments. Allow e.g. 'because the sales may not follow the pattern of the graph' 'there is not an equal; drop in numbers sold every 5 years' 'it's too far in the future we cannot tell' 'it could increase instead of decrease' 'more people may read the paper on the internet' Do not allow statements that do not relate to the graph e.g. 'there might be more or less than 10 000 sold in 2025' as no reference to the trend 'we can't tell' as no reference to time or trend
5(b) (52 000 000 ÷ (16 + 9) ×16 33 280 000	M1 A1	Allow a place value slip in 52 000 000 for M1 only Allow 33 000 000 and 33 300 000
	(3)	

6.* $5x + 40 = 6x + 20$ $x = 20$ $5 \times 20 + 40 + y + 35 = 180$ OR $6 \times 20 + 20 + y + 35 = 180$ OR $5 \times 20 + 40 + 2(y + 35) + 6 \times 20 + 20 = 360$ $y = 5$	 M1 A1 M2 A1	 Allow for $5 \times 20 + 40 = 6 \times 20 + 20$ which may be seen in stages FT 'their 20' for possible M2 provided previous M1 awarded May be seen in stages. M1 for a correct equation $5x + 40 + y + 35 = 180$ or $6x + 20 + y + 35 = 180$ or $5x + 40 + y + 35 + 6x + 20 + y + 35 = 360$ CAO
6. Alternative method (using simultaneous equations)* *Writes two correct equations in x and y* *$5x + 40 + y + 35 = 180$* *or $6x + 20 + y + 35 = 180$* *or $5x + 40 + y + 35 + 6x + 20 + y + 35 = 360$* *Method to eliminate variable, e.g. equal coefficients and method to find second variable* *Finds the value of the first variable* *Second variable*	 *M2* *m1* *A1* *A1*	 *M1 for each correct equation* *May be simplified* *Allow one error in one term but not with equal coefficients* *CAO* *$x = 20$ OR $y = 5$* *FT 'their first variable'*
	(5)	
7.* Correct perpendicular bisector construction with appropriate arcs Correct angle bisector construction of *XOY* with appropriate arcs Correct point indicated	 B2 B2 B1	 B1 for perpendicular bisector within tolerance ($\pm$ 2°) without arcs or with invalid arcs or for correct pair of arcs that intersect twice B1 for angle bisector within tolerance ($\pm$ 2°) without arcs or with invalid arcs or for a correct pair of arcs FT provided at least B1, B1 awarded; may be implied by intersecting loci
	(5)	
8*(a) $(x^2 =)\ 11.3^2 - 8.6^2$ $x^2 = 53.73$ or $(x =) \sqrt{53.73}$ $(x =)$ 7.3(3… cm)	 M1 A1 A1	 FT from M1 for the correctly evaluated square root of 'their 53.73' provided 'their x < 11.3' If no marks award SC2 for an answer of 7.3(3…) seen from use of $8.6^2 - 11.3^2$
8(b) $\cos(y) = 8.6 \div 13.5$ $(y =)\ \cos^{-1}(8.6 \div 13.5)$ $(y =)$ 50(.4…..°)	 M1 m1 A1	 Accept any equivalent full method
	(6)	

9. (7·3 × 60 ÷ 50) – (7·3 × 60 ÷ 70) 2·5 (mins)	 M3 A1	May be seen in stages Allow M3 for (7·3 × 60 ÷ 70) – (7·3 × 60 ÷ 50) M2 for 7·3 ÷ 50 - 7·3 ÷ 70 (=0·146 - 0·104..= 0·0417… or 0·042) may be embedded in other calculations OR 7·3 x 60 ÷ 50 (=8.76 min) OR 7·3 × 60 ÷ 70 (= 6.257… min) M1 for 7·3 ÷ 70 (=0·104..) OR 7·3 ÷ 50 (=0·146) CAO
	(4)	
10(a) 7476 ÷ (10 + 8 + 3) × 2 = 712 OR (712 ÷ 2) × (10 + 8 + 3) = 7476 OR 7476 ÷ (10 + 8 + 3) × 10 – 7476 ÷ (10 + 8 + 3) × 8 = 712	B2	B1 for sight of 7476 ÷ (10 + 8 + 3) (=356) Not for 356 from 712 ÷ 2 OR 3560 OR 2848 OR 1068
10(b) $\frac{5}{8}$ or 2 : 1 oe (5 : 3 AND) 6 : 3 OR 0.62(5) AND 0.66(…) or 0.67 OR 62(.5)% AND 66(…)% or 67% OR 15/24 AND 16/24 OR 1.6(…) : 1 or 1.7 : 1 AND 2 : 1 OR 1 : 0.6 AND 1 : 0.5 AND Third match unambiguously indicated	 B1 B1	Allow for 5 × n ÷ 8 AND 2 × n ÷ 3 where n is any value Allow for the correct evaluation of both 'their 5 × n ÷ 8 AND 2 × n ÷ 3' AND Third match unambiguously indicated
	(4)	
11. 1270 – 900 (=370) $\frac{370}{400}\times 1000$ (=925) or $\frac{370}{400}$ × 600 (=555) 1270 – 925 or 900 - 555 345 (g)	M1 m1 m1 A1	 CAO If M1 m0 m0 A0 then award SC1 for an answer of 653(.33..g) from use of 400 ml remaining
Alternative method *1270 – 900 (=370)* *(Bottle and 200 ml have mass) 900 – 370 (= 530 g)* *(Mass of bottle =) 530 – 370 ÷ 2* *345 (g)*	*M1* *m1* *m1* *A1*	 *FT 'their 1270 – 900'* *CAO*
	(4)	
12(a) –2.2	B1	CAO B0 for (3.5, -2.2)
12(b) 5.6	B2	B1 for 3.5 – 1.4 or 3.5 + (3.5 - 1.4) or clear evidence of attempting one of these. Accept 3.45 to 3.55 as 'their 3.5'
	(3)	
13. (3.30 × 10^{23}) ÷ (6.08 × 10^{19}) 5430 or 5.43 × 10^3	M1 A2	 A1 for 5427·(6…) or 5428 or equivalent
	(3)	

14. $4n^2 - 4n + 1$ Correct justification e.g. '$4n^2$ and $4n$ are even so $4n^2 - 4n + 1$ is odd' or ' = $4(n^2 - n) + 1$ or '= $2(2n^2 - 2n) + 1$'	B1 B1	Dep on first B1 If no marks allow SC2 for a complete explanation e.g. $2n$ is even, so $2n-1$ is odd, odd × odd=odd, so $(2n - 1)^2$ is odd or SC1 for a partial explanation e.g. $2n-1$ is odd, odd × odd=odd, so $(2n - 1)^2$ is odd SC1 for a complete justification with one error in the expansion: $4n^2 - 4n$ - 1 OR $4n^2 + 4n + 1$ OR $4n^2 - 2n + 1$
	(2)	
15. a + b = 19 (a + 2×5 + 1×3 + 4b + 5×2 + 6×3) ÷ 30=2.7 OR (a + 4b + 41) ÷ 30 = 2.7 OR a+ 2×5 +1×3 +4b + 5×2 + 6×3= 30×2.7 a + 4b = 2.7 × 30 − 41 or a + 4b = 40 Complete method to solve the simultaneous equations a = 12 and b = 7	B1 M1 M1 M1 A1	Allow for a + 5 + 1 + b + 2 + 3 = 30 FT 'their derived 41' FT 'their equations' for M1 only CAO
	(5)	
16(a) $\frac{1}{3}\pi r^2 \times 20 = 2400$ (r^2 =) 3×2400 ÷ 20π (=114.5(9) or 114.6) (L^2 =) 114.5(9…) +20^2 or $10.7^2 + 20^2$ (L =) answer in the range 22.68 to 22.7 (cm)	M1 A1 M1 A1	 (r = 10.7(0…)) FT 'their derived r' FT 'their derived r' providing 'their L' > 20 Allow 23 from correct working.
16(b) Use of 18 ÷ 12 or 12 ÷ 18 oe $(18 \div 12)^2 \times 300$ or $300 \div (12 \div 18)^2$ oe 675 (cm^2)	B1 M1 A1	May be embedded in further working Award M1 for any other complete and correct method Award B1 M0 A0 SC1 if 675 obtained from use of curved surface area = 300 cm^2.
	(7)	

17(a) (Width =) (15 – y) OR $\frac{55}{y}$ OR 2y + 2w = 30 AND wy = 55 where w is the width	M1	Allow (30 – 2y)/2
y(15 – y)= 55 OR $2\left(\frac{55}{y}+y\right)=30$ oe	M1	
Correct completion to y^2 – 15y + 55 = 0	A1	Must be from convincing working.
17(b)(i) (y =) $\frac{-(-15) \pm\sqrt{((-15)^2 - 4 \times 1 \times 55)}}{2 (\times 1)}$	M1	This substitution into the formula must be seen for M1, otherwise award M0 A0 A0. Allow one slip in substitution for M1 only but must be correct formula.
= $\frac{15 \pm\sqrt{5}}{2}$	A1	Can be implied from at least one correct value of y evaluated.
8.62 AND 6.38	A1	Both solutions to 2dp
17(b)(ii) Correct interpretation e.g. 'The values give the length and width of rectangle.'	B1	Allow length = 'their 8.62' and width = 'their 6.38' or vice versa Allow length could be 'their 8.62' or 'their 6.38'
	(7)	
18(a) $x + y \leq 10$ $x + 3y \geq 15$	B1 B1	Allow the use of other variables e.g. c and d If no marks award SC1 if both inequalities are only inaccurate due to incorrect inequality signs.
18(b) Line $x + y = 10$ drawn Line $x + 3y = 15$ drawn Correct region indicated  	B1 B1 B1	FT 'their linear inequalities' (if they give equations of the form ax + by =c) where possible FT if closed region Do not penalise omission of the line x = 0 unless the area to the left of the axis is clearly included in the required region.
(c) 3	B1	FT 'their closed region'
	(6)	
19(a) No with valid explanation e.g. 'she has plotted frequency, not frequency density'	B1	Allow No 'it is a bar chart'
19(b) 160	B2	B1 for sight of any one of: • 120 ÷ 30 • 1 square represents 4 (patients) oe • Areas in ratio e.g. 30 : 40 • 24 and 16 placed correctly on vertical scale
	(3)	

20(a) $0.3 \times 0.25 + (1 - 0.3)$ 0.775	 M2 A1	 M1 for sight of 0.3×0.25
20(b)(i) Venn diagram correctly completed  	B1	
20(b)(ii) $x + (0.25 - x) + (0.45 - x) + 3x = 1$ 0.15	M1 A1	FT 'their Venn diagram' provided of similar difficulty CAO
20(b)(iii) $0.15 \div 0.25$ OR $(F \times 0.15) \div (0.25 \times F)$ OR $x \div 0.25$ 0.6	M1 A1	FT 'their 0.15'
	(8)	
21. $\frac{greatest\ U^2}{smallest\ 2a}$ $\frac{4.25^2}{2\times1.55}$ or $\frac{18.0625}{3.1}$ 5.8(2…) or 5.83	S1 M1 A1	Allow $4.2 < U \leq 4.25$ and $1.55 \leq a < 1.6$ Allow an answer of 6 from correct working only. If many attempts are offered without a method or answer being identified, then mark final attempt
	(3)	
22(a) Starting with either form, show the two stages of rearrangement	B1	$x = \sqrt{x+7}$ $\quad x^2 - x - 7 = 0$ $x^2 = x + 7$ or $x^2 = x + 7$ $x^2 - x - 7 = 0$ $\quad x = \sqrt{x+7}$
22(b) Sight of x_2= 3.16(22…) Sight of both x_4 = 3.19(18……) **and** x_5 = 3.19(24……) Solution to 2 d.p. is 3.19 from sight of both x_4 = 3.191(8……) **and** x_5 = 3.192(4……)	M1 m1 A1	 Allow for sight of x_3 = 3.18(78……) or 3.19 **and** x_4 = 3.19(18……) Ignore any further calculations
	(4)	

23(a) $DC = \frac{9.6}{\sin(180-(79+39))} \times \sin 39$ 6.8(…) (cm)	M2 A1	M1 for $\frac{DC}{\sin 39} = \frac{9.6}{\sin(180-(79+39))}$
23(b) $A\hat{D}B > 101$ sin $A\hat{D}B$ < sin 101 Mona's area is $^1/_2 \times 9.6 \times 5.7 \sin A\hat{D}B$ and is too large or $^1/_2 \times AD \times BD \times \sin A\hat{D}B$ is too large	B1 B1 B1	Accept example of 101 < $A\hat{D}B$ < 101.5 Accept FT example of 0.9799 < sin $A\hat{D}B$ < 0.9816 Need both 'too big' and sight of $^1/_2 ab \sin C$. Accept calculation using $^1/_2 \times AD \times BD \times \sin A\hat{D}B$ e.g. 26.810 < area < 26.857 If no marks award SC1 for a convincing explanation without calculations, e.g. by drawing B3 for Area = $^1/_2 \times 9.6 \times 5.7 \sin A\hat{D}B$ and sin 101 > sin $A\hat{D}B$
	(6)	
24(a) Correct sketch with inflection points at (0,0), (180, 0) and (360,0) AND graph tending towards the vertical asymptotes at x = 90 and x = 270	B2	If vertical asymptotes not seen, they may be implied by a break in the curve of 'their sketch' at x = 90 x = 270 provided there is asymptotic behaviour. Graph must be attempted from x = 0 to x = 360. Ignore continuation of sketch beyond these values. B1 for sketch with inflection points at (0,0), (180, 0) and (360,0) only OR vertical asymptotes seen at 90 and 270 only
24(b) 40 and 220 and no others in the range	B2	B1 for either one
	(4)	
25(a)(i) 135	B1	
25(a)(ii) 33 or 33.8 or 34	B2	Award B2 for answers of 32.59(…) or 32.6 from working year by year and rounding down to a whole number. B1 for any one of the following seen • 1.06^5 (=1.338(…)) or 133.8(…) or 134 • 135×1.06^5 (=180.66…) • 179, 180(.66) or 181 voles after 5 years
25(a)(iii) 0.54(…)	B1	
25(b) $\left(1+\frac{p}{100}=\right) \sqrt[20]{2}$ or $1.03526...$ 3.5(26…)	B2 B1	Allow B2 for $p = \sqrt[20]{2}$ or p = 1.03(52…) B1 for $(300\times)\left(1+\frac{p}{100}\right)^{20} = 2(300)$ or $x^{20} = 2$ Allow B1 for $p^{20} = 2$
	(7)	

26(a) $\frac{x}{360} \times 2\pi r = 5\pi$ $x = \frac{900}{r}$ from clear correct working	 M1 A1	
Alternative method $\frac{x}{360} = \frac{5}{2r}$ $x = \frac{900}{r}$ *from clear correct working*	 *M1* *A1*	
26(b) $\frac{x}{360} \times \pi r^2 = 30\pi$	 M1	
$\frac{\left(\frac{900}{r}\right)}{360} \times \pi \times r^2 = 30\pi$ (r =) 12 (x =) 75	m1 A1 A1	 FT 'their derived 12' provided M1 previously awarded
Alternative method $\frac{x}{360} \times \pi r^2 = 30\pi$ $xr = 900$ *and* $xr^2 = 10800$ *oe* *(r =) 12* *(x =) 75*	 *M1* *m1* *A1* *A1*	 *FT 'their derived 12' provided M1 previously awarded*
Alternative method $\frac{x}{360} = \frac{30}{r^2}$ oe $\frac{5}{2r} = \frac{30}{r^2}$ *(r =) 12* *(x =) 75*	 *M1* *m1* *A1* *A1*	 *FT 'their derived 12' provided M1 previously awarded*
Alternative method $\frac{x}{360} = \frac{30}{r^2}$ oe $\frac{x}{360} = \frac{30}{\left(\frac{900}{x}\right)^2}$ *(x =) 75*	 *M1* *m1* *A2*	
	(6)	