GCSE MARKING SCHEME

AUTUMN 2022

GCSE
MATHEMATICS
UNIT 1 – HIGHER TIER
3300U50-1

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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.

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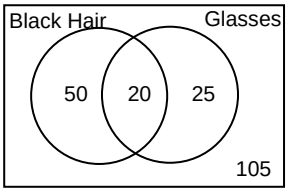
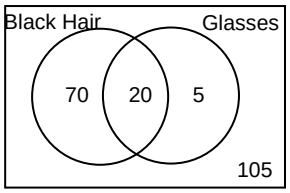
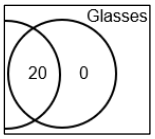
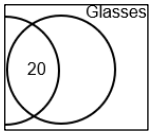
WJEC GCSE MATHEMATICS

AUTUMN 2022 MARK SCHEME

Unit 1: Higher Tier	Mark	Comments
1.(a) 		If 'notches/tallies' are used, penalise −1 once.
20 AND 105 in correct position	B1	B0 if any other number written in the same section.
Total of 70 for *Black Hair*	B1	FT 'their 50' + 'their 20', provided both are non-zero values.
Overall total of 200	B1	Note: The answer below is awarded B1B0B1. 
1.(b) $\frac{45}{200}$ or $\frac{9}{40}$ or equivalent. ISW	B2	For B2 or B1, the numerator and denominator must be a whole number. FT $\frac{\text{'their 20' + 'their 25'}}{200}$ provided both sections not blank. Award B1 for one of the following: • a numerator of 45 in a fraction < 1 • FT 'their 20' + 'their 25', provided both sections are not blank, as a numerator in a fraction < 1 • a denominator of 200 in a fraction < 1. An answer of $\frac{45}{200}$ gains B2 regardless of 'their Venn diagram'. Penalise incorrect notation (e.g. '45 in 200') −1. Note:  An answer of $\frac{20}{200}$ is awarded B2.  An answer of $\frac{20}{200}$ is awarded B1.

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2. Correct construction of 60° at A Correct construction of angle 45° at C	 B1 B2	Treat reversed angles at A and C MR-1. Correct construction arcs must be seen and angle drawn. If B3, penalise -1 if triangle not completed. Award B1 for one of the following: • correct <u>construction</u> of angle 90° at C • correct bisection of 90° at C, but their own perpendicular line at C drawn • any correct bisection of 90° seen.
3. For a correct method that produces 2 prime factors from the set {3, 3, 5, 5, 7} before the 2nd error. 3, 3, 5, 5, 7 $3^2 \times 5^2 \times 7$	M1 A1 B1	Must be a method that involves only division CAO for sight of the five correct factors (Ignore 1s) Do not FT non-primes. FT 'their <u>primes</u>' provided at least one index form used with at least a square. Allow $(3^2)(5^2)(7)$ and $3^2.5^2.7$ Do not allow $3^2,5^2,7$. Inclusion of 1 as a factor gets B0.
4.*(a)* $6p^7q^8$	B2	Mark final answer Award B1 for one of the following: • $6 \times p^7 \times q^8$ • $6p^7 \times q^8$ • $6\times p^7q^8$ • $6p^7q^{\cdots}$ • $6p^{\cdots}q^8$ • kp^7q^8 $(k \neq 0 \text{ or } 6)$ • Sight of $6p^7$ **AND** q^8 in an expression (e.g. $6p^7 + q^8$).

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4.*(b)* $7a^2 + 35a - 6a^2 - 12a + 14$ $= a^2 + 23a + 14$	B2 B2	Award B1 for one of the following: • sight of $7a^2 + 35a$. • sight of $-6a^2 - 12a + 14$ (brackets must be removed) Note: If $7a^2 + 35a - 6a^2 + 12a - 14 = a^2 + 23a + 14$ is seen, then award B2 B2 (brackets implied). *FT for B2 if at least two a^2 terms AND at least two a terms to be simplified.* *FT for B1 if at least two a^2 terms OR at least two a terms to be simplified.* Award B2 for $1a^2 + 23a + 14$ If B2 not awarded, award B1 for one of the following: • correct collection of 'a^2 terms' $(1)a^2$ • correct collection of 'a terms' $(+23a)$. This 2nd B2 (or B1) is for their **final** answer. A correct answer must come from correct workings seen, however $7a^2 + 35a - 6a^2 + 12a - 14 = a^2 + 23a + 14$ is awarded B2 B2 (brackets implied). Mark final answer Penalise −1 from the final B1 or B2 mark for any one of the following: • incorrect subsequent working • any attempt to equate their expression to zero (and attempting to solve) • incorrectly factorising Note (sign error): Award B1B2 for $7a^2 + 35a - 6a^2 + 12a + 14 = a^2 + 47a + 14$ $7a^2 + 35a - 6a^2 + 12a - 14 = a^2 + 47a - 14$ $7a^2 + 35a - 6a^2 - 12a - 14 = a^2 + 23a - 14$
5.*(a)* (i) 4	B1	Accept 4/1 or equivalent. The correct gradient has to be unambiguously shown. $y = 4x - 2$ is B0, but $y = 4x - 2$ is B1. Award B0 for a final answer of $4x$.
5.*(a)* (ii) $y = 4x - 2$	B2	FT 'their gradient' from *(a)* Award B1 for one of the following: • $y = 4x \pm k$. • $y = kx - 2$ $(k \neq 0)$ • $4x - 2$ ('$y =$' missing) • $y = 4x + -2$.

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5. (b) Valid explanation with rearranged equation AND indicating that the gradient is 3 or equivalent e.g. "2y – 6x = 23 is the same as y = 3x + 11·5, so the gradient of both lines is 3" "2y = 6x + 23 and 2y = 6x – 16 and the gradient of both lines is 3"	B2	B1 for one of the following: • sight of $y = 3x + k$ ($k \neq 0$ or -8) • sight of $y = \frac{6x + 23}{2}$ • showing 2 equivalent equations written in the same format e.g. 2y = 6x + 23 and 2y = 6x – 16 • unsupported statement that both the gradients are 3. Allow "the 3x (or 3) show the lines are parallel" as an explanation Do not allow: • "the gradients are the same" unless the '3' is also given or unambiguously shown • gradient = 3x.
6. (Volume) Area None Volume Length None	'	*Must use the terminology given in the question.* B3 for all 5 correct. B2 for 3 or 4 correct. B1 for 2 correct. B0 otherwise.
7.(a) 5(·0) × 10^6	B2	Mark final answer. Award B1 for one of the following: • sight of 0·5 × 10^7 • sight of 5 000 000 • equivalent correct value but not in standard form. • sight of 30 000 AND 0·006 • 5 × 10^n ($n \geq 3$, but not 6), following one place value error in one of the given numbers.
7.(b) 4·795(0) × 10^4	B2	Mark final answer. B1 for one of the following: • sight of 479·5(0) × 10^2 • 4·8(0) × 10^4 • sight of 47 950 • equivalent correct value but not in standard form. • sight of 47800 AND 150 • 'their 47 950' is written correctly in standard form, following one place value error in one of the given numbers or in the addition of 47800 AND 150.
8.*(a)* $x = \sqrt{25^2 - 10^2}$	B1	
8.*(b)* $\sin 40° = \frac{y}{25}$	B1	

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9. $POQ = 180 - (2 \times 38)$ 104 (°) $x = 52(°)$ For two valid angle properties appropriately stated with at least one circle property (e.g. two radii make an <u>isosceles triangle</u> AND <u>angle</u> subtended by an arc <u>at the centre</u> of a circle is <u>twice the angle</u> subtended at the <u>circumference</u>)	 M1 A1 B1 E1	Check diagram for answers. Award M1A1 for sight of 104. FT 'their 104' ÷ 2. Award E1 for any one correct appropriate angle property AND any one appropriate correct circle property associated with correct workings. ISW any other incorrect properties. Allow • "the angles in a triangle (add to 180°)" for the 'angle' property • "angle at the centre (theorem)" • "equal radii" for isosceles.
9. *<u>Alternative method – angles in a semi-circle</u>* *Extending the line (PO or QO) to create a right-angle triangle* *180 – 90 – 38* *$x = 52(°)$* *For two valid angle properties appropriately stated with at least one circle property* *(e.g. the angle subtended at the circumference by a semicircle is a right angle AND that angles in the same segment are equal)*	*S1* *M1* *A1* *E1*	*Shown on diagram* *M1 implies S1*

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10. $5n - 7 > n + 26$ or equivalent.	B2	Award B2 for $5n - 7 > n + 19 + 7$. Award B1 for one of the following: • Sight of $5n - 7$ • Sight of $n + 26$ • Sight of $n + 19 + 7$
(Least number of apples Twm picked =) 9	B2	An answer must be given following work from an inequality. Award B2 for $n = 9$. FT for B2 or B1, from 'their inequality', if of equivalent difficulty (must be at least 3 terms, with at least 2 'n' terms and a constant). Possible scenarios:

1st B2	2nd B2	
Inequality used	B2 awarded for:	B1 awarded for:
$\mathbf{5n - 7 > n + 26}$ B2 awarded	9	Sight of: • $4n > 33$ • $n > \frac{33}{4}$ or equiv • 8(·25) One slip in solving the inequality, but final answer rounded correctly
$\mathbf{5n - 7 > n + 19}$ B1 awarded	7	Sight of: • 4n > 26 • $n > \frac{26}{4}$ or equiv • 6(·5) One slip in solving the inequality, but final answer rounded correctly
$\mathbf{5n > n + 26}$ B1 awarded		
$\mathbf{5n - 7 < n + 26}$ B1 awarded		Sight of: • $4n < 33$ • $n < \frac{33}{4}$ or equiv

Unsupported answers or no inequality shown
If B0 B0, award SC1 for an unsupported answer of 9 without showing any working or no inequality shown.

Use of equations
If an equation is used throughout, a possible first B1 (see bullet points) and then B0 is awarded.

If B1 for an equation is awarded (see bullet points), a second B2 or B1 could be awarded if there is evidence that the equation has then been turned to an inequality (e.g. $n > 8{\cdot}25$, so answer is 9).

If an inequality is shown and then equation used, B2 B2 is possible.

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Organisation and Communication. Accuracy of writing.	OC1 W1	For OC1, candidates will be expected to: • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanation and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means For W1, candidates will be expected to: • show all their working • make few, if any, errors in spelling, punctuation and grammar • use correct mathematical form in their working • use appropriate terminology, units, etc.
11.*(a)* (i) $y \alpha x^3$ OR $y = k x^3$ $108 = k \times 3^3$ OR $k = 4$ $(y =)\ 4x^3$	B1 M1 A1	Allow $y \alpha k x^3$ M1 implies B1. F.T. from $y \alpha x^n$ with $n > 1$ or n = –3 Use of n = –3 leads to k = 2916 Use of n = 2 leads to k = 12 May be seen in part (ii)
11.*(a)* (ii) x: 3, 5, **10** y: 108, **500**, 4000	B2	B1 for each correct value. Check working space if table is empty. F.T. from 'their k', provided M1 awarded (accept answer left as a root) (No FT for $y = (1)x^3$) F.T. from $y \alpha x^n$ with $n > 1$ or n = –3 Use of n = –3 leads to answers of 23.328 and 0.9 Use of n = 2 leads to answers of 300 and √(1000/3)
11.*(b)* Valid statement e.g. *e* is halved; *e* is divided by 2	E1	
12. Reference to: Enlargement Scale factor –2 Centre of enlargement (–3, 1)	 B1 B1 B1	 If B3, penalise -1 for a multi-stage transformation e.g. extra 'rotation 180°'
13. *AE* = *CE* (Given) *BE* = *DE* (Given) Angle *AEB* = Angle *CED* (Vertically opposite angles) SAS (therefore triangle *ABE* and triangle *CDE* are congruent)	B2 E1	All 3 stated. 'Notches' or 'arcs' (or labelling) on the diagram are insufficient. B1 for 1 or 2 stated. Additional (correct or incorrect) statements may be ignored. FT provided at least B1 awarded. Allow an equivalent statement e.g. 'two sides and the included angle' (but not e.g. 'two sides and an angle').
14. Lines $y = \frac{1}{2}x + 1$, $y + x = 0$ and $x = 3$ all correct. Correct region identified.	B2 B1	B1 for any 2 correct lines. If $y = 3$ and any other vertical or horizontal line shown e.g. $y = \pm 3$ or $x = -3$, do not award a mark unless $x = 3$ is selected for the region or clearly labelled. Strict FT provided B1 awarded. Accept indication by 'shading out'.

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15.*(a)* x = 0·6545454..... and 100x = 65·45454... with an attempt to subtract 648/990 (= 324/495 = 108/165 = 36/55 or equivalent)	M1 A1	Complete method. Or 10x and 1000x, or equivalent. Or a complete alternative method. x and 10 000x gives an answer of 65448 / 99990. An answer of 64·8/99 gains M1 only. ISW
15.(a) Alternative method *0·6 + 0·0545454..... = 6/10 + 54/990 or equivalent* *648/990* *(= 36/55 or equivalent)*	*M1* *A1*	 *An answer of 64·8/99 gains M1 only.* *ISW*
15.*(b)* 1/9	B2	B1 for 9^{-1} or $1/3^2$ or $(1/3)^2$ or $1/\sqrt[3]{729}$ or $1/729^{1/3}$ or $(1/729)^{1/3}$ or $\sqrt[3]{(1/729)}$ Mark final answer.
16. $\left(\frac{1}{3}\pi r^2 h =\right)\ \pi r^2 \times \frac{3r}{2}$ or equivalent $2\pi r^2 h = 3\pi r^2 \times 3r$ or equivalent OR $\frac{1}{3}h = \frac{3r}{2}$ or equivalent OR $h = \frac{3\pi r^2 \times 3r}{2\pi r^2}$ or equivalent $h = \frac{9r}{2}$ or equivalent	M1 M1 A1	Correct expression for volume of cylinder Equating volumes AND one further step to find h e.g. • clearing fractions • cancelling π or r^2 or both • isolating h (unsimplified) Correct simplified expression. Award full marks for a correct answer, provided no incorrect working seen.
17. $\sqrt{20} = 2\sqrt{5}$ $(\sqrt{5})^3 = 5\sqrt{5}$ $\left(\frac{2\sqrt{5} + 5\sqrt{5} + 11\sqrt{5}}{3} =\right)$ $6\sqrt{5}$	B1 B1 B1	 FT provided B1 already awarded AND provided all terms are of the form $a\sqrt{5}$ (and the answer is $b\sqrt{5}$ where b is an integer). $18\sqrt{5}$ (with no contradictory working) implies B2. $6\sqrt{5}$ (with no contradictory working) implies B3.
18. Strategy P(blue, yellow) and P(yellow, blue) 7/10 × 5/11 + 3/10 × 9/11 = 62/110 (= 31/55)	S1 M2 A1	Any indication e.g. tree diagram with relevant branches identified M1 for sight of 7/10 × 5/11 or 3/10 × 9/11 OR M1 for a (consistent) error in a denominator within an otherwise complete calculation ISW If M0 A0, award (S1) SC1 for an answer of 42/90 or 52/100 or 62/120 or equivalent (from non-replacement or replacing with one card only or replacing original card as well as additional cards.)

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<u>Alternative method</u> *Strategy 1 – [P(blue, blue) + P(yellow, yellow)]* *1 – [7/10 × 6/11 + 3/10 × 2/11]* *= 62/110 (= 31/55)*	*S1* *M2* *A1*	*Any indication e.g. tree diagram <u>with</u> relevant branches identified* *M1 for sight of 7/10 × 6/11 or 3/10 × 2/11* *OR* *M1 for a (consistent) error in a denominator within an otherwise complete calculation* *ISW* *If M0 A0, award (S1) SC1 for an answer of 42/90 or 52/100 or 62/120 or equivalent (from non-replacement or replacing with one card only or replacing original card as well as additional cards.)*
19.*(a)* (i) (-5, 8)	B1	
19.*(a)* (ii) (2, 4)	B1	
19.*(b)* $y = f(-x)$	B1	
20. 155° and 205° with no other values	B2	B1 for either angle. Check diagram. Ignore extra (correct or incorrect) values outside the required range Penalise -1 for each extra value within range (beyond 2 attempts).
21. x(4x – 5) = 2(x + 1) or equivalent $4x^2 - 7x - 2$ [= 0] $(4x + 1)(x - 2)$ [= 0] $x = -\frac{1}{4}$ AND $x = 2$	M1 A1 B2 B1	M1 for sight of x(4x – 5) AND 2(x + 1) or equivalent Ignore presence of denominator (provided correct). B1 for (4x …. 1)(x …. 2) OR for (2x ± 1)(2x ∓ 2) FT their quadratic equation, provided of equivalent difficulty. Both answers required. Strict FT 'their <u>derived</u> brackets'. *<u>Allow use of quadratic formula</u> FT their quadratic equation, provided of equivalent difficulty.* $(x =) \quad \frac{7 \pm \sqrt{[(-7)^2 - 4(4)(-2)]}}{2(4)}$ *M1* *For M1, allow one error, in sign or substitution, but not in formula.* $x = \frac{7 \pm \sqrt{81}}{8}$ *A1* $x = -\frac{1}{4}$ *AND* $x = 2$ *(both answers required) A1* *No marks for a trial and improvement method.*

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