GCSE MARKING SCHEME

SUMMER 2019

GCSE
MATHEMATICS – UNIT 2 (HIGHER TIER)
3300U60-1

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INTRODUCTION

This marking scheme was used by WJEC for the 2019 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

SUMMER 2019 MARK SCHEME

GCSE MATHEMATICS **Unit 2 : Higher Tier**	**Mark**	**Comments**
1.(a) $3n + 5$ or equivalent	B2	B1 for sight of 3n. B0 for −3n Mark final answer.
1.(b) $3t = r + 8$ or $r + 8 = 3t$ or $-3t = -r - 8$ $t = \frac{r+8}{3}$ or $\frac{r+8}{3} = t$ or $t = \frac{-r-8}{-3}$	B1 B1	F.T. only from $3t = \pm r \pm 8$, stated or implied. ($3t = r + 8$ will have already gained the previous B1.) B1B0 for $-t = \frac{-r-8}{3}$ or equivalent. Mark final answer. *Note* *Allow B1B0 for $t = (r + 8) \div 3$ with or without brackets.* *Allow B1B0 for $\frac{r+8}{3}$ ('t' missing)*
1.(c) $6x + 4 = 46$ OR $3x + 2 = 23$ $6x = 42$ OR $3x = 21$ $(x =) 7$	B2 B1 B1	B1 for $(x + 5) + (2x – 3) + (x + 5) + (2x – 3) = 46$ or equivalent e.g. $(x + 5) + (2x – 3) = 23$ FT collection of 'their terms' if of equivalent difficulty. (linear equation only.) FT only from $ax = b$. Allow a fraction from a FT value unless x is a whole number. $(x =) 7$ gains all four marks. Each B mark implies all previous B marks. Mark final answer.
1.(c) Alternative method *A trial showing correct values and understanding of perimeter. (e.g. $2(4 + 5) + 2(2\times4 – 3) = 28$)* *An improved trial.* *$(x =) 7$*	*B1* *B1* *B2*	*Consistent use of x AND correct evaluation.* *Dependent on first B1.* *If 1st trial is using '7' award B1B1 followed by B1 if left embedded but B2 if shown as $x = 7$.* *B1 for an implied / embedded '$x = 7$' but not shown as $x = 7$.* *$(x =) 7$ gains all four marks.* *Mark final answer.*

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2. Intent to square at least two of the three values.	S1	(*Note:* $12{\cdot}8^2 = 163{\cdot}84$, $22{\cdot}7^2 = 515{\cdot}29$ and $25{\cdot}6^2 = 655{\cdot}36$)
Comparing $(25{\cdot}6)^2$ with $(12{\cdot}8)^2 + (22{\cdot}7)^2$ or Any intent to compare any other relevant values. (e.g. $(25{\cdot}6)^2 - (22{\cdot}7)^2$ with $(12{\cdot}8)^2$ or $\sqrt{[(12{\cdot}8)^2 + (22{\cdot}7)^2]}$ (with 25·6))	M1	The comparison attempted must show <u>both</u> intended calculations e.g. $(25{\cdot}6)^2$ AND $(12{\cdot}8)^2 + (22{\cdot}7)^2$ unless intention is to compare with a given side e.g. $\sqrt{[(12{\cdot}8)^2 + (22{\cdot}7)^2]}$ with 25·6
Correct evaluation of value(s) to be compared. (e.g 'sight of 655·36 WITH 679·13' or 'sight of 140·07 WITH 163·84' or 'sight of 26·06 (WITH 25·6)')	A1	C.A.O. but allow evaluated answers to be given to the nearest whole number. e.g. 655 WITH 679.
Statement that it is NOT possible	A1	Allow FT if M1 awarded. *If all marks gained ISW.*
2. <u>Alternative method 1</u> *Intent to use two right-angled trig ratios **using 2 <u>different pairs</u> of given sides***	S1	*i.e. In order to find the value of either the same angle OR two different angles, whilst sufficient to show that it isn't a right-angled triangle.*
*Correct right-angled trig ratio used **twice**, **using 2 <u>different</u> given sides**, in order to compare* • *the values of the same angle or* • *the sum of the two angles with 90°.*	M1	
Correct evaluation of value(s) to be compared. *e.g. sight of any two of 30(°), 27.5…(°) and 29.4…(°) OR sight of 30(°) and 60.58…(°) (and the sum to be compared with 90°)*	A1	*CAO* **Ratio / Opp / Adj / Hyp / Angle** Sin / 12.8 / / 25.6 / 30(°) Cos / / 22.7 / 25.6 / 27.5…(°) Tan / 12.8 / 22.7 / / 29.4…(°) Sin / 22.7 / / 25.6 / 62.46…(°) Cos / / 12.8 / 25.6 / 60(°) Tan / 22.7 / 12.8 / / 60.58…(°)
Statement that it is NOT possible	A1	*If comparing the sum of two angles (with 90°), the sum must be shown.* *Allow FT if M1 awarded.* *If all marks gained ISW.*
2. <u>Alternative method 2</u> (using the cosine rule)		*<u>NOTE</u> The cosine rule is not on the intermediate tier specification, but as it is a common question, it may be seen by Higher tier candidates.*
(cos A =) $(12.8^2 + 22.7^2 - 25.6^2) / (2\times12.8\times22.7)$ (= 2377/58112 or 0·0409..)	*M2*	*M1 for $25.6^2 = 12.8^2 + 22.7^2 - 2\times12.8\times22.7\times\cos A$*
(A =) 87(.6557…°)	*A1*	
Statement that it is NOT possible	*A1*	*If all marks gained ISW.*

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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
3.(a) $A \cap B$	B1	
3.(b) B'	B1	
4 Four numbers with a range of 10. Four numbers with a total of 36. Four numbers with a median of 8. Possible answers for all three marks are 5,5,11,15 or 5,6,10,15 or 5,7,9,15 or 5,8,8,15	 B1 B1 B1	B0 if all four original numbers used.
5. (number of females in Porth =) $\frac{90}{360} \times 128$ OR (number of males in Porth =) $\frac{120}{360} \times 72$ (number of females in Porth =) 32 (number of males in Porth =) 24 (Probability from Porth =) $\frac{56}{200}$ or equivalent ISW	M1 A1 A1 A1	Or equivalent *Answers may be seen on the diagram.* An answer of 32 implies M1. An answer of 24 implies M1. FT ('their 32' + 'their 24') /200 provided M1 gained. Penalise incorrect notation −1. e.g. '56 in 200'.
6. $\sin(QPR) = \frac{9{\cdot}6}{16{\cdot}7}$ (QPR =) $\sin^{-1}(9.6/16{\cdot}7)$ or $\sin^{-1}(0{\cdot}57..)$ = 35·1(°) or 35·09(°) or 35·089(…°)	M1 m1 A1	 Implies M1. Allow any answer that rounds to 35(°)
6.Alternative method. ***Correct** use of 'two-step' method.* *(x)* = 35·1(°) or 35·09(°) or 35·089(…°)	 M2 A1	 *A partial trigonometric method is M0.* Allow any answer that rounds to 35(°)
7. 7x + 2y = (£)41.5(0) AND 4x + 3y = (£)29.75 Method to eliminate variable (Attempt at equal coefficients and subtraction) First variable found x =(£) 5 or y = (£)3.25. Substitute to find the 2nd variable. Second variable found.	B1 M1 A1 m1 A1	Allow use of other letters to denote variables. B0 for using 4150 and 2975. FT 'their equations' if of equal difficulty. Allow 1 error in one term, not one with equal coefficients. C.A.O. (for their equations if FT.) F.T. their '1st variable'. FT answers should be given to the nearest penny (rounded or truncated). If M0, award SC2 (with possible B1) for both answers of (£) 5 AND (£)3.25.

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8. One correct evaluation $1 \le x \le 2$ 2 correct evaluations $1{\cdot}55 \le x \le 1{\cdot}75$, one < 0, one > 0. 2 correct evaluations $1{\cdot}55 \le x \le 1{\cdot}65$, one < 0, one > 0. $x = 1{\cdot}6$	 B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if 'too high' or 'too low'. If evaluations not seen accept 'too high' or 'too low'.* $\underline{x}$ $\underline{2x^3 + x - 10}$ (or check $2x^3 + x = 10$) 1 −7 1·1 −6·238 1·2 −5·344 1·3 −4·306 1·4 −3·112 1·45 − 2·452... 1·5 −1·75 1·55 − 1·002... **1·6** **−0·208** **1·65** **0·634**... **1·7** **1·526** 1·75 2·468... 1·8 3·464 (1·62 0·123..) 1·9 5·618 (1·63 0·291..) 2 8 (1·64 0·461..)
9. 85% ≡ 6154 $\frac{6154}{85} \times 100$ OR $\frac{6154}{0{\cdot}85}$ = 7240	B1 M1 A1	Accept any indication. Implies the B1.
10. x = 54(°) Opposite angles (of a) cyclic quad. (add up to 180°). y = 108(°) Angle at the centre (is twice the angle at the circumference).	B1 E1 B1 E1	 Dependent on an attempt at 180 – 126. FT 2 × 'their 54' only if less than 360° Dependent on an attempt at 2 × 'their 54'.
11. Correct enlargement	B2	Otherwise B1 for 2 correct vertices within a triangle. OR for 3 correct vertices in the correct location not joined to form the triangle OR triangle of correct shape, size and orientation in incorrect position OR consistent correct use of an incorrect negative scale factor.
12(a). $(9p + 1)(9p - 1)$	B2	B1 for $(9p \ldots 1)(9p \ldots 1)$
12(b). $(7t - 2)(t + 3)$	B2	B1 for $(7t \ldots 2)(t \ldots 3)$
13. Sight of 297.5 AND 6.5 297.5 ÷ 6.5 = 45.77(km/h)	B1 M1 A1	Accept 6 hours 30 minutes, but not 6.3 hours. If other calculations shown, then the relevant calculation must be identified. Award M1 for their values provided 295≤d<300 AND 6<t≤7 (but not 6 hours 30 minutes). CAO. Correct answer must be clearly identified.
14. sin BAD = (2×70)/(8×19) or equivalent (BAD=) 67(.08…°) (Area of sector ABD=) 67(.08…)/360×π×8^2 Accept answers in the range 37.4(cm^2) to 37.5(cm^2) OR 37(cm^2)	M2 A1 M1 A1	Allow any unambiguous indication of angle BAD. M1 for the correct use of the formula when sinBAD is not the subject, for example: 70 = 1/2×8×19×sinBAD. Allow any answer that rounds to 67(°). Accept 292.9(…)/360×π×8^2 OR 293/360×π×8^2 for the area of the major sector ABD. FT their derived or stated value of angle BAD. Accept an answer in the range 163.5(cm^2) to 163.7(cm^2) OR 164(cm^2) for the area of the major sector ABD.

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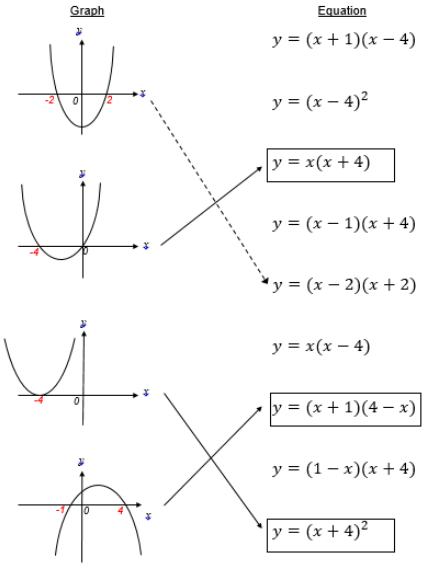
15.  	B2	B1 for any 1 or 2 correct.
16.(a) General sine curve with appropriate orientation and position. -1 and 1 indicated on the y-axis, curve passes through (-180°,0), (0°,0) and (180°,0) and approximately (-90°,-1) and (90°,1).	M1 A1	Ignore curve shown for values x< -180° or x> 180°.
16(b). -30(°) AND -150(°)	B2	Accept embedded answers. Penalise further incorrect answer(s) -1. Ignore further answer(s) outside of the range. Award B1 for sight of an answer -30(°) or -150(°) (but not for sight of -30 as part of working).
17.(a) $\frac{3}{100} \times \frac{1}{99}$ $= \frac{3}{9900}\left(= \frac{1}{3300}\right)$ ISW	M1 A1	Allow $3(.03\ldots)\times10^{-4}$ OR $0.0003(03\ldots)$ or equivalent. A0 for $0.0003(03\ldots)$%. An unsupported $0.000303(\ldots)$ gains M1A1. An unsupported 3/10000 OR 0.0003 gains no marks.
17(b) $2 \times \frac{3}{100} \times \frac{1}{99}\left(= \frac{6}{9900} = \frac{1}{1650}\right)$ $+ \frac{3}{100} \times \frac{2}{99}\left(= \frac{6}{9900} = \frac{1}{1650}\right)$ OR $\frac{4}{100} \times \frac{3}{99}$ $= \frac{12}{9900}\left(= \frac{1}{825}\right)$ ISW	M2 A1	M1 for sight of $\left(\frac{3}{100} \times \frac{1}{99}\right) + \left(\frac{3}{100} \times \frac{1}{99}\right)$ OR $\left(\frac{3}{100} \times \frac{1}{99}\right) + \left(\frac{1}{100} \times \frac{3}{99}\right)$ OR $2 \times \frac{3}{100} \times \frac{1}{99}$ OR $\left(\frac{3}{100} \times \frac{1}{99}\right) + \left(\frac{3}{100} \times \frac{2}{99}\right)$ Allow $1(.21\ldots)\times10^{-3}$ OR $0.001(21\ldots)$ or equivalent. An unsupported answer of $0.00121(2\ldots)$ gains M2A1. A0 for $0.001(21\ldots)$%. SC1 for working with replacement leading to an answer of 12/10000 (3/2500) OR 0.001(2) [may be unsupported].

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17.(b) <u>Alternative method</u> $1-\left[\left(\frac{96}{100}\times\frac{95}{99}\right)+\left(2\times\frac{3}{100}\times\frac{96}{99}\right)+\left(2\times\frac{1}{100}\times\frac{96}{99}\right)\right]$ $=\frac{12}{9900}\left(=\frac{1}{825}\right)$ *ISW*	*M2* *A1*	*M1 for sight of:* $\left[\left(\frac{96}{100}\times\frac{95}{99}\right)+\left(2\times\frac{3}{100}\times\frac{96}{99}\right)+\left(2\times\frac{1}{100}\times\frac{96}{99}\right)\right]$ *OR* $1-\left[\left(\frac{96}{100}\times\frac{95}{99}\right)+\left(\frac{3}{100}\times\frac{96}{99}\right)+\left(\frac{1}{100}\times\frac{96}{99}\right)\right]$ *Allow 1(.21…)×10^{-3} OR 0.001(21…) or equivalent.* *An unsupported answer of 0.00121(2…) gains M2A1.* *A0 for 0.001(21…)%.* *SC1 for working with replacement leading to an answer of 12/10000 (3/2500) OR 0.001(2) [may be unsupported].*
18. (cos CAB =) $(13^2 + 17^2 - 23^2) / (2\times13\times17)$ (=-71/442 OR -0.16(06…)) (CAB =) 99(.2…°)	M2 A1	M1 for $23^2 = 13^2 + 17^2 - 2\times13\times17\times\cos CAB$ SC1 for the correct evaluation of either of the two other angles. ABC = 33(.9...) and ACB = 46(.8...).
19. Sight of $9x^2-6x-6x+4$ Sight of $x^2+x+2x+2$ $8x^2-15x+2=0$ $x=\frac{-(-15)\pm\sqrt{(-15)^2-4\times8\times2}}{2\times8}$ $x=\frac{15\pm\sqrt{161}}{16}$ $x=1.73$ with $x=0.14$ (answers to 2dp)	B1 B1 B1 M1 A1 A1	Or equivalent. Or equivalent. FT expansions of equivalent level of difficulty provided B1 previously awarded. '= 0' required, but may be implied by an attempt to use the quadratic formula or if $a=8, b=-15$, $c=2$ used in the quadratic formula. This substitution into the formula must be seen for M1. FT 'their derived quadratic equation' equated to zero of equivalent difficulty (a, b and c must be non-zero). Allow one slip in substitution **<u>for M1 only</u>**, but must be correct formula. Can be implied from at least one correct value of x evaluated. CAO for their quadratic equation but not if complex roots. M0A0A0 if trial and improvement used or for unsupported answers.
20. Volume scale factor: $\left(\sqrt{199/47}\right)^3$ (=8.712…) OR $\left(\sqrt{47/199}\right)^3$ (=0.114…) or equivalent. Volume of larger solid $350\times\left(\sqrt{199/47}\right)^3$ OR $350\div\left(\sqrt{47/199}\right)^3$ or equivalent. 3049(.305…cm^3)	B2 M1 A1	May be seen in parts. Award B1 for a linear scale factor: $\sqrt{(199/47)}$ (= 2.057…) OR $\sqrt{(47/199)}$ (= 0.485…) or equivalent OR Award B1 for $(199/47)^3$ (= 75.904…) OR $(47/199)^3$ (= 0.013...). CAO. Not from premature approximation.

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