GCSE MARKING SCHEME

AUTUMN 2017

GCSE
MATHEMATICS
UNIT 1 - HIGHER TIER
3300U50-1

INTRODUCTION

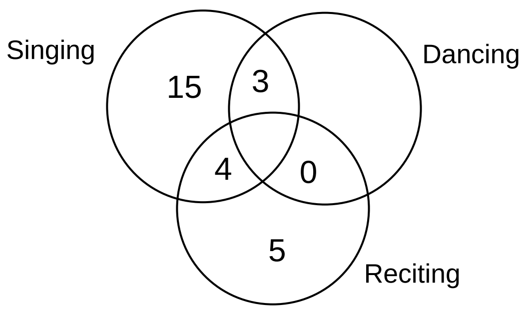
This marking scheme was used by WJEC for the 2017 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' 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.

GCSE MATHEMATICS Unit 1 : Higher Tier Autumn 2017 Final Marking Scheme	Mark	Comments
1.(a) Kite	B1	
1.(b) Trapezium	B1	
1.(c) Rhombus	B1	
2.(a) −3 Scale on y-axis ‘2cm square ≡ 5 units’ OR ‘2cm square ≡ 4 units’. At least 5 correct plots and no incorrect plot. A smooth <u>curve</u> drawn through their plots.	B1 B1 P1 C1	 B0 for ‘2cm square ≡ 10 units’. F.T. ‘their (−1, −3)’ AND ‘their uniform scale’ if possible. Allow ± ‘½ a small square’. F.T. ‘their 6 plots’ OR a curve through the 5 given plots and (−1, −3). Allow for the intention to pass through their plots. (± 1 small square horizontal OR vertical).
2.(b) $y = x^2 + 3$	B1	
3.(a) Correct rotation.	B2	Allow B1 for two correct vertices. B1 for a 90° clockwise rotation about (−2, 3) OR B1 for a 90° anticlockwise rotation about (3, −2).
3.(b) Correct enlargement.	B2	Allow B1 for two correct vertices. B1 for an enlargement of scale factor ½ but not centred at (0,0). Must be in the correct orientation. SC1 for a correct enlargement using a scale factor of −1/2 centred at (0,0).

4.		*<u>Note:</u> Both E1 marks are awarded for a suitable/valid attempt at statement (not an implied reason from a calculation).* *Both E marks are dependent on attempt at related work.* *Look for angles seen on the diagram.* *For this question allow angles shown in diagram to take precedence over answer space.*
(RQP or QRP =) $\frac{180 - 30}{2}$	M1	
= 75(°)	A1	
Tangents (from external point) are equal (in length) OR a geometric consequence based on this fact e.g. 'QPR is isosceles' or 'PQOR is a kite'.	E1	Accept any suitable attempt at a valid statement. Allow PQ = PR. Also allow unambiguous indication on the diagram. 'Angles in a triangle' not sufficient.
(OQR = 90 – 75 =) 15(°)	B1	F.T. 'their derived 75' provided acute.
Tangent and radius (at any point) are perpendicular	E1	Accept any suitable attempt at a valid statement. Also allow unambiguous indication on the diagram. *<u>Alternative method 1</u>* *(ROQ = 360−90−90−30 =) 150(°) B1* *Tangent and radius (at any point) are perpendicular. E1* *OQR = $\frac{180 - 150}{2}$ M1* *F.T. 'their derived 150'* *= 15(°) A1* *Radii form an isosceles triangle. E1* *<u>Alternative method 2 (with line OP drawn)</u>* *(POQ or RQP=) 180 −90 – 15 M1* *= 75(°) A1* *Tangents (from external point) are equal (in length) OR a geometric consequence based on this fact e.g. 'QPR is isosceles' or 'PQOR is a kite'. E1* *(OQR = 90 – 75 =) 15(°) B1* *F.T. 'their derived 75' provided acute* *Tangent and radius (at any point) are perpendicular. E1* *[Note: Do not 'mix and match' marks from alternative methods.]*
	OC1	Organisation and Communication. 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
	W1	Accuracy of writing. 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

5.(a) $4{\cdot}2 \times 10^{-4}$	B1	
5.(b) $3{\cdot}6 \times 10^{8}$	B1	
5.(c) $4{\cdot}08 \times 10^{5}$	B2	B1 for sight of any correct value but not in standard form. e.g. $40{\cdot}8 \times 10^{4}$ or 408 000.
6. Arc, <u>centre P</u>, intersecting AB at two points. (B may be one of the points with no arc seen at point B) Intersecting arcs (equal radii) using the above two points as centres. Line drawn	M1 m1 A1	[Note to markers: These arcs may be identified by the fact that they will 'cross the line AB at an acute angle'. Arcs 'crossing the line at 90°' is evidence of an inappropriate method.] M1 and m1 must be gained before A1 is awarded. *<u>Alternative method</u>* *Using the properties of a kite.* *Intersecting arcs whose centres are any two points on the line AB and respective radii equal in length to the distance from the points to the point P.* *M2* *[Note to markers: The arcs will always intersect at a point that is a 'reflection of point P' in the line AB.]* *Line drawn* *A1*
7.  5 AND 3 AND 0 in correct position. Total of 9 for 'Reciting'. Total of 22 for 'Singing'. (Probability only took part in '*Singing*') $= \frac{15}{29}$ ISW	 B1 B1 B1 B2	Allow empty space to imply 0. C.A.O. 15/29 gains all 5 marks. Otherwise, strict F.T. from 'their diagram'. B1 for a correct numerator in a fraction <1. B1 for a correct denominator in a fraction <1. Penalise -1 if incorrect notation used for probability e.g. '15 out of 29'.

8. $(x-9)(x+2)$ $(x=)\ 9$ AND $(x=)\ -2$	B2 B1	B1 for $(x \ldots 9)(x \ldots 2)$. Strict F.T. from their <u>brackets.</u> Penalise change of letter −1. If no factorising shown, allow the following. B2 for $x-9\ (=0)$ AND $x+2\ (=0)$ (B1) $(x=)\ 9$ AND $(x=)\ -2$ (B1) B1 for $x+9\ (=0)$ AND $x-2\ (=0)$ (B0) $(x=)\ -9$ AND $(x=)\ 2$ (B1) FT B1 if only $(x=)\ 9$ AND $(x=)\ -2$ seen. (B1)
9. Method to eliminate variable e.g. equal coefficients with <u>appropriate</u> addition or subtraction. First variable found, $x = 3\frac{1}{2}$ or $y = 4$. Substitute to find the 2nd variable. Second variable found	 M1 A1 m1 A1	*No marks for trial and improvement.* Allow 1 error in one term, not one with equal coefficients. C.A.O. F.T. their '1st variable'.
10. (Volume of cube =) m^3 OR $m \times m \times m$ OR $m^2 \times m$ (Volume of cylinder =) $\frac{\pi m^3}{4}$ OR $\frac{\pi \times m \times m \times m}{4}$ OR $\frac{\pi \times m^2 \times m}{4}$ $k = 4$	B1 B2 B1	For sight of m^3 or equivalent. For sight of $\pi m^3/4$ or equivalent. B1 for $\pi \times \left(\frac{m}{2}\right)^2 \times m$. Also allow this B1 if brackets are missing. $m^3 : \frac{\pi m^3}{4}$ OR $4m^3 : \pi m^3$ OR $1 : \frac{\pi}{4}$ all imply B1B2. Allow B1 if left as $4 : \pi$. F.T. only for $\pi m^3 / 2$ (giving $k = 2$ or $2 : \pi$) <u>Note :</u> If a value is used for m then mark as above and penalise −1 from total mark gained.

11. $y \geq -2$ or equivalent $y \leq 3x + 1$ or equivalent	B1 B2	Accept '>' Accept '<'. B1 for $y = 3x + 1$ or $y > 3x + 1$ or $y \geq 3x + 1$ B1 for $y \leq kx + 1$ or $y < kx + 1$ (with $k \neq 3$ and $k > 0$) B1 for $y \leq 3x + c$ or $y < 3x + c$ (with $c \neq 1$)
12. *(a)* (Total area =) $x^2 + (x + 3)^2$ or equivalent $x^2 + x^2 + 3x + 3x + 9$ $2x^2 + 6x + 9 = 22.5$ $4x^2 + 12x - 27 = 0$	B1 M1 A1 A1	Allow award of B1 if brackets are omitted F.T. for equivalent difficulty i.e. from $x^2 + (ax + b)^2$ with a,b ≠ 0. Equating to zero and doubling. Must be convincing.
12. *(b)* $(2x - 3)(2x + 9) = 0$ $x = 3/2$ [or $x = -9/2$] (Dimensions are) 3/2 (cm) and (3/2 + 3 =) 9/2 (cm) Explanation that x cannot be – 9/2 (cm) because a length cannot be negative (or must be positive).	B2 B1 B1 E1	B1 for ($2x$ … 3)($2x$ … 9) FT from 'their two brackets'. (If both F.T. solutions are of the same sign, then both are required for this B1.) Ignore presence or absence of x = –9/2. *Alternative method (using quadratic formula):* $x = [-12 \pm \sqrt{(12^2 - 4 \times 4 \times -27)}] / (2 \times 4)$ *Allow one error, in sign or substitution, but not in the formula.* *M1* $x = [-12 \pm \sqrt{576}] / 8$ *C.A.O.* *A1* $x = 3/2$ [or $x = -9/2$] *C.A.O.* *A1* F.T. 'their derived x'. F.T. provided one solution is positive and the other is negative.

13. *(a)* $y \; \alpha \; 1/x^3$ OR $y = k/x^3$ $120 = k/2^3$ OR $k = 960$ $y = 960/x^3$	B1 M1 A1	Allow $y \, \alpha \, k/x^3$ F.T. from $y \; \alpha \; x^3$ or $y \; \alpha \; 1/x^n$ with $n > 0$ and $n \neq 1$ M1 implies B1 (excluding F.T. case) May be seen in part *(b).* Allow equivalent e.g. $x^3 = 960/y$
13. *(b)* x: 2, 10, **4** y: 120, **0·96**, 15	B2	Accept equivalent e.g. 960/1000 B1 for one correct value. F.T. provided $y \; \alpha \; 1/x^n$ with $n > 0$ and $n \neq 1$ used in part *(a).* SC1 for following through from $y = k/x$, provided both answers are correct OR SC1 for following through from $y = k\,x^3$, provided both answers are correct.
14. Missing angle(s) is/are 59° or 84° AND statement B (identified or implied) Explanation that having equal angles is not a sufficient condition for congruency or Explanation that the (corresponding) side lengths could be different / same (even though the angles are equal)	B1 E1	(Check diagrams) If two angles are given, they must both be correct. Accept valid alternatives e.g. the triangles are similar but not necessarily congruent or e.g. if (a pair of corresponding) side lengths were known, we could apply ASA to test for congruency
15. *(a)* $x = 0{\cdot}6424242.....$ $100x = 64{\cdot}24242.....$ <u>with</u> an attempt to subtract 636/990 or 106/165 or equivalent	M1 A1	Or $10x$ and $1000x$, or equivalent. C.A.O. (63·6/99 gets M1 A0). ISW. *<u>Alternative method</u>* *(0·6+0·0424242...=) 6/10 + 42/990 or equivalent M1* *636/990 (= 106/165) ISW A1*
15. *(b)* 6	B2	B1 for $36^{\frac{1}{2}}$ or $\sqrt{36}$ or $(36/1)^{\frac{1}{2}}$ or $(1/6)^{-1}$ or 1/(1/6) Allow SC1 for an answer of – 6.
16. *(a)* $2\sqrt{10}$	B1	
16. *(b)* 20	B1	
16. *(c)* $100\sqrt{10}$	B1	
17. (Numerator) $4\,(3x + 4)$ (Denominator) $(3x + 4)\,(3x - 4)$ $\dfrac{4}{3x - 4}$	B1 B2 B1	 B1 for $(3x$ ….. $4)\,(3x$ ….. $4)$ Mark final answer. F.T. provided no more than 1 previous error and provided simplification required.

18. $y = f(x + 4)$	B1	
19. *(a)* 2/6 × 3/5 + 3/6 × 2/5 OR 2 × 2/6 × 3/5 OR 2 × 3/6 × 2/5 12/30 (= 2/5)	M2 A1	P(3, 4 or 4, 3). M1 for sight of 2/6 × 3/5 or sight of 3/6 × 2/5. CAO. Mark final answer If no marks gained, award SC1 for method 'with replacement' leading to 12/36 (= 1/3) _Alternative method_ *A list of the 30 possible ordered pairs (permutations) with the correct 12 identified OR a list of the 15 possible pairs (combinations) with the correct 6 identified OR a 6 × 6 two-way table with diagonal deleted to leave 30 spaces with the correct 12 identified M2* *(otherwise M1 for a sample space of 30, or M1 for identifying the correct 6 combinations or the correct 12 ordered pairs (permutations))* *12/30 (= 6/15 = 2/5) CAO A1*

		F.T. consistent use of incorrect total number of cards.
(b) Strategy of finding P(even, even) and P(odd, odd)	S1	Or equivalent e.g. P(2,4) + P(4,2) + P(3,3) + P(4,4) or e.g. 1 – P(sum is odd)
$4/6 \times 3/5 + 2/6 \times 1/5$	M2	OR M2 for $1/6 \times 3/5 + 3/6 \times 1/5 + 2/6 \times 1/5 + 3/6 \times 2/5$ OR M2 for $1 - (4/6 \times 2/5 + 2/6 \times 4/5)$ M1 for sight of $4/6 \times 3/5$ or sight of $2/6 \times 1/5$ OR M1 for sight of <u>two</u> of the following products $1/6 \times 3/5$, $3/6 \times 1/5$, $2/6 \times 1/5$, $3/6 \times 2/5$ OR M1 for sight of $4/6 \times 2/5$ or sight of $2/6 \times 4/5$
14/30 (= 7/15)	A1	CAO. Mark final answer. If no marks gained, award S1 SC1 for method 'with replacement' leading to 20/36 (= 5/9) <u>*Alternative method*</u> *Strategy of finding P(even, even) and P(odd, odd) or equivalent e.g. P(2,4) + P(4,2) + P(3,3) + P(4,4) or e.g. 1 – P(sum is odd)* *S1* *(If a strategy is not explicitly stated, S1 may be awarded retrospectively for sight of a correct probability)* *A list of the 30 possible ordered pairs (permutations) with the correct 14 identified* *OR a list of the 15 possible pairs (combinations) with the correct 7 identified* *e.g. as (2, 4), (2, 4), (2, 4), (3, 3), (4, 4), (4, 4), (4, 4)* *OR a 6 × 6 two-way table with diagonal deleted to leave 30 spaces with the correct 14 identified* *M2* *(otherwise M1 for a sample space of 30, or M1 for identifying the correct 7 combinations or the correct 14 ordered pairs (permutations))* *14/30 (= 7/15) CAO* *A1*