GCSE MARKING SCHEME

AUTUMN 2017

GCSE
MATHEMATICS
UNIT 2 - HIGHER TIER
3300U60-1

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.

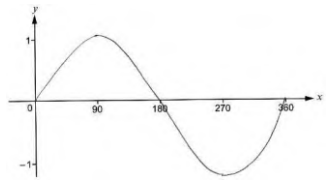
GCSE Mathematics Unit 2: Higher Tier Autumn 2017 Final Mark Scheme	Mark	Comment
1.(a) $18p^9$	B1	
1.(b) $\frac{g^6}{4}$	B1	
1.(c) 1	B1	
2. One correct evaluation $4 \le x \le 5$ 2 correct evaluations $4{\cdot}25 \le x \le 4{\cdot}45$, one < 91, one > 91. 2 correct evaluations $4{\cdot}25 \le x \le 4{\cdot}35$, one < 91, one > 91. $x = 4{\cdot}3$	 B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if <91 or >91. If evaluations not seen accept 'too high' or 'too low'.* *Look out for testing $x^3 + 2x - 91 = 0$* x $x^3 + 2x$ 4 72 4·1 77·121 4·2 82·488 4·3 88·107 4·4 93·984 4·5 100·125 4·25 85·26.... 4·6 106·536 4·35 91·01... 4·7 113·223 4·45 97·02... 4·8 120·192 4·9 127·449 5 135
3. $4x - 3 = x + 48$ $3x = 51$ $x = 17$ ABC (or/and ACB) = 65(°) $y = 180 - 2 \times 65$ = 50(°)	 M1 A1 A1 B1 M1 A1	Look at diagram. F.T. from $ax = b$. $a \neq 1$. Unsupported x = 17 gains M1A1A1 F.T. using 'their derived or stated value for x' substituted in either (4x – 3) or (x + 48). F.T. 180 – 2 × 'their 65' derived using 'their x' in either angle'. OR F.T. 180 – 'their derived ABC' – 'their derived ACB' (Must be using a consistent value for x.) A0 if error in either 'deriving ABC' or 'deriving ACB'. A0 if 'y' is negative on FT. *Alternative method* *M1A1A1 as before.* *$y + (4x-3) + (x+48) = 180$ or equivalent B1* *$y = 135 - 5\times17$ FT 'their derived or stated 17' M1* *$y = 50(°)$ A1*

4.(a)		*Work for 4(a) must be seen in 4(a) and not awarded retrospectively from work in 4(b).* In (a) allow correctly working in metres BUT final answer must be in cm^2.
$35^2 = 21^2 + AB^2$ OR $(AB^2 =) 35^2 - 21^2$	M1	
$(AB^2 =) 784$ or $(AB =) \sqrt{784}$	A1	F.T. 'their784' if M1 gained and if <1225
$(AB =) 28(cm)$	A1	0
(Area ABC =) $\frac{21 \times 28}{2}$	M1	F.T. (21 × 'their stated or shown AB') / 2 AND (AB ≠ 35 and ≠ 21)
$= 294(cm^2)$	A1	
		Alternative method. *Cos C = 21/35* *M1* *C = cos^{-1} 0·6* m1 *ACB = 53(·13..)(°)* *A1* *F.T. 'their 53°'* *Area ABC = ½ × 21 × 35 × sin 53·13°* *M1* *= 294(cm^2)* *A1* *Answer from a 'FT angle' must be correct to at least 1dp. (Note using 53° leads to 293·498….)*
	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
4.(b) Use of 'Volume = area ABC × length'.	M1	*Work for 4(b) must be seen in 4(b).* Allow this M1 even if using 'mixed units'. Where 'area ABC' is that shown in 4(a) or calculated using 'their AB' from 4(a) AND the length is '2×10^n'. (Note: using 'their AB' as an area is M0.)
(Volume =) 294 × 200 OR 0·0294 × 2	m1	F.T. 'their area of ABC' OR 294 AND using 'consistent' units.
$= 58800\ cm^3$ OR $0{\cdot}0588\ m^3$.	A1	Correct units must be shown. Mark final answer. An unsupported 588×10^n implies M1.

5. (LCM of 12, 18 and 24 =) 72 or equivalent, e.g. 2×2×2×3×3. (HCF of 36 and 54 =) 18 or equivalent, e.g. 2×3×3. (72 ÷ 18 =) 4	B2 B2 B1	B1 for any other common multiple identified. e.g 144, 432, 5184 etc. B1 for any other common factor identified. i.e. 2, 3, 6, 9. Do not accept 1. F.T. only if at least one B2 gained. B0 for 72/18. Unsupported 4 gains 5 marks.
6(a) $2x + 2y = 7y - 3$ OR $x + y = \frac{7y - 3}{2}$ $2x = 5y - 3$ OR $x = \frac{7y - 3}{2} - y$ $x = \frac{5y - 3}{2}$	B1 B1 B1	F.T. until 2nd error provided of equivalent difficulty. Accept $x = \frac{5y}{2} - \frac{3}{2}$ OR $x = \frac{-5y + 3}{-2}$ OR $x = 2\frac{1}{2}y - 1\frac{1}{2}$ or equivalent. Must have 'x = '. An answer of $\frac{5y - 3}{2}$ gains B1B1B0 (missing 'x =') Mark final answer.
6.(b) $n^2 + 2$	B2	Mark final answer. B1 for $n^2 \pm$ …., not for n^2 alone B0 for $an^2 \pm$ ….. where $a \neq 1$.
7 $QS = \frac{8}{\sin 38}$ $= 13$ or $12{\cdot}99(..)$ $\tan x = \frac{15}{12.99(..)}$ $x = \tan^{-1}(15/12{\cdot}99\ldots)$ $= 49(\cdot 098..°)$	M2 A1 M1 m1 A1	M1 for $\frac{8}{QS} = \sin 38$. Accept M1 for $\frac{QS}{\sin 90} = \frac{8}{\sin 38}$ M2 for $QS = \frac{8 \times \sin 90}{\sin 38}$ F.T. 'their 12.99(..)', stated or shown on diagram. Mark final answer. If FT leads to a non-integer value, allow to the nearest degree.
8.(a) 0·13 on 'car' branch. 1/3 on 'other day' branches.	B1 B1	Do not penalise if one of branches left blank.
8.(b) $1 - 0{\cdot}87 \times \frac{2}{3}$ OR $0{\cdot}87 \times \frac{1}{3} + 0{\cdot}13 \times \frac{2}{3} + 0{\cdot}13 \times \frac{1}{3}$ $= 0{\cdot}42$	M2 A1	M1 for sight of $0{\cdot}87 \times 2/3$. F.T. 'their 0·13' and 'their 1/3'. C.A.O. If M0 allow SC1 for sight of $0{\cdot}13 \times \frac{2}{3}$ (= 0·0866..) seen in part (b). (This for travelling by car on the first day.)

9.(a) $10w^2 - 10w + 3w - 3$ $4 - 6w - 6w + 9w^2$ $10w^2 - 10w + 3w - 3 - 4 + 6w + 6w - 9w^2$ $(=)w^2 + 5w - 7$	 B1 B1 B1 B1	 Or equivalent. Or equivalent. FT if at least B1 awarded for equivalent level of difficulty, ie. at least three terms for each expansion. Penalise any further error. CAO (convincing). Dependent on B1B1B1.
9.(b) $w = \frac{-(5) \pm \sqrt{(5)^2 - 4 \times 1 \times (-7)}}{2 \times 1}$ $= \frac{-5 \pm \sqrt{53}}{2}$ $w = 1.14$ AND $w = -6.14$	 M1 A1 A1	Trial and improvement method gains M0. Allow one slip in substitution, but must be correct formula. CAO

10. For a correct proof: i.e. each angle <u>within the triangle</u> is correctly evaluated as 60° AND with correct reasons. No assumptions can be made at any stage of the proof for the evaluation of any angles.	E1 E1 E1	If any other angle is used within the proof e.g. angle FYH, then a correct reason must again be stated (there is no E1 for this angle as it is working towards one of the angles within the triangle). Award E2 for two angles <u>within the triangle</u> correctly evaluated as 60° AND with correct reasons. Award E1 for one angle <u>within the triangle</u> correctly evaluated as 60° AND with correct reason(s). *Do not accept 'Z' angles for alternate angles. <u>*Examples*</u> *<EFY = 60° AND Alternate Segment Theorem; E1* *<FEY = 60° AND Alternate angles; E1* *(<EYF = 60° AND) angles in a triangle (therefore equilateral) OR* *(<EYF = 60° AND) therefore equilateral E1* *<FEY = 60° AND Alternate angles E1* *<FYH = 60° AND Alternate Segment Theorem* *<FYE = (180°–60°–60°)=60° AND straight line E1* *(<EFY = 60° AND) angles in a triangle (therefore equilateral) OR* *(<EFY = 60° AND) therefore equilateral E1* *<EFY = 60° AND Alternate Segment Theorem E1* *<FYH = 60° AND Alternate angles* *<FYE = (180°–60°–60°)=60° AND straight line E1* *(<FEY = 60° AND) angles in a triangle (therefore equilateral) OR* *(<FEY = 60° AND) therefore equilateral E1* *<EFY = 60° AND Alternate Segment Theorem E1* *<FYE = 60° AND Interior angles E1* *(<FEY = (180°–60°–60°)=60° AND) angles in a triangle (therefore equilateral) OR* *(<FEY = 60° AND) therefore equilateral E1*
11. (Curved surface area of cone =) π×11×13 (Curved surface area of cylinder =) 2×π×11×17 (Base of cylinder =) π×11×11 (Total surface area=) Answer in the range 2003.3(cm^2) to 2004.6(cm^2) or 2005(cm^2) or 638π (cm^2)	M1 M1 M1 A1	143π or values between 449.02 and 449.306 374π or values between 1174.36 and 1175.108 121π or values between 379.94 and 380.182 CAO. Unsupported correct answer is awarded full marks.

12. 137.5 ÷ 10.5 = 13.1(cm)	M1 A1	Use of 137.4 and 137.49 gains M0, but the correct use of $137.4\dot{9}$ (with only the 9 recurring) can gain M1. If other calculations shown, then the relevant calculation must be identified. CAO
13. $2 \times \frac{5}{10} \times \frac{4}{9} \times \frac{3}{8}$ $= \frac{120}{720}$ or equivalent $\left(\frac{1}{6}\right)$	M2 A1	M1 for sight of $\frac{5}{10} \times \frac{4}{9} \times \frac{3}{8}$ CAO. Mark final answer. SC1 for an answer of ¼ or 0.25 from the use of calculating 'with replacement'.
14.(a)  	C1	Clear Intention to draw a curve. Curve must pass through (0,0), (180,0) and (360,0) AND intention to have maximum at (90,1) and minimum at (270,-1). Ignore curve shown for values x < 0° or x > 360°.
14.(b)(i) 17 AND 163 OR 17.5 AND 162.5 OR 17.4(576…) AND 162.5(423…)	B2	If more than two answers offered award B1 for sight of one correct angle. Allow embedded answers. Rounded angles must add up to 180°. B1 for sight of one correct angle OR, B1 for two angles which total 180°. Allow different degrees of accuracy in rounding.
14.(b)(ii) 270(°)	B1	Allow an embedded answer.
15. (Linear scale factor=) $\sqrt[3]{}$(3100/3970) OR $\sqrt[3]{}$3100/$\sqrt[3]{}$3970 (= 0.92…) $\sqrt[3]{}$(3100/3970)×25 = 23(.021…cm)	B1 M1 A1	Or equivalent. FT their derived linear scale factor (from $\sqrt[3]{}$). Accept answer in the range of 22.9 to 23.05. Do not award this mark if an answer outside of this range is then rounded to 23. *<u>Alternative method</u> (using reciprocal of volume SF)* *$\sqrt[3]{}$(3970/3100) (= 1.0859…) B1* *25÷$\sqrt[3]{}$(3970/3100) OR 1/$\sqrt[3]{}$(3970/3100) × 25 M1* *= 23(.02..cm) A1*

16)

Graph A

$y = 7x^2$	
$y = -(x+7)^2$	
$y = (x-7)^2$	
$y = 7 - x^2$	✓
$y = x^2 + 7$	

B1

Graph B

$y = x^2 + 1$	
$y = 2^x$	✓
$y + 1 = x^2$	
$y = \frac{1}{x}$	
$y = x^o$	

B1

17.

S1 For an attempt to subtract area of a triangle from the area of sector (This may even include an expression in terms of x).

cos x = (3^2 + 7^2 – 6^2) / (2×3×7)
(x =) 58.4(1…°)

M2 M1 for $6^2 = 3^2 + 7^2 - 2\times3\times7\times\cos x$
A1 Allow 58°.

Area of sector = 58.4(1…) /360 × π × 7²
(Answer in the range: 24.9(595…cm²) to 25(cm²))

M1 FT 'their derived 58.4(1…°)'

Area of triangle = ½ ×3×7×sin58.4(1…)
(Answer in the range:
8.9(4…cm²) to 8.94(4… cm²) or 9(cm²))

M1 FT 'their derived 58.4(1…°)'
M0 for use of a right-angled triangle.
Unsupported 9 cm² gains M0.

(Area of shaded region)
answer in the range of 15.9(cm²) to 16.1(cm²)

A2 FT 'their derived 58.4(1…°)' provided previous M1, M1 awarded.
Award A1 for sight of either:
area of sector in the range
24.9(595…cm²) to 25(cm²)
FT 'their derived 58.4(1…°)'
OR
area of triangle in the range
8.9(4…cm²) to 8.94(4… cm²) or 9(cm²)
FT 'their derived 58.4(1…°)'

This A1 is dependent on gaining the corresponding M1.

NB Unsupported answer of 16(cm^2) gains 0.