



GCSE MARKING SCHEME

SUMMER 2016

**GCSE MATHEMATICS LINKED PAIR METHODS
UNIT 2 HIGHER
4364-02**

INTRODUCTION

This marking scheme was used by WJEC for the 2016 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.

METHODS IN MATHEMATICS
UNIT 2 (HIGHER TIER) - SUMMER 2016

Methods in Mathematics Unit 2 Higher Tier		Comments
1. Shape completed accurately with correct rotation seen	B3 3	With no other 90° rotations shown B2 for at least two lines correct in attempting to complete the shape with correct rotation of their shape with no other 90° rotations shown, OR B1 for the shape completed correctly, or a correct rotation of the part of the shape given, ignore other 90° rotations shown
2(a) $3x + x$ OR $4x$ (cm) (b) $(x =)$ 40	B1 B2 3	Mark final answer FT for $8x +$ 'their FE' = 480 B1 for sight of $12x = 480$ or equivalent informal notation
3(a) $100 \times 45 / 9000$ or $100 \times 45 \div 9000$ 0.5(%) or $\frac{1}{2}$ (%) (b) 1.015×4000 or $4000 + 4000 \times 1.5 / 100$ or $101.5 \times 4000 / 100$ 4060 (c) 0.28×1350 or $\frac{5}{8} \times 580$ or 0.084×4450 or equivalent 378 (m) 362.5 (m) 373.8 (m) 360 370 380 (d) $10 - 9$ = 1	M1 A1 M1 A1 M1 A1 A1 A1 B1 M1 A1 11	CAO Accept 0.5 written as $\frac{1}{2}$ CAO Any one correct calculation shown Accept to 2 sig. figs. 380 Accept 362(.5) or 363 or to 2 sig. figs. 360 Accept 373(.8) or 374 or to 2 sig. figs. 370 Ignore any further working for M and A marks Must all be 2 significant figures, do not accept 360.0 etc. FT provided at least 2 of the A marks awarded <i>If no marks, award SC1 for sight of $9.999 - 9 = 0.999$ or 0.9 recurring</i>
4. (a) $(x =) 12 \times 8 / 3$ x = 32 (b) $(x =) 8$ (c) $35x - 65 = 40$ OR $7x - 13 = 40 / 5$ $35x = 105$ or $x = 105 / 35$ $7x = 21$ or $x = 21 / 7$ x=3 (d) $6x < 100 - 4$ or $6x < 96$ or $3x < 50 - 2$ or $3x < 48$ x < 16 (e) $x < 81 / 3$ or $x < 27$ or $78 < 81$ (x =) 26	M1 A1 B1 B1 B1 B1 M1 A1 M1 A1 10	Accept embedded answers in parts (a), (b) & (c) Mark final answer. Do not accept 72/9 FT until 2 nd error Accept an embedded answer for B3 No marks for use of "=", unless finally replaced to give x<16 then award M1 A1. SC1 for $x < 104 / 6$ ISW Or sight of $3 \times 26 = 78$ with $3 \times 27 = 81$ or equivalent divisions Accept unsupported 26, or a unique answer of 26 from a trial and improvement method, or $3 \times 26 < 81$ Do not accept $x < 26$. <i>Allow sight of $3x = 81$, $x = 27$ followed by selecting $x = 26$</i>
5. $24\pi = 2\pi r$ or $24\pi = \pi d$ or $d = 24$ (cm) r = 12 (cm)	M1 A1 2	Do not accept 11.9(9...)
6. $(x^2 =) 6.8^2 + 8.4^2$ (y ² =) $9.3^2 - 6.8^2$ $x^2 = 116.8$ or $(x =) \sqrt{116.8}$ OR $y^2 = 40.25$ or $(y =) \sqrt{40.25}$ x = 10.8(07...) y = 6.3(44...)	M1 M1 A1 A1 A1 5	Accept 11 from correct working Accept 6 from correct working

Methods in Mathematics Unit 2 Higher Tier		Comments
7.(a) Correct rotation	B2	B1 near miss of grid lines, or for anticlockwise 90° about (2, 0), or for clockwise 90° about (0, 2)
(b) Correct reflection in $y = x$	B2	B1 for sight of the line $y = x$ or correct reflection in $y = -x$
(c) Enlargement scale factor $\frac{1}{2}$ with correct orientation	B2	B1 for any 1 line correct, or consistent incorrect fractional scale <1 , or enlargement scale factor $\frac{1}{2}$ with incorrect orientation
Correct position	B1 7	Not FT. Use bottom right hand vertex as a guide
8. (base edge ²) $576.6 \div 15$ (=38.44) (base edge) $\sqrt{(576.6 \div 15)}$ (=6.2 cm) (new base edge) $\sqrt{(576.6 \div 15)} \times 6/5$ or equivalent 7.44(cm) (New volume) $7.44 \times 7.44 \times 15$ (=830.304 cm ³) (Difference volume) $830.304 - 576.6$ (=253.704 cm ³) (Percentage increase is) $\frac{253.704}{576.6} (\times 100)$ or $1(\times 100) - \frac{830.304}{576.6} (\times 100)$ 44(%)	M1 m1 m1 A1 B1 B1 M1 A1	FT 'their 6.2' that is 'their base edge' CAO FT their 7.44 provided M1, m2 previously awarded FT their new volume provided M1 previously awarded and attempt 'their 7.44' \times 'their 7.44' \times 'their 15' May be implied in further working FT provided their difference in volumes correctly evaluated or implied in an equivalent method ('their 15' as 18 gives an answer of 72.8(%) or 73(%)) <i>Alternative:</i> <i>Linear scale factor 1.2 or equivalent</i> M2 <i>Volume scale factor 1.2^2</i> m3 $= 1.44$ A2 <i>Percentage increase 44(%)</i> A1 <i>Other alternatives are accepted, such as new volume as % original subtract 100, or comparison of base areas</i>
QWC2: Candidates will be expected to <ul style="list-style-type: none"> present work clearly, with words explaining start, process or steps AND <ul style="list-style-type: none"> make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer QWC1: Candidates will be expected to <ul style="list-style-type: none"> present work clearly, with words explaining start, process or steps OR <ul style="list-style-type: none"> make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer 	Q W C 2	QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.
9(a) $x = 14.3 \times \sin 35^\circ$ $x = 8.2(02\dots\text{cm})$ (b) $\tan y = 14.6/8.7$ $y = \tan^{-1} 14.6/8.7$ or $\tan y = 1.678\dots$ $y = 59(.2^\circ)$	M2 A1 M1 A1 A1 6	M1 for $\sin 35^\circ = x/14.3$ Accept 8(cm) from correct working Allow for sight of $\tan y = 1.67$ or 1.68

Methods in Mathematics Unit 2 Higher Tier		Comments
10. (+£) 32 AND (+) 4.3(%) (£) 900 (+£) 100 AND (+) 12.5(%) (£) 81	B2 B2 B1 B1 6	B1 for (32 and) 32/750 or sight of 4.2(666...%) B1 for interpretation '1(.)09 is 981', e.g. 981÷1(.)09 CAO CAO
11. 1.23×10^2	B3 3	B2 for $1.2(29...) \times 10^2$ or 123 B1 for 122.903...
12. $x = 2.6 \times 4.6 \div 3.2$ 3.7(375 cm)	M2 A1 3	M1 for $3.2/4.6 = 2.6/x$ or equivalent <i>Award M2, A0 for an answer of 3.8(3...cm) from $4.6 \div 1.2$</i> Accept 4(cm) from appropriate working. No marks for unsupported 4(cm)
13(a) $3 \times 13.6 \div 8.5$ or 3×1.6 or equivalent 4.8 (cm) (b) Volume scale factor 1.6^3 or 0.625^3 or unsimplified equivalents Volume smaller box 102.4×0.625^3 or $102.4 \div 1.6^3$ 25 (cm ³)	M1 A1 B1 M1 A1 5	 FT 'their derived 1.6^3 '
14. $y = 7 - x$ OR $x = 7 - y$ $2x^2 + x(7-x) + 6 (=0)$ $2(7-y)^2 + (7-y)y + 6 (=0)$ $x^2 + 7x + 6 = 0$ $y^2 - 21y + 104 = 0$ (x + 1)(x+6) (=0) (y -8)(y -13) (=0) x = -1, x = -6 OR y = 8, y = 13 y = 8, y = 13 x = -1, x = -6	M1 M1 A1 M1 A1 A1 6	OR For sight of $x^2 + xy = 7x$ (2 nd eqn multiplied by x) OR Subtraction from 1 st equation OR $x^2 + 7x = -6$ or equivalent FT provided quadratic from an appropriate substitution method or subtraction method OR alternative method to solve, e.g. formula with correct substitution and $b^2 - 4ac$ correctly simplified <i>If A0, A0 then SC1 for x= -1, y=8 OR x= -6, y=13 provided algebraic method shown with appropriate M1, M1, M1 marks</i> <i>No marks for trial & improvement methods</i>
15. $y \propto 1/x^2$ OR $y = k/x^2$ $10 = k/6^2$ $y = 360/x^2$ or $k = 360$ $x^2 = 360/4$ or $x = (\pm)\sqrt{90}$ or $x = 9.4868..$ $x = \pm 9.4868... or \pm 3\sqrt{10}$	B1 M1 A1 M1 A1 5	Ignore use of incorrect symbol 'α' later FT $y \propto 1/x$ or $y \propto x^2$ FT 'their k' provided at least 1 mark previously awarded Accept rounded or truncated, but MUST be ±. No FT from $1/x$ as both solutions required
16. Sight of BA = 2.8(cm) and AO = 5.6(cm) Outer arc $2 \times \pi \times 8.4 \times 131/360$ Inner arc $2 \times \pi \times 5.6 \times 131/360$ Outer arc 19.2(...cm) AND Inner arc 12.8(...cm) Perimeter 2.8+2.8+ outer arc + inner arc 37.6 (cm)	B1 M1 M1 A1 M1 A1 6	FT 'their 5.6' provided <8.4, ≠4.2 and >2.8 CAO <i>If M0, M0, A0 allow: SC2 for 9.6(cm) with 6.4(cm), or SC1 for sight of $v \times \pi \times 131/360$, where v is a value >0</i> FT 'their 2.8' provided <4.2. FT their outer and inner arcs provided derived from dimensionally correct formulae CAO <i>Alternative: use of mean arc, using mean radius 7cm twice – must be convincing, then B1 mean radius, M2, A1 for mean arc used twice, then M1, A1 for perimeter</i>

Methods in Mathematics Unit 2 Higher Tier		Comments
17. $EG^2 = 7.8^2 + 5.5^2 - 2 \times 7.8 \times 5.5 \times \cos 136^\circ$ $EG = 12.36... \text{ (cm)}$	M1 A1	or $EG^2 = 152.809...$ or $EG = \sqrt{152.809...}$
$\sin F = \frac{\sin 51^\circ \times 12.36...}{11.4}$	M2	FT 'their derived EG' provided M1 awarded M1 for $\frac{\sin F}{12.36...} = \frac{\sin 51^\circ}{11.4}$ or $\frac{12.36...}{\sin F} = \frac{11.4}{\sin 51^\circ}$
$F = 57.4...^\circ$ AND sight or use of $E = 180^\circ - 51^\circ - F (=71.57...^\circ)$	A1	$EG=12\text{cm}$ gives $54.88...^\circ$ $EG=12.3\text{cm}$ gives $56.98...^\circ$ $EG=12.4\text{cm}$ gives $57.7...^\circ$
Area EFG OR Area EHG $= \frac{1}{2} \times 11.4 \times 12.36 \times \sin 71.6^\circ$ $= \frac{1}{2} \times 7.8 \times 5.5 \times \sin 136^\circ$	M1	FT 'their EG' provided at least M2 previously awarded FT their correct evaluation of angle E from their angle F provided $<90^\circ$ and at least M2 previously awarded ($E = 71.6^\circ$)
$= 66.85(...\text{cm}^2)$	A1	($E=72^\circ$, $EG=12.4\text{cm}$ gives $67(.22...\text{cm}^2)$)
$= 14.9(..\text{cm}^2)$	A1	Accept $15(\text{cm}^2)$
Area EFGH $81.7(49... \text{cm}^2)$ or $82(\text{cm}^2)$	A1	Accept other rounding, unrounded or truncated answers. FT provided at least one of the areas EFG or EHG is correct AND all M marks awarded
	9	