GCSE MARKING SCHEME

JANUARY 2016

MATHEMATICS UNITISED - UNIT 3
HIGHER TIER
4353/02

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.

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1. (a) 1·7 (b) 4a(3b + 5) (c) 5/15 or 1/3 or 0·33(333….)	B2 B2 B1 5	B1 for 1·6(810….) B1 for 4a(3b….) or 4a(…+ 5) or correct partial factorisation. Mark final answer. Do not accept 0·3.
2. (Ratio =) 1:2 or equivalent. (1 part =) 45 ÷ 3 William £15 Rushan £30	B1 M1 A1 3	Allow 2:1 or equivalent FT the sum of their ratio. CAO An answer of 30, 15 gets B1M1A0
3. Suitable arcs for 30° angle. Line drawn at 30°. Suitable arcs for 120° (60° from the right side of the vertex). Line drawn at 120°.	M1 A1 M1 A1 4	 Use overlay. Allow ±2°. Use overlay. Allow ±2°. Penalise –1 for incomplete triangle if all marks are gained. *Alternative method:* *Candidates may use the fact that the triangle is isosceles for the 2nd M1A1.*
4. (1/12 × 510) 42·5(0) OR (0·016 × 510) 8·16 510 – 42·5(0) OR 510 + 8·16 = (£)467·5(0) OR = (£)518·16 1·016 × 467·5(0) OR (11/12) × 518·16 (Cost of season ticket =) (£)474·98 (Saving =) (£)35·02 QWC: Look for • correct units used i.e. £, p • spelling in at least 1 statement/sentence • clarity of text explanations QWC2: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer QWC1: Candidates will be expected to • present work clearly, with words or quantities shown for clarity of process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer	B1 M1 A1 M1 A1 B1 QWC 2 8	 (11/12) × 510 OR 1·016 × 510 gains B1M1. FT 'their 467·50' OR 'their 518·16'. FT provided at least one M1 awarded. QWC2 Presents material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents 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.
5. (Internal angle of the regular pentagon =) (3 × 180) ÷ 5 = 108(°) (4th angle in the quadrilateral =) 360 – (90 + 111 + 57) = 102(°) (x =) (360 – 108 – 102) = 150(°)	M1 A1 M1 A1 B1 5	*Alternative method:* *M1 for (exterior angle of pentagon =) 360 ÷ 5* *A1 for 72(°)* *M1 for (4th angle in the quadrilateral =) 360 – (90 + 111 + 57)* *A1 for 102(°)* *A1 for (78 + 72) =150(°).* FT provided at least one of the previous M1 marks awarded, and x<180.
6. $8y - 3 = 4y + 16$ $8y - 4y = 16 + 3$ $y = 4\frac{3}{4}$ OR 4·75 OR 19/4	B1 B1 B1 3	FT until 2nd error. Mark final answer.

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7. Squaring at least 2 lengths $8^2 + 15^2$ (= 64 + 225 = 289) $17^2 = 289$ OR $\sqrt{289} = 17$ (and conclusion)	B1 M1 A1 3	 Accept equivalent methods. *Alternative method:* *B1 for squaring at least 2 lengths* *M1 for cos(angle) = $(15^2+8^2-17^2)/(2\times15\times8)$* *A1 for angle = 90°*
8. (a) Sight of the mid-points 49·5, 149·5, 249·5, 349·5, 449·5. 49·5×4 + 149·5×9 + 249·5×14 + 349·5×1 + 449·5×2 (=198 + 1345·5 + 3493 + 349·5 + 899) (=6285) 6285 ÷ 30 = 209·5 (b) valid assumption e.g. '…every data item lies at the mid-point of each group.' OR '…the data is evenly distributed across each group.' OR '… the same number of copies made each day' (c) valid description e.g. 'She could have calculated accurate means using the actual data she recorded.' OR 'She could have used smaller class intervals.'	B1 M1 m1 A1 E1 E1 6	 FT their mid-points from within or at the bounds of the groups. FT '*their 6285*'. Accept 210 from correct working. An answer of 209·5 found from using mid-points of 50, 150, … and subtracting 0·5 gains full marks. Accept '…how many copies were made each day'
9. (a) 8, −1 (b) At least 6 points plotted accurately Smooth curve drawn connecting all 7 correct points. (c) (x =) 0·2 AND 2·3	B2 P1 C1 B1 5	B1 for each value of *y*. FT '*their 8*' and '*their −1*'. FT their graph provided there are 2 solutions.
10. (Area of square =) 3^2 (= 9) (cm^2) $\frac{3}{4} \times \pi \times 3^2$ = 21 to 21·22(cm^2) (Total area =) 30 to 30·22 (cm^2)	B1 M1 A1 B1 4	 FT 'their 21…' + 9 provided $\pi \times 3^2$ used in their calculation.
11. 150 × tan39(°) = 121(·467…) (m) (Height of tower =) 123(·167…) (m)	M2 A1 A1 4	M1 for tan39(°) = h/150 Allow M1 for incorrect placement of the angle of elevation leading to h = 150 × tan51(°) CAO FT from M1 (for adding 1·7 onto 'their 121(·467…)'
12. (a) $4{\cdot}137 \times 10^4$ (b) Correct conversion to common units. $0{\cdot}07 \div (6{\cdot}8\times10^{-16})$ OR $(7\times10^4) \div (6{\cdot}8\times10^{-10})$ or equivalent. = $1{\cdot}03\times10^{14}$	B2 B1 M1 A2 6	B1 for 41370 or $41{\cdot}37\times10^3$ or $413{\cdot}7\times10^2$ or 4137×10 or premature rounding written correctly in standard form Accept use of 7 instead of 6·8 for B1M1 only. FT with incorrect place value provided conversion attempted. A1 for $1{\cdot}0(29411\ldots)\times10^{14}$ or correct number but not in standard form. SC1 for $1{\cdot}0(29411\ldots)\times10^8$. SC2 for $1{\cdot}03\times10^8$.
13. Method of working with all 3 terms to clear the 2 fractions. Correctly expanding brackets and collecting like terms i.e. ($10x + 15 - 14x = 16$ leading to) $15 - 4x = 16$ or equivalent. $x = -1/4$ or $-0{\cdot}25$	M2 A1 A1 4	e.g. multiplying each term by a multiple of 20. M1 for appropriate working for 2 of the 3 terms. Clearing implies denominator of 1. FT provided at least M1 awarded. FT until 2nd error. Mark their final answer. *If no marks awarded SC1 for sight of (15−4x)/20 or equivalent.*

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14. (a) Valid reason e.g 'Melfach's median is higher than Brynwyn's', with correct values given or implied, or an indication on the graph. OR 'Melfach's graph is to the right of Brynwyn's' (b) 14(%) (c) Valid reason e.g. 'The cumulative frequencies are percentages' OR 'We don't know how many houses there were altogether in each village' OR '60% of the houses in Brynwyn may be less than 14% of the houses in Melfach' OR 'It doesn't show the number of houses'	E1 B1 E1 3	Accept sight of medians for both villages (£175,000-£180,000 and £335,000-£340,000). If percentages quoted they need to be correct.
15. (a) $(x + 10)(x – 2)$ $x = -10$ AND $x = 2$ (b) $0 = 70 + 4t – 5t^2$ (t =) $\frac{-4 \pm \sqrt{4^2 - 4 \times -5 \times 70}}{2 \times -5}$ or $\frac{4 \pm \sqrt{(-4)^2 - 4 \times 5 \times -70}}{2 \times 5}$ (t =) $\frac{-4 \pm \sqrt{1416}}{-10}$ or $\frac{4 \pm \sqrt{1416}}{10}$ 4·16 (seconds)	B2 B1 B1 M1 A1 A2 8	B1 for $(x \ldots 10)(x \ldots 2)$ Strict FT their brackets provided previous B1 awarded. May be implied in their working. Allow 1 slip in substitution. CAO CAO. A1 for (t =) −3·36 and 4·16 (seconds) OR A1 for 4·1(6297…) OR 4·2 with or without the negative value.
16. (a) $(BC^2 =) 7{\cdot}4^2 + 5{\cdot}9^2 - 2 \times 7{\cdot}4 \times 5{\cdot}9 \times \cos 26(°)$ $BC^2 = 11{\cdot}0(873\ldots)$ or (BC =) $\sqrt{11{\cdot}0(873\ldots)}$ (BC =) 3·3(297…) (cm) (b) (angle =) $\sin^{-1}(\frac{\sin 96}{23} \times 12)$ Angle = 31(·2572…) (°) (Area =) ½×12×23×sin52·7(427…) (Area =) 109·8(377…) (cm^2)	M1 A1 A1 M2 A1 M1 A1 8	M1 for $\frac{\sin angle}{12} = \frac{\sin 96}{23}$ FT provided the sine or cosine rule attempted for previous M1. *Alternative method* *M1 for ½×18·4(0712…)×23×sin31·2(572…)* Allow answers in the range 109·77 to 110·21 that come from premature rounding of the angle.
17. Frequency densities of 1·8, 2·6, 0·5, 0·2 Histogram of their frequency densities drawn.	M2 A1 3	M1 for any 2 or 3 correct. Provided at least M1 awarded.
18. Split into 5 areas and attempt to sum. (Distance =) ½×20(0 + 2×19 + 2×21 + 2×16 + 2×18 + 0) = 1480 (m)	M1 M1 A1 3	Or equivalent. (Areas of 190, 400, 370, 340, 180). Award for up to 1 error in reading scale. CAO.
19. (a) $\frac{h}{h-40} = \frac{30}{20}$ or equivalent . 20h = 30(h – 40) or equivalent. Height of large cone = 120 (cm) (b) (Volume =) ⅓ × π × ($120 \times 15^2 - 80 \times 10^2$) = 19886 to 19905 ($cm^3$)	M1 m1 A1 M1 A1 5	Award M1m1 for 40 ≡ ⅓ h. FT 'their 120'.