

Mark Scheme (Results)

June 2011

International GCSE

Mathematics (4MP0) Paper 01

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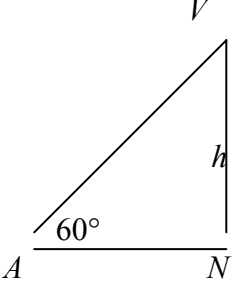
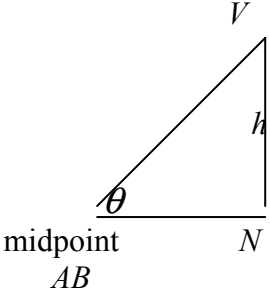
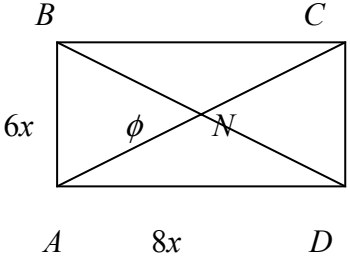
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| Question number | Scheme | Marks |
|-----------------|---|---|
| 1. | $7 + x = x^2 - 3x + 2$ $x^2 - 4x - 5 = 0$ $(x - 5)(x + 1) = 0$ $x = 5 \quad y = 12$ $x = -1 \quad y = 6$ $y = (y - 7)^2 - 3(y - 7) + 2$ $y^2 - 18y + 72 = 0$ $(y - 6)(y - 12) = 0$ $y = 6 \quad y = 12$ $x = -1 \quad x = 5$ | M1 A1 M1 A1 A1 (5) |
| 2. | <p>(a) $\log_a b = \frac{\log_b b}{\log_b a} = \frac{1}{\log_b a}$</p> <p>(b) $\log_x 8 - 6 \log_8 x = 1$</p> $\log_x 8 - \frac{6}{\log_x 8} = 1$ $(\log_x 8)^2 - \log_x 8 - 6 = 0$ $(\log_x 8 - 3)(\log_x 8 + 2) = 0$ $\log_x 8 = 3 \Rightarrow 8 = x^3 \quad x = 2$ $(\log_x 8 = -2 \quad x \notin \mathbf{Z}^+)$ $\frac{1}{\log_8 x} - 6 \log_8 x = 1$ $6(\log_8 x)^2 + \log_8 x - 1 = 0$ $(3 \log_8 x - 1)(2 \log_8 x + 1) = 0$ $\log_8 x = \frac{1}{3} \quad x = 8^{\frac{1}{3}} = 2$ $(\log_8 x = -\frac{1}{2}, x = 8^{-\frac{1}{2}} \notin \mathbf{Z}^+)$ | M1A1 M1 M1 M1 M1A1 (7) |
| 3. | <p>(a) $\frac{dy}{dx} = 2e^{2x} \sin 3x + 3e^{2x} \cos 3x$</p> <p>(b) $\frac{d^2y}{dx^2} = 4e^{2x} \sin 3x + 6e^{2x} \cos 3x + 6e^{2x} \cos 3x - 9e^{2x} \sin 3x$</p> $\frac{d^2y}{dx^2} = 2 \frac{dy}{dx} - 9y + 6e^{2x} \cos 3x$ <p>or $\frac{dy}{dx} = 2y + 3e^{2x} \cos 3x$</p> $\frac{d^2y}{dx^2} = 2 \frac{dy}{dx} - 9e^{2x} \sin 3x + 6e^{2x} \cos 3x$ $= 2 \frac{dy}{dx} - 9y + 6e^{2x} \cos 3x$ | M1A1A1 M1A1 M1A1 (7) |

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| 4. | <p>(a) $\sin 2A = \sin A \cos A + \cos A \sin A \quad (= 2 \sin A \cos A)$</p> <p>(b) $\cos 2A = \cos^2 A - \sin^2 A = (1 - \sin^2 A) - \sin^2 A \quad (= 1 - 2 \sin^2 A)$</p> <p>(c) $\sin 3A + \sin A = \sin(2A + A) = \sin 2A \cos A + \cos 2A \sin A + \sin A$ $= 2 \sin A \cos^2 A + (1 - 2 \sin^2 A) \sin A + \sin A$ $= 2 \sin A (1 - \sin^2 A) + \sin A - 2 \sin^3 A + \sin A$ $= 4 \sin A - 4 \sin^3 A$</p> | <p>B1</p> <p>M1A1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>A1 (7)</p> |
| 5. | <p>(a) $a^2 = 5a \quad a = 5$</p> <p>(b) $y - 5 = -\frac{5}{7}(x - 5)$ $y = 0 \quad (x - 5) = 7 \quad x = 12$</p> <p>(c) Vol. of cone $= \frac{1}{3} \pi \times 5^2 \times (12 - 5) = \frac{175}{3} \pi$</p> $\int_0^5 \pi y^2 dx = \int_0^5 \pi \times 5x dx = 5\pi \left[\frac{x^2}{2} \right]_0^5$ $= \frac{125}{2} \pi$ <p>Total vol. $= \frac{125}{2} \pi + \frac{175}{3} \pi = \frac{725}{6} \pi$</p> | <p>M1A1</p> <p>M1</p> <p>M1A1</p> <p>B1</p> <p>M1A1ft</p> <p>A1</p> <p>B1ft (9)</p> |
| 6. | <p>(a) $a + 2d = 70$ $\frac{10}{2}(2a + 9d) = 450$ $2a + 9d = 90$ $5d = -50 \Rightarrow d = -10$</p> <p>(b) $a = 70 + 20 = 90$</p> $S = \frac{n}{2}(180 - 10(n - 1))$ $\frac{n}{2}(190 - 10n) \dots 350 \quad 190n - 10n^2 \dots 700$ $n^2 - 19n + 70 \dots 0$ $(n - 5)(n - 14) \dots 0$ <p>critical values: 5, 14</p> $5 \dots n \dots 14 \quad n \in \mathbb{Z} \quad (n = 5, 7, \dots, 13, 14)$ | <p>M1</p> <p>A1</p> <p>M1A1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>A1ft (10)</p> |

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| 7. | <p>(a) $(5p-1)(p-2) = 0$ $p = \frac{1}{5} \quad p = 2$</p> <p>(b) $5(3^x)^2 - 11(3^x) + 2 = 0$ $3^x = \frac{1}{5} \quad x \ln 3 = \ln 0.2 \quad x = \frac{\ln 0.2}{\ln 3} = -1.464\dots = -1.46$ $3^x = 2 \quad x \ln 3 = \ln 2 \quad x = \frac{\ln 2}{\ln 3} = 0.6309\dots = 0.631$</p> <p>(c) $y = 5(3^{2x}) - 6(3^x) = 5(3^x)^2 - 6(3^x) - 2$ $5(3^{2x}) - 11(3^x) + 2 = 0$ $3^x = 0.2 \quad y = 5 \times 0.2 - 2 = -1$ $3^x = 2 \quad y = 5 \times 2 - 2 = 8$ Points are $(-1.46, -1)$ and $(0.631, 8)$</p> | M1 A1 M1 M1A1 A1 M1 M1 A1 B1ft (10) |
| 8. | <p>(a) $\frac{y-5}{7-5} = \frac{x-1}{9-1}$ $8(y-5) = 2(x-1)$ $4y - 20 = x - 1$ $y = \frac{1}{4}x + \frac{19}{4}$</p> <p>(b) Grad. of $l = -4$ Midpoint of $AB = (5, 6)$ Eqn. of $l: y - 6 = -4(x - 5) \quad (y = -4x + 26)$</p> <p>(c) $x = 3 \quad q = -4 \times -2 + 6 = 14$</p> <p>(d) $y = 0 \quad x = 6\frac{1}{2}$ length $CD = \sqrt{(6\frac{1}{2} - 3)^2 + 14^2} = \sqrt{\frac{7^2}{2^2} + 14^2} = \frac{7}{2}\sqrt{17}$ length $AB = \sqrt{(7-5)^2 + (9-1)^2} = \sqrt{68} = 2\sqrt{17}$ Area of kite $= \frac{1}{2} \times \frac{7}{2}\sqrt{17} \times 2\sqrt{17} = 59\frac{1}{2}$ (accept 59.5 provided surds seen) or $14 \times 8 - \frac{1}{2}(9 \times 2 + 7 \times 6 + 7 \times 2\frac{1}{2} + 5 \times 5\frac{1}{2})$ or $2 \times 3\frac{1}{2} + \frac{1}{2}(9 \times 2 + 7 \times 6 + 7 \times 2\frac{1}{2} + 5 \times 5\frac{1}{2})$</p> | M1A1 B1ft B1 M1A1 M1A1ft B1ft M1 A1 B1 cao (13) |

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| 9. | <p>(a) $x = 2$ oe</p> <p>(b) $\frac{dy}{dx} = \frac{4x(3x-6) - 3(2x^2-6)}{(3x-6)^2}$</p> <p>$\frac{dy}{dx} = 0 \quad 12x^2 - 24x - 6x^2 + 18 = 0$</p> <p>$x^2 - 4x + 3 = 0$</p> <p>$(x-3)(x-1) = 0$</p> <p>$x = 3 \quad y = \frac{2 \times 9 - 6}{9 - 6} = \frac{12}{3} \quad (3, 4)$</p> <p>$x = 1 \quad y = \frac{-4}{-3} = \frac{4}{3} \quad (1, \frac{4}{3})$</p> <p>(c) $x = 0 \quad y = 1$</p> <p>$\frac{dy}{dx} = \frac{18}{36} = \frac{1}{2}$ grad. normal = -2</p> <p>eqn. normal: $y - 1 = -2x$ oe</p> <p>(d) $-2x + 1 = \frac{2x^2 - 6}{3x - 6}$</p> <p>$-6x^2 + 15x - 6 = 2x^2 - 6$</p> <p>$8x^2 - 15x = 0$</p> <p>$(x = 0 \text{ (at } A)) \quad \therefore \text{ at } B \quad x = \frac{15}{8}$</p> | <p>B1</p> <p>M1A1A1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>M1A1</p> <p>A1 (15)</p> |

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| 10. | <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">  <p style="text-align: center;">$VA^2 = (5x)^2 + (5\sqrt{3}x)^2$ or</p>  <p style="text-align: center;">midpoint AB</p>  <p style="text-align: center;">or $(6x)^2 = (5x)^2 + (5x)^2 - 2(5x)(5x)\cos\phi$</p> </div> <div style="width: 45%;"> <p>(a) $AC = 10x$ $\frac{VN}{5x} = \tan 60$ $VN = 5x\sqrt{3}$</p> <p>(b) $\frac{5x}{VA} = \cos 60^\circ$ $VA = 10x$</p> <p>(c) $\tan \theta = \frac{VN}{4x} = \frac{5x\sqrt{3}}{4x} = \frac{5\sqrt{3}}{4}$ $\theta = 65.20\dots = 65.2^\circ$</p> <p>(d) $\tan \frac{1}{2}\phi = \frac{3}{4}$ $\phi = 2 \times 36.86\dots = 73.7^\circ$ (or obtuse 106.3°)</p> <p>(e) Vol. = $\frac{1}{3} \times \text{base area} \times \text{height}$ $\frac{1}{3} \times 48x^2 \times 5x\sqrt{3} = 1110$ $x^3 = \frac{1110 \times 6}{48 \times 5\sqrt{3}} = 8.010\dots$ $x = 2.0008\dots = 2$</p> </div> </div> | <p>B1</p> <p>M1A1ft</p> <p>A1</p> <p>M1A1ft</p> <p>A1 cao</p> <p>M1A1ft</p> <p>A1</p> <p>M1A1</p> <p>A1</p> <p>M1</p> <p>A1ft</p> <p>A1</p> <p style="text-align: right;">(16)</p> |

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