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Mark Scheme (Results)

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International GCSE

Mathematics (4MP0) Paper 01

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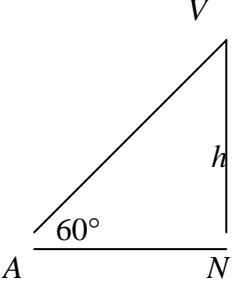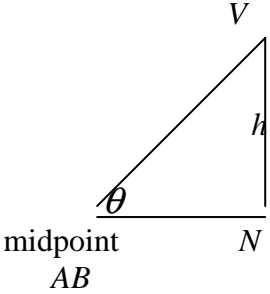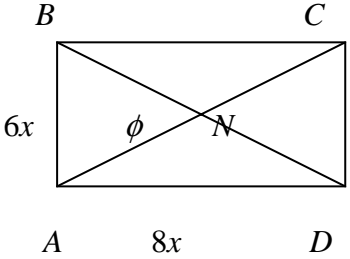
Question number	Scheme	Marks
1.	$7 + x = x^2 - 3x + 2$ $\qquad\qquad$ $y = (y-7)^2 - 3(y-7) + 2$ $x^2 - 4x - 5 = 0$ $\qquad\qquad$ $y^2 - 18y + 72 = 0$ $(x-5)(x+1) = 0$ $\qquad\qquad$ $(y-6)(y-12) = 0$ $x = 5 \quad y = 12$ $\qquad\qquad$ $y = 6 \quad y = 12$ $x = -1 \quad y = 6$ $\qquad\qquad$ $x = -1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

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

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

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

Question number	Scheme	Marks
10.	(a) $AC = 10x$ $\dfrac{VN}{5x} = \tan 60$ $VN = 5x\sqrt{3}$	B1 M1A1ft A1
	$VA^2 = (5x)^2 + (5\sqrt{3}x)^2$ *or* (b) $\dfrac{5x}{VA} = \cos 60°$ $VA = 10x$	M1A1ft A1 cao
	(c) $\tan \theta = \dfrac{VN}{4x} = \dfrac{5x\sqrt{3}}{4x} = \dfrac{5\sqrt{3}}{4}$ $\theta = 65.20.... = 65.2°$	M1A1ft A1
	(d) $\tan \tfrac{1}{2}\phi = \dfrac{3}{4}$ $\phi = 2 \times 36.86... = 73.7°$ $(\text{or obtuse } 106.3°)$	M1A1 A1
	or $(6x)^2 = (5x)^2 + (5x)^2 - 2(5x)(5x)\cos\phi$ (e) Vol. $= \dfrac{1}{3} \times \text{base area} \times \text{height}$ $\dfrac{1}{3} \times 48x^2 \times 5x\sqrt{3} = 1110$ $x^3 = \dfrac{1110 \times 6}{48 \times 5\sqrt{3}} = 8.010...$ $x = 2.0008... = 2$	M1 A1ft A1 (16)

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