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Mark Scheme (Results)
January 2010

GCE O Level

Pure Mathematics (7362/02)
Paper 2

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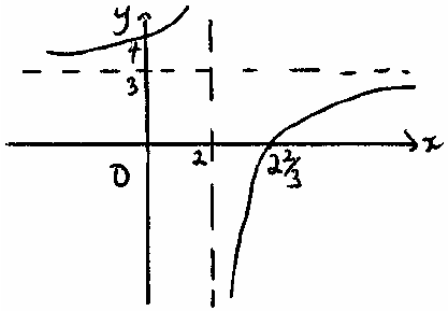
AO Pure Mathematics 7362 Mark Scheme

Paper 2

Q.	Scheme	Marks
1	$y = e^{2x}\sin 3x \qquad \frac{dy}{dx} = 2e^{2x}\sin 3x + 3e^{2x}\cos 3x$	M1A1A1 **(3)**
2	(a) $\cos C = \frac{6.9^2 + 8.3^2 - 5^2}{2\times 6.9\times 8.3}$ $C = 36.97... = 37.0°$ (b) Area $\Delta ABC = \frac{1}{2}\times 8.3\times 6.9\sin C = 17.2\ \text{cm}^2$	M1A1 A1 (3) M1A1A1 (3) **(6)**
3	(a) (i) $y = 3$ (ii) $x = 2$ (b) (i) $y = 0$ $2 = \frac{2}{x-2}$ $x = 2\frac{2}{3}$ (ii) $x = 0$ $y = 3+1 = 4$ (c)  (c)	B1B1 (2) B1 B1 (2) G1(2 branches) G1(asymptotes) G1(crossing pts) (3) **(7)**
4	(a) x: 0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 y: 1 | 0.649 | **-1.28** | -4.52 | **-8.61** | -12.8 | **-15.9** | -15.9 | **-9.40** (b) Graph drawn (see diagram overleaf) (c) (i) $4x^2 = e^x + 8$ $e^x - 4x^2 = -8, \quad x = 1.9$ (ii) $e^x = 4x^2 - 8, \quad e^x - 4x^2 = -3, \quad x = 1.3$	B2(all corr) (B1 for 2 or 3) (2) G1 (pts plotted) G1 (smooth curve) (2) M1A1 M1M1A1 (5) **(9)**

4 (b)

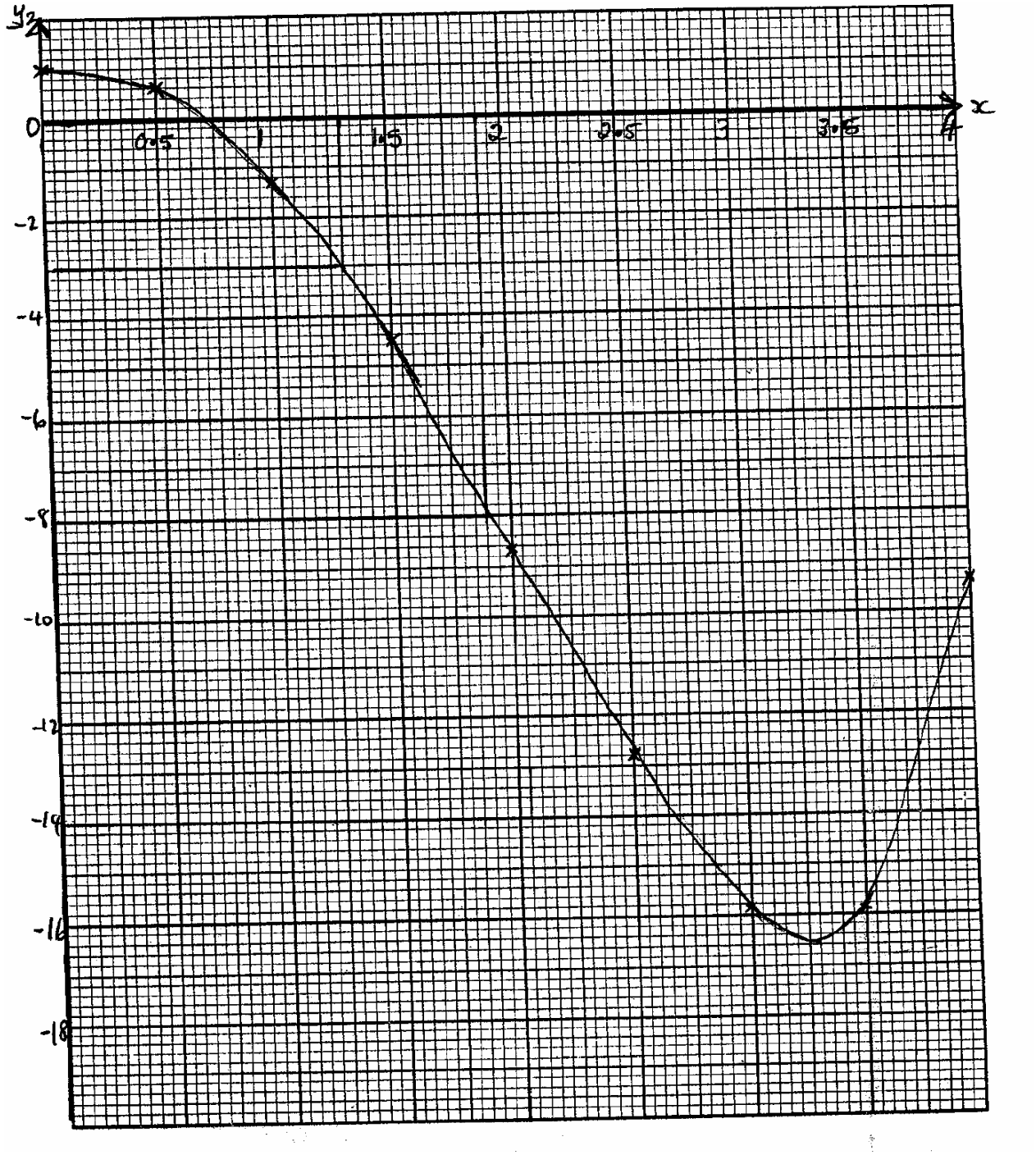


Diagram of graph

5	(a) $0 = t(t^2 - 7t + 12) = t(t-3)(t-4)$ $(t = 0)\quad t = 3,\quad t = 4$	M1 A1A1 (3)
	(b)  	G1 shape G1 3 and 4 (2)
	(c) $s = \int_0^3 (t^3 - 7t^2 + 12t)\,dt - \int_3^4 (t^3 - 7t^2 + 12t)\,dt$ $= \left[\frac{t^4}{4} - \frac{7t^3}{3} + 6t^2\right]_0^3 - \left[\frac{t^4}{4} - \frac{7t^3}{3} + 6t^2\right]_3^4$ $= \frac{81}{4} - 63 + 54 - 0 - \left(64 - 7\times\frac{64}{3} + 96\right) + \left(\frac{81}{4} - 63 + 54\right) = 11.8\text{m}$	M1 M1 M1A1 (5) **(9)**
6	(a) $S_\infty = \frac{a}{1-r} = 80x \quad S_4 = \frac{a(1-r^4)}{1-r} = 75x$ $75x = 80x(1-r^4) \qquad 80r^4 = 5 \quad r^4 = \frac{1}{16} \quad r = \pm\frac{1}{2}$	M1A1 M1A1 (4)
	(b) $a = 80x\left(1 \mp \frac{1}{2}\right)$ $a > 100x \quad \Rightarrow \quad a = 80x \times \frac{3}{2} = 120x$	M1 M1A1 (3)
	(c) $ar^4 = 30 \quad 120x\left(-\frac{1}{2}\right)^4 = 30$ $4x \times \frac{1}{16} = 1 \quad x = 4$	M1A1ft A1 (3) **(10)**
7	(a) $4e^{2x} = (e^{2x} - 3)^2$ $(e^{2x})^2 - 6e^{2x} + 9 = 4e^{2x}$ $(e^{2x})^2 - 10e^{2x} + 9 = 0$ $(e^{2x} - 9)(e^{2x} - 1) = 0$ $e^{2x} = 9 \quad e^x = 3 \quad x = \ln 3$ (accept awrt 1.1) $\quad y = 4e^{2x} = 36$ $e^{2x} = 1 \quad x = 0 \quad y = 4$	M1 A1 M1 M1A1 B1 (6)
	(b) $AB = \sqrt{(1.099^2 + 32^2)} = 32.02$	M1A1 (2)
	(c) Trap + Δ − Δ $= \frac{1}{2}(36+4)\times 1.099 + \frac{1}{2}\times 36\times(5 - 1.099) - 10$ $= 82.2 \text{ units}^2$	M1 A2,1,0 ft A1 (4) **(12)**

8	(a) $\text{Vol} = 125\text{ cm}^3 = \pi r^2 h$	B1	
	$A = 2\pi rh + 2\pi r^2$	B1	
	$\pi rh = \frac{125}{r} \quad A = \frac{250}{r} + 2\pi r^2 \quad *$	M1A1	(4)
	(b) $\frac{dA}{dr} = -\frac{250}{r^2} + 4\pi r$	M1	
	$250 = 4\pi r^3$	M1	
	$r = \sqrt[3]{\frac{250}{4\pi}} \quad r = 2.709... = 2.71$	A1	(3)
	(c) $\frac{d^2A}{dr^2} = \frac{500}{r^3} + 4\pi$	M1	
	$r > 0 \Rightarrow \frac{d^2A}{dr^2} > 0 \quad \therefore \text{ min.}$	M1A1	(3)
	(d) $A = \frac{250}{2.71} + 2\pi \times 2.709...^2 = 138.3... = 138$	M1A1	(2)
			(12)
9	(a) $(\alpha+\beta)(\alpha^2 - \alpha\beta + \beta^2) \equiv \alpha^3 - \alpha^2\beta + \alpha\beta^2 + \beta\alpha^2 - \alpha\beta^2 + \beta^3 \equiv \alpha^3 + \beta^3$	M1A1	
	$(\alpha-\beta)(\alpha^2 + \alpha\beta + \beta^2) \equiv \alpha^3 + \alpha^2\beta + \alpha\beta^2 - \beta\alpha^2 - \alpha\beta^2 + \beta^3 \equiv \alpha^3 - \beta^3$	A1	(3)
	(b) $\alpha + \beta = -7 \quad \alpha\beta = 3$	B1	
	$\alpha^3 + \beta^3 = (\alpha+\beta)(\alpha^2 - \alpha\beta + \beta^2)$	M1	
	$= (\alpha+\beta)((\alpha+\beta)^2 - 3\alpha\beta)$		
	$= (-7)(49-9) = -280$	A1	(3)
	(c) $(\alpha-\beta)^2 = (\alpha+\beta)^2 - 4\alpha\beta = 49 - 12 = 37$	M1A1	(2)
	(d) $\alpha^3 - \beta^3 = (\alpha-\beta)(\alpha^2 + \alpha\beta + \beta^2) = (\alpha-\beta)((\alpha+\beta)^2 - \alpha\beta)$	M1M1	
	$= \sqrt{37}(49-3) = 46\sqrt{37}$	A1	(3)
	(e) $\frac{\alpha}{\beta^2} + \frac{\beta}{\alpha^2} = \frac{\alpha^3+\beta^3}{\alpha^2\beta^2} = -\frac{280}{9}$	M1	
	$\frac{\alpha}{\beta^2} \times \frac{\beta}{\alpha^2} = \frac{1}{\alpha\beta} = \frac{1}{3}$	B1	
	$x^2 + \frac{280}{9}x + \frac{1}{3} = 0$	M1	
	$9x^2 + 280x + 3 = 0$	A1	(4)
			(15)

10	(a) $\tan(A+B)=\dfrac{\sin A\cos B+\cos A\sin B}{\cos A\cos B-\sin A\sin B}$		
	$=\dfrac{\frac{\sin A\cos B}{\cos A\cos B}+\frac{\cos A\sin B}{\cos A\cos B}}{1-\frac{\sin A\sin B}{\cos A\cos B}}$	M1	
	$=\dfrac{\tan A+\tan B}{1-\tan A\tan B}$ *	M1A1	(3)
	(b) (i) $A=45°\quad B=30°$		
	$\tan 75=\dfrac{\tan 45+\tan 30}{1-\tan 45\tan 30}$	M1	
	$=\dfrac{1+\frac{1}{\sqrt{3}}}{1-\frac{1}{\sqrt{3}}},=\dfrac{\sqrt{3}+1}{\sqrt{3}-1}$	A1A1	
	(ii) $\tan 15=\dfrac{1}{\tan 75}=\dfrac{\sqrt{3}-1}{\sqrt{3}+1}$	M1A1	(5)
	(c) $\tan 2\theta=\dfrac{2\tan\theta}{1-\tan^2\theta}$	B1	(1)
	(d) $\theta=22.5°\quad 1=\dfrac{2\tan\theta}{1-\tan^2\theta}$	M1	
	$\tan^2\theta+2\tan\theta-1=0$	M1	
	$\tan\theta=\dfrac{-2\pm\sqrt{(4+4)}}{2}=-1\pm\sqrt{2}$	A1	
	$\tan 22.5>0\quad\therefore\tan 22.5=\sqrt{2}-1$	A1	(4)
	(e) $\tan 2\theta=\dfrac{\frac{4}{5}}{1-\left(\frac{2}{5}\right)^2}=\frac{4}{5}\times\frac{25}{21}=\frac{20}{21}$	M1A1	
	$\sin 2\theta=\dfrac{20}{\sqrt{(21^2+20^2)}}=\dfrac{20}{\sqrt{841}}=\dfrac{20}{29}$	M1A1	(4)
			(17)

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