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Mark Scheme (Results)
Summer 2010

GCE O Level

GCE AO Level Pure Mathematics (7362/02)

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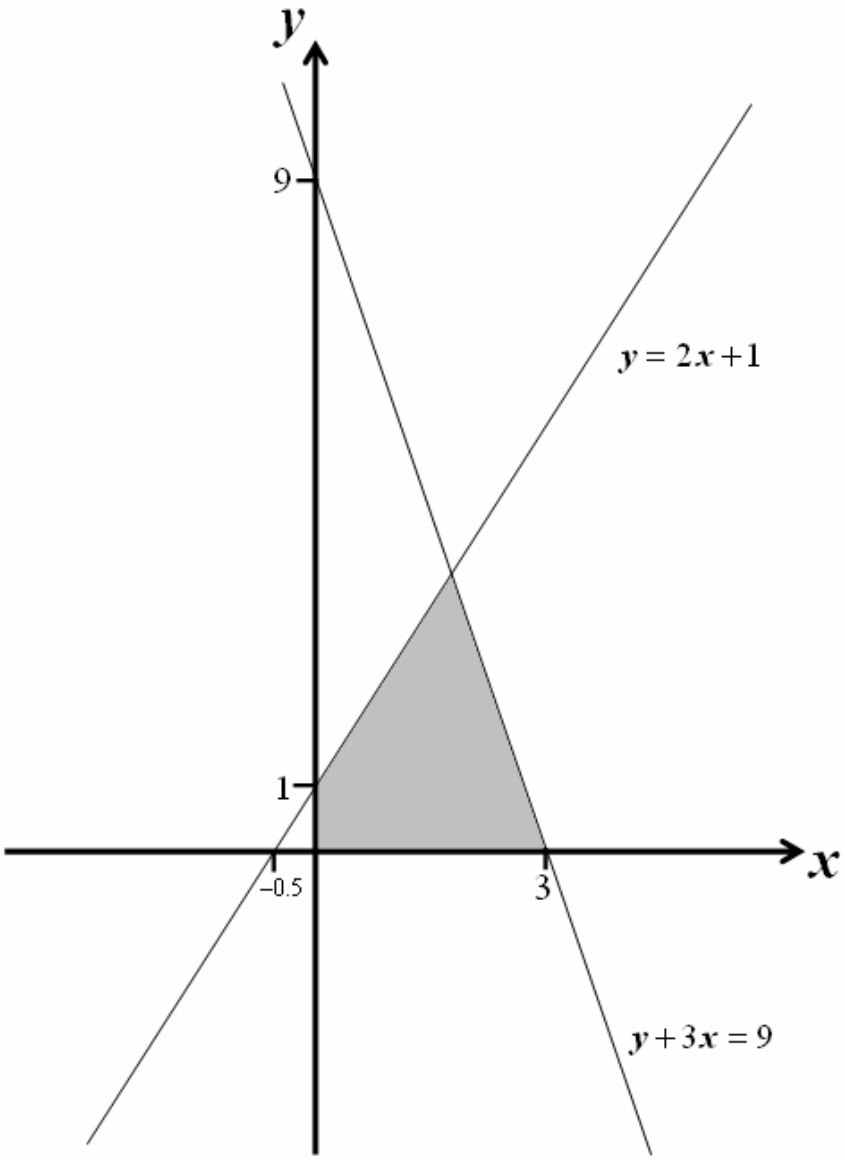
Summer 2010

Pure Mathematics 7362, Mark Scheme Summer 2010

Paper 2

Question Number	Scheme	Marks
1.	(a) and (b)  	B1 B1 B1 **[3]**

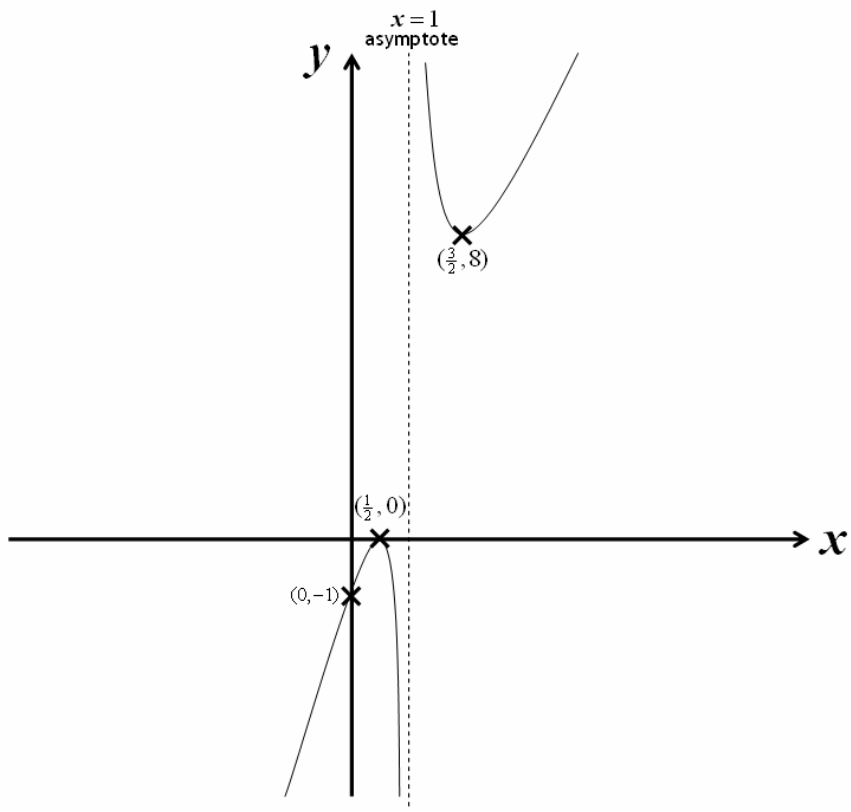
Question Number	Scheme	Marks
2.	(a) $(x-2)(x+1)$	B1
	(b) $f(2)=8+8-10-6=0$ $f(-1)=-1+2+5-6=0$ $\therefore\ (x^2-x-2)$ is a factor	M1 M1 A1 **[4]**
3.	$\sum_{r=5}^{n}(2r-1)=\frac{(n-4)}{2}(9+2n-1)$ $=\frac{(n-4)}{2}(2n+8)=(n-4)(n+4)$ $=n^2-16$ *	B1 (n-4) M1 A1ft A1 **[4]**
4.	(a) $9=\frac{a+14}{2}$ $\quad 40=\frac{8+b}{2}$ $a=4$ $\quad b=72$	M1 A1
	(b) $\frac{1}{41}(9\mathbf{i}+40\mathbf{j})$	M1 A1 **[4]**
5.	$A=\pi r^2$ $\quad \frac{dA}{dr}=2\pi r$	B1
	$A=40$ $\quad r=\sqrt{\frac{40}{\pi}}$	B1
	$\frac{dr}{dt}=\frac{dA}{dt}\times\frac{dr}{dA}=0.3\times\frac{1}{2\pi\sqrt{\frac{40}{\pi}}}$	M1 A1
	$=0.01338...=0.0134$ (allow 1.34%)	A1 **[5]**

Question Number	Scheme	Marks
6.	(a) $y = \tan x = \dfrac{\sin x}{\cos x}$	M1 A1
	$\dfrac{dy}{dx} = \dfrac{\cos^2 x + \sin^2 x}{\cos^2 x}$	
	$= \dfrac{1}{\cos^2 x}$ *	A1
	(b) $\dfrac{dy}{dx} = 3e^{3x}\tan x + e^{3x} \times \dfrac{1}{\cos^2 x}$	M1 A1 A1
	(c) $\tan\theta = 2$	M1
	$\theta = 1.11$	A1
		[8]
7.	(a) $V = \dfrac{1}{2}x^2 h$	B1
	(b) $S = \dfrac{1}{2}x^2 + 3xh$	B1
	$\dfrac{1}{2}x^2 = 400 \qquad h = \dfrac{800}{x^2}$	
	$S = \dfrac{1}{2}x^2 + 3x \times \dfrac{800}{x^2} = \dfrac{1}{2}x^2 + \dfrac{2400}{x}$ *	M1 A1
	(c) $\dfrac{dS}{dx} = x - \dfrac{2400}{x^2}$	M1
	$\dfrac{dS}{dx} = 0 \qquad x^3 = 2400 \qquad x = \sqrt[3]{2400} \qquad (\text{awrt } 13.4)$	M1 A1
	$S_{\min} = \dfrac{1}{2}\left(\sqrt[3]{2400}\right)^2 + \dfrac{2400}{\sqrt[3]{2400}} = 268.8 = 269$	M1 A1
	(d) $\dfrac{d^2S}{dx^2} = 1 + \dfrac{4800}{\left(\sqrt[3]{2400}\right)^3}$	M1
	$x > 0 \Rightarrow \dfrac{d^2S}{dx^2} > 0 \qquad \therefore \min$	A1
		[11]

Question Number	Scheme	Marks
8.	(a) $\alpha^3 + a^2\beta + \alpha\beta^2 - \beta\alpha^2 - \beta^2\alpha - \beta^3 = \alpha^3 - \beta^3$ *	M1
	$\alpha^3 - a^2\beta + \alpha\beta^2 + \beta\alpha^2 - \beta^2\alpha + \beta^3 = \alpha^3 + \beta^3$ *	A1
	(b) $\alpha + \beta = 2 \quad \alpha\beta = -5$	B1
	$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = 4 + 10 = 14$	M1 A1
	(c) $(\alpha - \beta)^2 = \alpha^2 + \beta^2 - 2\alpha\beta = 14 + 10 = 24$	M1 A1
	(d) $\alpha^3 + \beta^3 = (\alpha + \beta)(\alpha^2 + \beta^2 - \alpha\beta) = 2(14 + 5) = 38$	M1 A1
	(e) $\alpha^3 - \beta^3 = (\alpha - \beta)(\alpha^2 + \beta^2 + \alpha\beta) = \sqrt{2}\,4(14 - 5) = 18\sqrt{6}$	M1 A1
	(f) $(\alpha - \beta)^2 + (\alpha + \beta)^2 = 24 + 4 = 28$	M1 A1
	$(\alpha - \beta)^2(\alpha + \beta)^2 = 24 \times 4 = 96$	B1
	Eqn $x^2 - 28x + 96 = 0$	B1ft
		[15]

Question Number	Scheme	Marks
9.	(a) $\cos(A+B)+\cos(A-B)$ $=\cos A\cos B-\sin A\sin B+\cos A\cos B+\sin A\sin B$ $=2\cos A\cos B$ *	B1
	(b) $\cos 2A=\cos^2 A-\sin^2 A=\cos^2 A-(1-\cos^2 A)$	M1
	$=2\cos^2 A-1$ *	A1
	(c) $P=A+B$, $Q=A+B$, $\frac{P+Q}{2}=A$, $\frac{P-Q}{2}=B$	M1
	from (a): $\cos P+\cos Q=2\cos\frac{P+Q}{2}=A\cos\frac{P-Q}{2}$ *	A1
	(d) $\cos 8x+2\cos 6x+\cos 4x$	
	$=2\cos\left(\frac{8x+4x}{2}\right)\cos\left(\frac{8x-4x}{2}\right)+2\cos 6x$	M1
	$=2\cos 6x(\cos 2x+1)$	M1
	$=2\cos 6x\times 2\cos^2 x$	M1
	$=4\cos 6x\cos^2 x$ *	A1
	(e) $\int_0^{\frac{\pi}{4}}\cos 6x\cos^2 x\,dx$	M1
	$=\frac{1}{4}\int_0^{\frac{\pi}{4}}(\cos 8x+2\cos 6x+\cos 4x)dx$	
	$=\frac{1}{4}\left[\left(\frac{1}{8}\sin 8x+\frac{1}{3}\sin 6x+\frac{1}{4}\sin 4x\right)\right]_0^{\frac{\pi}{4}}$	M1 A1ft
	$=\frac{1}{4}\left[\frac{1}{8}\sin 2\pi+\frac{1}{3}\sin\frac{3\pi}{2}+\frac{1}{4}\sin\pi-0\right],=\frac{1}{12}$	M1 A1, A1
		[15]

Question Number	Scheme	Marks
10.	(a) $x = 1$	B1
	(b) $\dfrac{dy}{dx} = 4 - \dfrac{1}{(x-1)^2}$	M1 A1
	$x = \dfrac{3}{2} \quad \dfrac{dy}{dx} = 4 - \dfrac{1}{\left(\frac{3}{2}-1\right)^2} = 4 - \dfrac{1}{\left(-\frac{1}{2}\right)^2} = 4 - 4 = 0$	M1 A1
	$x = \dfrac{1}{2} \quad \dfrac{dy}{dx} = 4 - \dfrac{1}{\left(\frac{1}{2}-1\right)^2} = 4 - \dfrac{1}{\left(-\frac{1}{2}\right)^2} = 4 - 4 = 0$	A1
	$\dfrac{d^2y}{dx^2} = \dfrac{2}{(x-1)^3}$	M1
	$x = \dfrac{3}{2} \quad \dfrac{d^2y}{dx^2} = \dfrac{2}{\left(\frac{1}{2}\right)^3} > 0 \quad \therefore \min$	A1
	$x = \dfrac{1}{2} \quad \dfrac{d^2y}{dx^2} = \dfrac{2}{\left(-\frac{1}{2}\right)^3} < 0 \quad \therefore \max$	A1
	(c)(i) $x = \dfrac{3}{2} \quad y = 4 \times \dfrac{3}{2} + \dfrac{1}{\left(\frac{3}{2}-1\right)} = 6 + 2 = 8$	B1
	(ii) $x = \dfrac{1}{2} \quad y = 4 \times \dfrac{1}{2} + \dfrac{1}{\left(\frac{1}{2}-1\right)} = 2 - 2 = 0$	B1

Question Number	Scheme	Marks
10	(d)  	B1 (2 branches) B1 (asy) **Vertical only** B1 (turning points) B1 (0,-1) **[15]**

Question Number	Scheme	Marks
11.	(a) $(2x-1)^2=(x-4)(16x+1)$	M1
	$4x^2-4x+1=16x^2-63x-4$	
	$12x^2-59x-5=0$	A1
	$(12x+1)(x-5)=0$	M1
	$x=-\frac{1}{12}$ $\quad x=5$	A1 A1
	(b) $x=5$	M1
	$a=1$	A1
	(c) $r^2=\frac{10-1}{5-4}=9$ $\quad r=3$	M1 A1
	$r=-3$ not poss.	B1
	(d) $x=-\frac{1}{12}$	
	$a=-\frac{1}{12}-4=-\frac{49}{12}$	
	(e) $r^2=\frac{-\frac{1}{6}-1}{-\frac{49}{12}}=\frac{14}{49}=\frac{2}{7}$	M1
	$r=\sqrt{\frac{2}{7}}$ $\quad (r>0)$	A1
	$S=\frac{a}{1-r}=\frac{-\frac{49}{12}}{1-\sqrt{\frac{2}{7}}}=-8.772...=-8.77$	M1 A1
		[16]

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