Mark Scheme (Results)
Summer 2008

GCE O Level

AO Level Pure Mathematics (7362) Paper 1

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Pure Mathematics 7362

Paper 1

Q.	Scheme	Marks
1	$\cos\theta = \dfrac{4^2+5^2-6^2}{2\times4\times5} = \dfrac{16+25-36}{40}\left(=\dfrac{1}{8}\right)$	M1 M1A1
	$\theta = 82.8°$	A1 (4)
2	$5-x = x^2-8x+11$	M1
	$x^2-7x+6=0$	A1
	$(x-6)(x-1)=0$	M1
	$x=6 \quad y=-1$	A1
	$x=1 \quad y=4$	A1 (5)
3	$\frac{r}{h}=\tan 30 \quad h=\frac{r}{\tan 30}$	B1
	$V=\frac{1}{3}\pi r^2\times\frac{r}{\tan 30}$	M1
	$\dfrac{dV}{dr}=\dfrac{\pi r^2}{\tan 30}$	M1
	$\dfrac{dV}{dt}=-5 \quad \dfrac{dr}{dt}=\dfrac{dV}{dt}\times\dfrac{dr}{dV}$	B1 M1
	$=-5\times\dfrac{\tan 30}{\pi r^2}=-5\times\dfrac{\tan 30}{\pi\left(h\tan 30\right)^2}$	A1
	$h=10 \quad \dfrac{dr}{dt}=\dfrac{-5}{100\pi\tan 30}=-0.0275...=-0.028\text{ cm/s}$	
	Rate of decrease $=0.028$ cm/s	A1 (7)
4	(a) $\dfrac{dy}{dx}=10xe^{2x}+2\left(5x^2-2\right)e^{2x}$	M1A1A1 (3)
	(b) $\dfrac{dy}{dx}=\dfrac{3x^2\left(x-x^2\right)-\left(x^3+2\right)(1-2x)}{\left(x-x^2\right)^2}$	M1 A2,1,0
	$=\dfrac{2x^3-x^4+4x-2}{\left(x-x^2\right)^2}$	A1 (4)

5	(a) (i) $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = 5\mathbf{i} + 10\mathbf{j}$	B1
	(ii) $\overrightarrow{OC} = \overrightarrow{OA} + \frac{2}{5}\overrightarrow{AB} = 4\mathbf{i} + 5\mathbf{j} + 2\mathbf{i} + 4\mathbf{j} = 6\mathbf{i} + 9\mathbf{j}$	M1A1 (3)
	(b) unit vector = $\dfrac{\overrightarrow{AB}}{\lvert\overrightarrow{AB}\rvert} = \dfrac{5\mathbf{i} + 10\mathbf{j}}{\sqrt{125}} = \dfrac{\mathbf{i} + 2\mathbf{j}}{\sqrt{5}}$	M1A1 (2)
	(c) $\overrightarrow{DA} = -\lambda\mathbf{i} + 4\mathbf{i} + 5\mathbf{j} = (4-\lambda)\mathbf{i} + 5\mathbf{j}$	M1
	Parallel to $5\mathbf{i} + 10\mathbf{j}$ $\therefore\ 5 = 2(4-\lambda)$	M1
	$\lambda = \frac{3}{2}$	A1 (3)
6	(a) $p^5 = 243, \quad p = 3$	M1,A1 (2)
	(b) $3q + 4 = 4^3$	
	$3q + 4 = 64 \quad 3q = 60 \quad q = 20$	M1A1 (2)
	(c) $\mathrm{f}(x) = 2x\log_x 3 - 10\log_x 3 - x + 5$	M1
	$= 2\log_x 3(x-5) - (x-5)$	
	$= (x-5)(2\log_x 3 - 1) \quad a = 2, \quad b = 1$	M1A1 (3)
	(d) $\log_x 3 = \frac{1}{2}$	
	$x^{\frac{1}{2}} = 3 \quad x = 9$	M1A1
	or $x = 5$	B1 (3)
7	(a) $A = 2(10x^2 + 5xh + 2xh)$	B1 (1)
	(b) $(V =)10x^2h = 500$	B1
	$A = 20x^2 + 14x \times \frac{50}{x^2}$	M1
	$A = 20x^2 + \frac{700}{x}$	A1 (3)
	(c) $\dfrac{\mathrm{d}A}{\mathrm{d}x} = 40x - \frac{700}{x^2}$	M1
	$\frac{\mathrm{d}A}{\mathrm{d}x} = 0 \quad x^3 = \frac{700}{40} \quad (x = 2.596...)$	M1A1
	$A_{\min} = 20 \times 2.596^2 + \frac{700}{2.596} = 404.4... \quad = 404\ \text{cm}^3$	M1A1 (5)
	(d) $\dfrac{\mathrm{d}^2A}{\mathrm{d}x^2} = 40 + \frac{700\times 2}{x^3}$	M1
	$x > 0 \Rightarrow \dfrac{\mathrm{d}^2A}{\mathrm{d}x^2} > 0 \quad \therefore$ min A at $x = 2.596...$	A1ft (2)

8	(a) $(15x+6)(x+4)=(6x-3)^2$	M1
	$15x^2+66x+24=36x^2-36x+9$	
	$21x^2-102x-15=0 \quad 7x^2-34x-5=0$	M1
	$(7x+1)(x-5)=0 \quad x=-\frac{1}{7} \quad x=5$	A1A1 (4)
	(b) $x=5 \quad r=\frac{6x-3}{15x+6}=\frac{27}{81}=\frac{1}{3}$	M1A1ft
	$x=-\frac{1}{7} \quad r=\frac{-\frac{6}{7}-3}{-\frac{15}{7}+6}=\frac{-27/7}{27/7}=-1$	A1ft (3)
	(c) $r=\frac{1}{3} \quad a=81 \quad S_\infty=\frac{a}{1-r}=\frac{81}{2/3}=\frac{243}{2}=121\frac{1}{2}$	B1M1A1 (3)
	(d) $S_n=\dfrac{81\left(1-\left(\frac{1}{3}\right)^n\right)}{\frac{2}{3}}=\frac{243}{2}\left(1-\left(\frac{1}{3}\right)^n\right)$	M1
	% error $=\dfrac{(-)\frac{243}{2}\times\left(\frac{1}{3}\right)^n}{\frac{243}{2}}\times 100\%=(-)100\left(\frac{1}{3}\right)^n\%$	M1A1ft (on r) (3)
9	(a) $\cos 2A \equiv \cos^2 A-\sin^2 A=\cos^2 A-\left(1-\cos^2 A\right)=2\cos^2 A-1$	M1A1 (2)
	(b) $\sin 2A=2\sin A\cos A$	B1 (1)
	(c) $\cos 3A=\cos(2A+A)=\cos 2A\cos A-\sin 2A\sin A$	M1
	$=\left(2\cos^2 A-1\right)\cos A-2\sin^2 A\cos A$	M1
	$=2\cos^3 A-\cos A-2\left(1-\cos^2 A\right)\cos A$	M1
	$=4\cos^3 A-3\cos A$	A1 (4)
	(d) $\cos 3x=0.6$	M1
	$3x=53.13°, \quad 306.86°, \quad 413.13°$	M1
	$x=17.7°, \quad 102.3°, \quad 137.7°$	A3,2,1,0 (5)
	(e) $\frac{1}{4}\int_0^{\frac{\pi}{3}}(\cos 3\theta+3\cos\theta)\,\mathrm{d}\theta, \quad =\frac{1}{4}\left[\frac{1}{3}\sin 3\theta+3\sin\theta\right]_0^{\frac{\pi}{3}}$	M1,M1A1
	$=\frac{1}{4}\left[\frac{1}{3}\sin\pi+3\sin\frac{\pi}{3}-0\right]=\frac{3}{4}\frac{Ö3}{2}=\frac{3Ö3}{8} \quad a=3,\ b=8,\ c=3$	M1A1 (5)

10	(a) $(-2,0)$ on curve: $-8+4p-2q+6=0$	M1
	$4p-2q=2 \quad 2p-q=1$	
	$(2,-4)$ on curve: $8+4p+2q+6=-4$	A1
	$2p+q=-9$	
	Add: $4p=-8$	M1
	$p=-2 \quad q=-5$	A1A1 (5)
	(b) $\mathrm{f}(x)=(x+2)(x^2-4x+3)=(x+2)(x-3)(x-1)$	M1
	D is $(1,0)$ E is $(3,0)$	A1A1 (3)
	(c) $y=x^3-2x^2-5x+6 \quad \frac{\mathrm{d}y}{\mathrm{d}x}=3x^2-4x-5$	M1 A1ft
	$x=2 \quad \frac{\mathrm{d}y}{\mathrm{d}x}=12-8-5=-1$	
	grad normal $=1$ eqn. normal: $y+4=x-2 \quad (y=x-6)$	B1ft B1 (4)
	(d) $\int_1^2 (x^3-2x^2-5x+6)\,\mathrm{d}x=\left[\frac{x^4}{4}-\frac{2x^3}{3}-\frac{5x^2}{2}+6x\right]_1^2$	M1
	$=\left(4-\frac{16}{3}-10+12\right)-\left(\frac{1}{4}-\frac{2}{3}-\frac{5}{2}+6\right)=-2\frac{5}{12}$	M1A1
	Normal cuts x-axis at $x=6$	M1A1
	Area $\Delta=\frac{1}{2}\times 4\times 4=8$	
	Total area $=8+2\frac{5}{12}=10\frac{5}{12}$ units^2	B1ft (6)