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London Examinations GCE Ordinary Level

Mark Scheme and Examiners' Report for Pure Mathematics 7362

May/June 2000

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Mark Scheme and Chief Examiner's Report
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PURE MATHEMATICS 7362

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PURE MATHEMATICS 7362, MARK SCHEME

PAPER 1

EDEXCEL FOUNDATION

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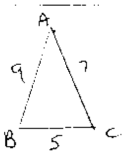
June 2000

Alternative Ordinary Level

General Certificate of Education

Subject **PURE MATHEMATICS 7362** Paper No. 1

Question number	Scheme	Marks
1.	$\alpha+\beta=-5 \qquad \alpha\beta=-4$	B1
	$\alpha^2\beta+\alpha\beta^2=\alpha\beta(\alpha+\beta)=20$	M1 either equ
	$\alpha^3\beta^3=-64$	A1 both.
	$x^2-20x-64=0$	B1 (4)
2.	(a) $\log_6 12=\log_6 2+\log_6 6=\frac{1}{2}a+1$	M1 A1
	(b) $\log_4 6=\frac{\log_6 6}{\log_6 4}=\frac{1}{a}$	M1 A1 (4)
3	(a) $\frac{dy}{dx}=e^{5x}+5xe^{5x}$	M1 A1 (2)
	(b) $x\frac{dy}{dx}=xe^{5x}+5x^2e^{5x}$	M1
	$=xe^{5x}(5x+1)=y(5x+1)$	A1 (2) (4)
4	$x^2+(p-3)x-2p+6=0$	
	real roots: $(p-3)^2\geqslant 4(6-2p)$	M1
	$p^2-6p+9\geqslant 24-8p$	
	$p^2+2p-15\geqslant 0$	
	$(p-3)(p+5)\geqslant 0$	M A1
	$p\leq -5$ or $p\geqslant 3$	A1 (4)
5	 	
	$\cos A=\frac{9^2+7^2-5^2}{2.9.7}$	M1
	$A=33.6°$	A1
	$\cos B=\frac{9^2+5^2-7^2}{2.9.5}$ (or sine rule)	M1
	$B=50.7°$	A1
	$C=180-(33.6+50.7)=95.7°$	B1 (5)

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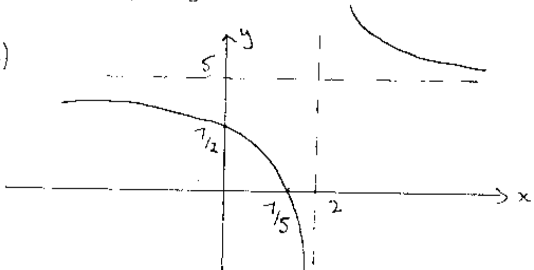
Question number	Scheme	Marks
6	(a) $\frac{dr}{dt} = \frac{dr}{dV} \cdot \frac{dV}{dt}$	M1
	$V = \frac{4}{3}\pi r^3$ $\quad \frac{dV}{dr} = 4\pi r^2$	B1
	$\frac{dr}{dt} = \frac{4}{4\pi r^2} = \frac{1}{\pi r^2}$	A1
	(b) $A = 4\pi r^2$ $\quad \frac{dA}{dt} = \frac{dA}{dr} \cdot \frac{dr}{dt} = (8\pi r)\frac{1}{\pi r^2}\left(= \frac{8}{r}\right)$	M1, B1
	$r = 10$ $\quad \frac{dA}{dt} = 0.8$	A1 (6)
7.	(a) $\int (e^{4x} - 2e^{2x} + 1)\,dx$, $= \frac{1}{4}e^{4x} - e^{2x} + x + c$	M1 M1, A1 (3)
	(b) $V = \int \pi y^2 dx = \pi \int_0^3 (e^{2x} - 1)^2 dx$	M1
	$= \pi \left[\frac{1}{4}e^{4x} - e^{2x} + x \right]_0^3$	A1√
	$= \pi \left[\frac{1}{4}e^{12} - e^{6} + 3 - \frac{1}{4} + 1 \right]$	
	$= \pi \left[\frac{1}{4}e^{12} - e^{6} + 3\frac{3}{4} \right]$	A1 (3) (6)
8	(a) $5 - \frac{3}{2-x} = 0$	
	$5(2-x) - 3 = 0$, $\quad x = \frac{7}{5}$	M1, A1 (2)
	(b) $x = 2$, $\quad y = 5$	B1, B1
	(c) 	G1 2 branches G1 Asymptotes G1 Crosses axes
	$x = 0$ $\quad y = 5 - \frac{3}{2} = \frac{7}{2}$	

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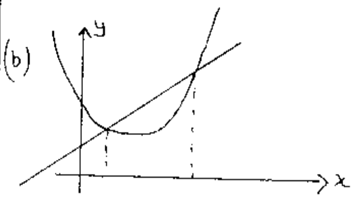
Paper No. 1

Question number	Scheme	Marks
9	(a) $x+1 = x^2-8x+19$	M1
	$x^2-9x+18=0 \quad (x-6)(x-3)=0$	M1
	$x=6 \quad x=3$ $y=7 \quad y=4$	A1, A1 (4)
	(b) 	
	Area trap. $= \frac{1}{2}(4+7)\times 3 = 33/2$	B1
	Area under curve $= \int_3^6 (x^2-8x+19)\,dx$	M1
	$= \left[\frac{1}{3}x^3 - 4x^2 + 19x\right]_3^6$	A1
	$= 6.\frac{36}{3} - 4.36 + 19.6 - (9-36+57)$	
	$= 12$	A1
	Req'd area $= 16\frac{1}{2} - 12 = 4\frac{1}{2}$	A1✓ (5)
	(c) $\frac{dy}{dx} = 2x-8 \quad x=0 \Rightarrow \frac{dy}{dx} = -8 \Rightarrow$ grad normal $= \frac{1}{8}$	M1
	R is (0, 19) ∴ equ normal: $y - 19 = \frac{1}{8}x$	M1 A1 (3)
	(d) Normal meets x-axis at $(-152, 0)$	B1
	Area $\Delta = \frac{1}{2}\times 152\times 19 = 1444$	M1 A1 (3) (15)
10 (i)	(a) $a+d=21$ $a+5d=9$ } $4d=-12 \quad d=-3$	M1 A1 A1 (3)
	(b) $a=24$	A1 (1)
	(c) $S_n = \frac{n}{2}(2\times 24 + (n-1)(-3))$	M1 A1
	$= \frac{3n}{2}(16-n+1) = \frac{3n}{2}(17-n)$	A1 (3)
	(d) $105 = \frac{3n}{2}(17-n)$	M1
	$3n^2 - 51n + 210 = 0$ $n^2 - 17n + 70 = 0$	M1
	$(n-10)(n-7) = 0 \quad n=10,\ n=7$	A1 (3)
(ii)	(a) $24 = \frac{a}{1+\frac{1}{2}}, \quad a = 36$	M1, A1 (2)
	(b) $S_9 = \frac{36(1-(-\frac{1}{2})^9)}{1+\frac{1}{2}}$	M1 A1
	$= 24.05 \quad (24.046\ldots)$	A1 (3) (15)

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11	(a) $\frac{2}{1-2x} + \frac{3}{1+3x} = \frac{2(1+3x)+3(1-2x)}{(1-2x)(1+3x)}$, $= \frac{5}{(1-2x)(1+3x)}$	M1 A1, A1 (3)
	(b) $(1-2x)^{-1} = 1 + 2x + \frac{(-1)(-2)}{2!}(-2x)^2 + \frac{(-1)(-2)(-3)}{3!}(-2x)^3 + \dots$	M1
	$= 1 + 2x + 4x^2 + 8x^3 + \dots$	A2, 1, 0
	Valid for $\lvert x \rvert < \frac{1}{2}$	B1 (4)
	(c) $(1+3x)^{-1} = 1 - 3x + \frac{(-1)(-2)}{2!}(3x)^2 + \frac{(-1)(-2)(-2)}{3!}(3x)^3 + \dots$	M1
	$= 1 - 3x + 9x^2 - 27x^3 + \dots$	A2, 1, 0
	Valid for $\lvert x \rvert < 1/3$	B1 (4)
	(d) $\frac{5}{(1-2x)(1+3x)} = 2(1-2x)^{-1} + 3(1-3x)^{-1}$	M1
	$= 2(1+2x+4x^2+8x^3+\dots) + 3(1-3x+9x^2-27x^3+\dots)$	[redacted]
	$= 5 - 5x + 35x^2 - 65x^3 + \dots$	A2, 1, 0 (4)
	Valid for $\lvert x \rvert < 1/3$	B1 (15)
12.	(a) (i) $\cos 2\theta = \cos^2\theta - \sin^2\theta = 1 - 2\sin^2\theta$	M1
	$2\sin^2\theta = 1 - \cos 2\theta$	
	$\sin^2\theta = \frac{1}{2}(1 - \cos 2\theta)$	A1 (2)
	(ii) $\sin 2\theta = \sin\theta\cos\theta + \cos\theta\sin\theta = 2\sin\theta\cos\theta$	B1 (1)
	(b) $f(\theta) = 5\sin^2\theta - 3(1 - \sin^2\theta)$	M1
	$= 8\sin^2\theta - 3$, $= 4(1-\cos 2\theta) - 3 = 1 - 4\cos 2\theta$	M1, A1 (3)
	(c) $1 - 4\cos 2\theta = 0.2$, $\cos 2\theta = 0.2$	M1, [redacted]
	$2\theta = 1.369$, 4.914	
	$\theta = 0.68$, 2.46	A1, A1 (3)
	(d) $1 - 4\cos 2\theta - \sin 2\theta = 1$	
	$\frac{\sin 2\theta}{\cos 2\theta}$, $= \tan 2\theta = -4$	M1, [redacted]
	$2\theta = 1.816$, 4.957, $\theta = 0.91, 2.48$	A1, A1 (3)
	(e) $\int_0^{\pi/6} (1 - 1 + 4\cos 2\theta)\,d\theta$, $= \left[2\sin 2\theta\right]_0^{\pi/6}$	M1, M1
	$= 2\sin\frac{\pi}{3} - 0 = \frac{2\sqrt{3}}{2} = \sqrt{3}$	A1 (3) (15)

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Paper No. **1**

Question number	Scheme	Marks
13 (i)	(a) $6x^2 + 8xh = 200$	M1 A1
	$h = \frac{100 - 3x^2}{4x}$	A1
	$V = 3x^2h = \frac{3x^2(100 - 3x^2)}{4x} = 75x - 9x^3/4$	M1 A1 (5)
	(b) $\frac{dV}{dx} = 75 - \frac{27x^2}{4}$	M1
	$\frac{dV}{dx} = 0 \quad x^2 = 75 \times 4/27 = 25 \times \frac{4}{9}$	M1
	$x = \pm 10/3 \Rightarrow x = 10/3$	A1 (3)
	(c) $V_{max} = 75 \times 10/3 - 9/4 \times \frac{1000}{27} = 166\,2/3 \text{ cm}^3$	M1 A1 (2)
(ii)	(a) $f'(x) = \frac{2x(x+4) - (x^2-1)}{(x+4)^2} \quad \left(= \frac{x^2 + 8x + 1}{(x+4)^2}\right)$	M1 A1 (2)
	(b) $f'(x) < 0 \quad (x+7)(x+1) < 0$	M1
	$-7 < x < -1, \; x \neq -4.$	A1, B1 (3) (15)
14.	(a) (i) $\overrightarrow{BC} = 2\underline{b} - 5\underline{a} - \underline{b} = \underline{b} - 5\underline{a}$	M1 A1
	(ii) $\overrightarrow{AB} = \underline{b} - \underline{a}$	B1
	(iii) $\overrightarrow{OD} = \underline{a} + \frac{3}{4}(\underline{b} - \underline{a}) = \frac{\underline{a}}{4} + \frac{3\underline{b}}{4}$	M1 A1 (5)
	(b) $\overrightarrow{BE} = \frac{\lambda}{1+\lambda}\overrightarrow{BC} = \frac{\lambda}{1+\lambda}(\underline{b} - 5\underline{a})$	B1
	$\overrightarrow{OE} = \underline{b} + \frac{\lambda}{1+\lambda}(\underline{b} - 5\underline{a})$	M1
	$(1+\lambda)\overrightarrow{OE} = (1+\lambda)\underline{b} + \lambda(\underline{b} - 5\underline{a}), = (1+2\lambda)\underline{b} - 5\lambda\underline{a}$	M1, A1 (4)
	(c) $AB \parallel OE \Rightarrow 1 + 2\lambda = 5\lambda$	M1
	$1 = 3\lambda \quad \lambda = 1/3$	A1 (2)
	(d) $\overrightarrow{DE} = \overrightarrow{OE} - \overrightarrow{OD} = \underline{b} + \frac{1}{4}(\underline{b} - 5\underline{a}) - \frac{\underline{a}}{4} - \frac{3\underline{b}}{4}$	M1
	$\overrightarrow{DE} = \frac{1}{2}\underline{b} - \frac{3}{2}\underline{a}$	A1 (2)
	(e) $\overrightarrow{AC} = 2\underline{b} - 6\underline{a} = 4\overrightarrow{DE}$	M1 A1 (2)
	$\therefore AC \parallel DE$	(15)

PAPER 2

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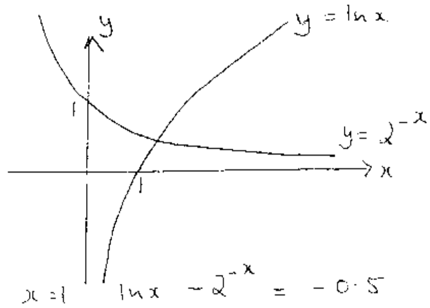
Paper No. 2

Question number	Scheme	Marks
1	(a) $y = x^2\sin 2x$ $\frac{dy}{dx} = 2x\sin 2x + 2x^2\cos 2x$	M1 A1
	(b) $y = \frac{e^x}{1+2x}$ $\frac{dy}{dx} = \frac{e^x(1+2x) - 2e^x}{(1+2x)^2}, = \frac{2xe^x - e^x}{(1+2x)^2}$	M1, A1 (4)
2	$(2-x)^9 = 2^9 + 9(-x)2^8 + \frac{9.8}{2!}(-x)^2.2^7 + \frac{9.8.7}{3!}(-x)^3 2^6 + \dots$	M1 A1
	$= 512 - 2304x + 4608x^2 - 5376x^3 + \dots$	A2,1,0 (4)
3	(a) 	G1 G1
	(b) $x = 1$ $\ln x - 2^{-x} = -0.5$ $x = 2$ $\ln x - 2^{-x} = 0.4431\dots$	M1
	∴ root bet. $x = 1$ and $x = 2$ (alt sign test at 2, use diag. for 1)	A1 (4)
4	$2 + 2\left(\frac{4}{5}\times 2 + 2\times\left(\frac{4}{5}\right)^2 + \dots\right)$	M1
	$= 2 + 2\times\frac{8/5}{1-4/5}$	M1 A1
	$= 2 + 16 = 18$	A1 (4)
5	(a) $\vec{BA} = \underline{a} - \underline{b}$, $\vec{OD} = \frac{1}{2}(\underline{a} + \underline{b})$	B1, M1 A1 (3)
	(b) ΔOAB is isos. $OD \perp r\ AB \Rightarrow \underline{a} - \underline{b}\ \perp r$ to $\frac{1}{2}(\underline{a} + \underline{b})$	M1
	$\Rightarrow \underline{a} - \underline{b}\ \perp r$ to $(\underline{a} + \underline{b})$	A1 (2) (5)

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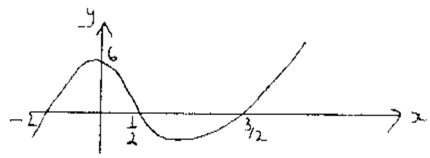
Paper No. 2

Question number	Scheme	Marks
6.	$2\sin^2\theta = 3\cos\theta$	
	$2 - 2\cos^2\theta = 3\cos\theta$	M1
	$2\cos^2\theta + 3\cos\theta - 2 = 0$	
	$(2\cos\theta - 1)(\cos\theta + 2) = 0$	M1
	$\cos\theta = \frac{1}{2}$ $\theta = \pi/3,\ 5\pi/3$	A1, A1
	$\cos\theta = -2$ not poss	A1 (5)
7.	(a) $4(-2)^3 + 2k + 6 = 0$	M1
	$-32 - 2k + 6 = 0$	
	$k = -13$	A1 (2)
	(b) $f(x) = (x+2)(4x^2 - 8x + 3) = 0$	
	$(x+2)(2x-1)(2x-3) = 0$	M1
	$x = -2,\ x = 1/2,\ x = 3/2$	A2,1,0 (3)
	(c) 	G1 (1)
		(6)
8	(a) Grad $= -1/5$	B1
	Eqn $y - 20 = -1/5(x+2)$	M1 A1 (3)
	(b) $5y - 100 = -x - 2$	
	$5y + x = 98$	
	$y - 5x = 4$	M1
	$5y - 25x = 20$	
	$26x = 78$ $x = 3$ $y = 19$ $(3, 19)$	A1 (2)
	(c) B: $29 = 5\times5 + 4$; D: $9 = 5\times1 + 4$	B1 (1)
	(d) Mid-point BD is $(3, 19)$	
	$\Rightarrow$ Mid-point AC is $(3, 19)$	M1
	C is $(8, 18)$	A1 (2)
		(8)

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Paper No. **2**

Question number	Scheme	Marks
9. (i)	(a) $\log_x 128 = 7 \quad x^7 = 128 \quad x = 2$	M1 A1 (2)
	(b) $\log_3(5y+1) = 4 \quad 3^4 = 5y+1, \quad 5y = 80 \quad y = 16$	M1, A1 (2)
	(c) $\log_3 p + \log_p 9 = 3$	
	$\log_3 p + \frac{\log_3 9}{\log_3 p} = 3$	M1
	$(\log_3 p)^2 + 2 = 3\log_3 p$	M1
	$(\log_3 p - 2)(\log_3 p - 1) = 0$	M1
	$\log_3 p = 2 \qquad \log_3 p = 1$	
	$p = 9 \qquad p = 3$	A1 A1 (5)
(ii)	(a) $f(1) = 0, \quad f(m) = 1$	B1, B1 (2)
	(b) $\log_m \sqrt[3]{r} = \frac{1}{3}\log_m r = 1$	M1 A1 (2)
	(c) $\log_m \frac{rs^2}{m} = \log_m r + 2\log_m s - \log_m m$	M1
	$= 3 + 8 - 1 = 10$	A1 (2) (15)
10	(a) $\alpha + \beta = 2, \quad \alpha\beta = -5/3$	B1, B1
	$\frac{2\alpha}{\beta} + \frac{2\beta}{\alpha} = \frac{2(\alpha^2+\beta^2)}{\alpha\beta} = \frac{2[(\alpha+\beta)^2 - 2\alpha\beta]}{\alpha\beta}$	M1
	$= \frac{2(4 + 10/3)}{-5/3} = -44/5$	A1
	$\frac{2\alpha}{\beta} \cdot \frac{2\beta}{\alpha} = 4$	B1
	$x^2 + 44/5\,x + 4 = 0 \qquad 5x^2 + 44x + 20 = 0$	B1 (6)
	(b) $4\alpha + \beta + \alpha + 4\beta = 5(\alpha+\beta) = 10$	M1
	$-p/3 = 10 \qquad p = -30$	A1
	$(4\alpha+\beta)(\alpha+4\beta) = 4(\alpha^2+\beta^2) + 17\alpha\beta$	
	$= 4(\alpha+\beta)^2 + 9\alpha\beta$	M1
	$= 16 + 9 \times (-5/3) = 16 - 15 = 1$	
	$q/3 = 1 \qquad q = 3$	A1 (4)
	(c) $q(x) = 3x^2 - 30x + 3 = 3(x^2 - 10x) + 3$	M1
	$= 3(x-5)^2 - 75 + 3$	M1
	$= 3(x-5)^2 - 72$	A1 (3)
	(d) $-1/72$	B1 ✓ (1)
	(e) $x = 5$	B1 ✓ (1) (15)

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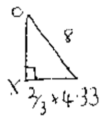
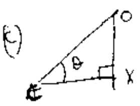
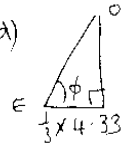
Paper No. **2**

Question number	Scheme	Marks
11	(a) $CE = \sqrt{(5^2 - (\frac{5}{2})^2)}$, $= 4.33$ cm	M1 A1, A1 (3)
	(b)  $OX = \sqrt{(8^2 - (\frac{2}{3}\times 4.33)^2)}$	M1 A1
	$= 7.461 = 7.46$ cm	A1 (3)
	(c)  $\sin\theta = \frac{7.461}{8}$ ident. ∠	B1 M1 A1
	$\theta = 68.8°$	A1 (4)
	(d)  $\tan\phi = \frac{7.461}{\frac{1}{3}\times 4.33}$ Ident. ∠	B1 M1 A1
	$\phi = 79.1°$	A1 A1 (5) (15)
12	(a) $f(x) = (x+1)(x-2)(x-3)$ $r = 1\times -2\times -3 = 6$	B1 (1)
	(b) $f(-1) = -1 + p - q + 6 = 0$, $p - q = -5$; $f(2) = 8 + 4p + 2q + 6 = 0$, $2p + q = -7$; $p = -4$ $q = 1$ or $f(x) = (x^2 - x - 2)(x-3) = x^3 - 4x^2 + x + 6$, $p = -4$, $q = 1$	M1 A1 A1 (3)
	(c) $f'(x) = 3x^2 - 8x + 1 = 0$; $x = \frac{8 \pm \sqrt{(64-12)}}{6}$	M1 A1
	$x = \frac{4 \pm \sqrt{13}}{3}$	A1 (3)
	(d) $f''(x) = 6x - 8$; $x = \frac{4+\sqrt{13}}{3}$ $f''(x) = 2(4+\sqrt{13}) - 8 > 0$ ∴ min	M1 A1
	$x = \frac{4-\sqrt{13}}{3}$ $f''(x) = 2(4-\sqrt{13}) - 8 < 0$ ∴ max	A1 (3)
	e) graph sketched	G2 (2)
	f) $A = \int_{-1}^{2}(x^3 - 4x^2 + x + 6)dx = \left[\frac{x^4}{4} - \frac{4x^3}{3} + \frac{x^2}{2} + 6x\right]_{-1}^{2}$	M1 A1
	$= 4 - \frac{32}{3} + 2 + 12 - (\frac{1}{4} + \frac{4}{3} + \frac{1}{2} - 6) = 11\frac{1}{4}$	A1 (3) (15)

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June 2000

Alternative Ordinary Level

General Certificate of Education

Subject **PURE MATHEMATICS 7362**

Paper No. **2**

Question number	Scheme	Marks
13	(a) (i) $5y = 3x - 3$	
	$2y = -x + 23$	
	$6y = -3x + 69$	M1
	$11y = 66$ $y = 6, x = 11$ P is $(11, 6)$	A1
	(ii) Q is $(1, 0)$	B1
	(iii) R is $(23, 0)$	B1 (4)
	(b) Area $\Delta PQR = \frac{1}{2} \times 22 \times 6 = 66$	B1 (1)
	(c) $PQ^2 = 10^2 + 6^2$, $PQ = 11.7$	M1, A1 (2)
	(d) $\frac{1}{2} RS.PQ$ = Area ΔPQR	M1
	$RS = 2 \times 66 / 11.7 = 11.3$	A1 (2)
	(e) Grad PQ $= \frac{6}{10}$ $\therefore$ grad RS $= -5/3$	B1
	Eqn. RS: $y - 0 = -\frac{5}{3}(x - 23)$	M1
	$3y = -5x + 115$	A1 (3)
	(f) $2y \geq 23 - x$	B1
	$5y < 3x - 3$	B1
	$3y < 115 - 5x$	B1 (3)
		(15)
14	(a) see table below	B1
		B2 (3)
	(b) On graph paper: correct scale.	G1
	each curve: plot points	G1 } ×2
	smooth curve	G1 (5)
	(c) 34.53 (± 0.5)	B1 (1)
	(d) line: $y = \frac{x}{15} - 0.5$ intersection with $y = f(x)$	M1 A1
	$x = 26.0$ (± 0.5)	B1 (3)
	(e) $y = 2 - \frac{x}{20}$ int with $y = g(x)$	M1 A1
	$x = 17.2$ (± 1)	B1 (3)
		(15)

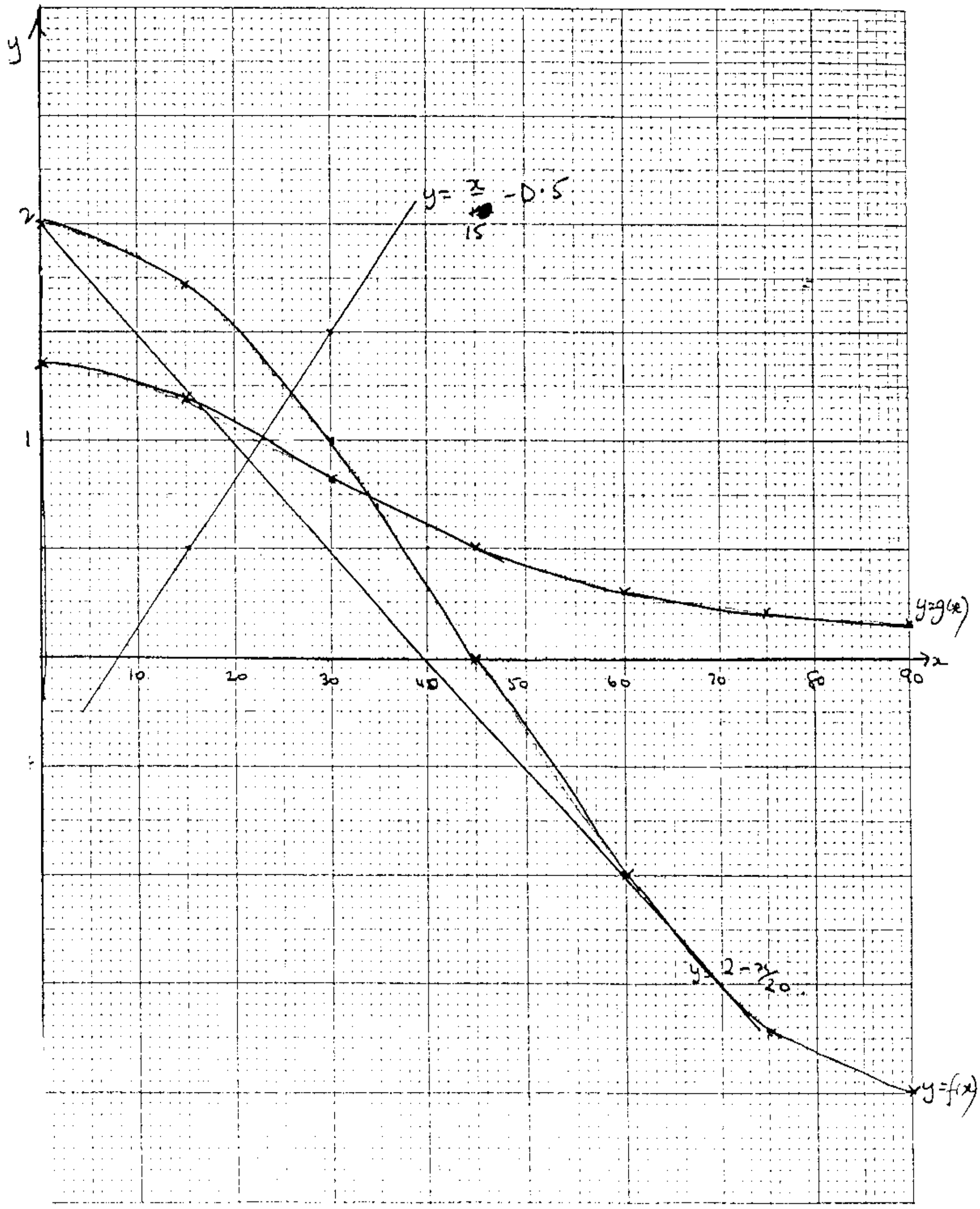
Table for 14(a):

x	0	15	30	45	60	75	90
$f(x)$	2	1.73	1	0	−1	−1.73	−2
$g(x)$	1.36	1.19	0.82	0.5	0.30	0.21	0.18

University of London Examinations and Assessment Council
General Certificate of Education

AB31

Centre No.	Candidate No.	Level A/O	For Examiner's Use
Subject Number & Title	7362.	Paper 2	
Surname & Initials		Section B	
Signature	Date June 2000	Qu. No. 14.	



PURE MATHEMATICS 7362, CHIEF EXAMINER'S REPORT

General Comments

This was the first year that any part of the syllabus could be tested on either paper. Previously the more difficult topics which tend to be taught later in the course allowing for less consolidation time, were tested on Paper 2. Consequently the marks tended to be lower on that paper. This year, although there was no apparent difference in the standard of the papers, the candidates seemed in general to find Paper 2 more difficult than Paper 1. However, the gap in performance on the two papers was narrower than previously seen.

There were the usual problems arising from candidates spending a great deal of time attempting more than the required number of Section B questions, often in an attempt to choose the ones they preferred rather than using spare time at the end. This frequently resulted in five or six questions yielding marks which were very similar, indicating that time would have been better spent concentrating on four.

Marks were lost throughout both papers by failure to round answers as instructed and working later parts of questions with previously rounded answers thus losing accuracy. Candidates should appreciate that to obtain an answer which is accurate to 3 significant figures they must work with at least 4 significant figures in their calculations. Other common errors occurred in trigonometric questions where the answer was required to be in radians, correct to 3 significant figures. Answers which are either in degrees or in radians but given as a multiple of π do not comply with this instruction and are therefore penalised.

Paper 1

Section A

Question 1

There were a few sign errors arising when finding the sum and product of the roots of the required equation. Some candidates preferred to find the new equation by first solving the given one. Provided they kept to the surd form of the answers the required equation could be found without loss of accuracy, but those who worked with 3 figure approximations could not obtain the required accuracy for the integer coefficients of the new equation.

Question 2

Candidates should be aware that, in general, the idea behind questions of this type is to simplify the given expression. Thus changing $\log_6 12$ to $a + \log_6 3$, which is more complicated, is not the answer required. Candidates coped well with $\log_4 6$.

Question 3

Most candidates knew the product rule and could apply it here. Those who differentiated correctly were usually able to complete part (*b*) correctly.

Question 4

Candidates often considered $b^2 - 4ac > 0$ rather than $b^2 - 4ac \geq 0$. When solving the quadratic inequality few considered either the shape of the graph or the signs of the brackets they had obtained.

Question 5

Most successful candidates used the cosine rule twice or were careful to avoid finding the largest angle by the sine rule. Those who used the sine rule to find $\angle ACB$ usually failed to realise that they had an ambiguous case and consequently gave the acute angle for their answer. A significant number of candidates found their third angle by the sine or cosine rule rather than the angle sum of a triangle.

Question 6

This question was usually well answered by those candidates who knew the formulae for the volume and surface area of a sphere although some unusual chain rule applications were presented.

Question 7

Many candidates either failed to expand the brackets before integrating or gave $\frac{e^{x+1}}{x+1}$ as the integral of e^x. Some omitted the constant of integration. A few either did not know the formula for a volume of revolution or failed to realise that the integral required was the integral from part (*a*). Some even managed to produce a correct solution for part (*b*) after failing with part (*a*)!

Question 8

Some candidates could solve the equation at part (*a*) but could not obtain the equations of the asymptotes in part (*b*) so were unable to sketch the curve successfully. Even the sketches that showed two asymptotes did not always have two branches.

Section B

Question 9

Candidates could generally find the coordinates of the two points of intersection of the line and curve successfully. However, the area between the curve and the line created more problems. Often the area under the curve was calculated with no further work undertaken. The equation of the normal was usually correct. The area of the triangle bounded by the normal and the coordinate axes was more often calculated by integration than by using the coordinates of the vertices and the formula for the area of a triangle.

Question 10

Most candidates who attempted this question found it straightforward. Errors which arose were mainly due to arithmetic slips.

Question 11

The solutions to parts (*b*) and (*c*) showed that few candidates were aware of the range of values for which this type of binomial expansion is valid. In part (*d*), most candidates ignored their result from part (*a*) and multiplied their two expansions rather than calculating $2(1-2x)^{-1}+3(1+3x)^{-1}$ which they should have found easier. However, care taken in multiplication generally produced a correct or almost correct result.

Question 12

This was the question which was least well done. The identities in parts (*a)* and (*b*) were usually correct although some fiddling was found especially in (*b*). Not all candidates then used the instruction to use part (*b*) for the remaining parts of the question. Part (*c*) was frequently solved correctly although not always in radians and not always giving both solutions. Part (*d*) proved harder, defeating many candidates who could not obtain a trigonometric equation in a single function. Of those who proceeded to part (*e*), most were successful but some made arithmetic slips which left them with a numerical term as well as $4\cos 2\theta$ to integrate. There was a lack of appreciation of the term "exact value" and many candidates gave a 3 significant figure final answer.

Question 13

In part (i) (*a*) most candidates tried to convince the examiners that the statement given was correct but in too many cases the formula did not follow from their working. In part (ii) most could find $f'(x)$ but some failed to realise that only the sign of the numerator need be considered to determine the values of *x* for which the derivative is negative. Very few stated that $x \neq -4$.

Question 14

Most candidates who attempted this question could find the vectors required in part (*a*). In part (*b*) some candidates made use of the formula for the position vector of a point dividing a line in a given ratio and produced a succinct solution. However, many others who attempted to solve the problem by using a multiple of $B\vec{C}$ could not make correct use of the ratio, although they often convinced themselves that they could obtain the required statement. There was little understanding of the condition for two vectors to be parallel and hence few correct values of λ. Consequently most candidates found it impossible to complete the rest of the question correctly.

Paper 2

Section A

Question 1

Most candidates knew and could apply the product and quotient rules well. The most common error was to add the two terms in the numerator of the quotient rule rather than subtracting. Many failed to tidy up their answer in part (*b*).

Question 2

The binomial expansion in its basic form of (1 + *x*)^n was clearly well known. However many of those who preferred to expand $(2-x)^9$ by extracting a factor of 2 forgot that 2^9 was required
giving $2^9\left(1-\frac{x}{2}\right)^9$. Less common, but more frequently successful, was the use of the expansion of $(a+b)^n$.

Question 3

These were graphs that the candidates should have been able to sketch from memory but many calculated values, wasting valuable time. Too many graphs stopped at the coordinate axes and marks were lost as a consequence. Some graphs were not sketched on the same axes marking part (*b*) virtually impossible to answer. Few candidates gave fully satisfactory solutions for Part (*b*); the sketch on its own shows that the root is greater than 1 but further work is necessary to show that it is less than 2.

Question 4

There were very few completely correct solutions to this question. Many recognised that an infinite geometric series was involved, calculating $2+2\times\frac{4}{5}+2\times\left(\frac{4}{5}\right)^2+2\times\left(\frac{4}{5}\right)^3+2\times\left(\frac{4}{5}\right)^3+\dots$. Credit was given for this, but full marks were only available to those who related this to the problem and obtained the final answer of 18.

Question 5

Part (*a*) was well answered but much imaginative fiddling was seen in the attempts to prove that the two given vectors were perpendicular. Very few realised that the perpendicularity depended on the isosceles triangle.

Question 6

Most candidates recognised that the identity $\cos^2\theta+\sin^2\theta=1$ was required to obtain a quadratic equation in $\cos\theta$. Those who solved the resulting equation correctly usually stated that $\cos\theta=-2$ was impossible. Some only gave one solution for $2\cos\theta-1=0$; very few answers outside the required range were seen.

Question 7

The remainder theorem was well understood and applied in part (*a*). However in part (*b*) the cubic equation was frequently treated as a quadratic and the formula was used to solve it with disastrous results. Those who could do algebraic division obtained the three answers easily. The graph in part (*c*) was sketched well by most of those who had obtained a correct solution to (*b*). However, some graphs stopped at the *x*-axis at one or both ends.

Question 8

Those who correctly obtained the gradient of the perpendicular almost always proceeded to a correct equation in part (*a*). Attempts at finding the coordinates of the point of intersection of l_1 and l_2 could only be accurate if a correct equation had been obtained. In part (*c*) many candidates seemed to think that showing that the gradient of *BD* was the same as that of l_1 was sufficient to show that the points lay on the line. Very few candidates understood the geometry of the rhombus sufficiently to answer part (*d*) successfully; they found the coordinates of the mid-point of *BD* as suggested in the question and assumed that this gave them the coordinates of *C*. A rough sketch showing the lines and the various points mentioned would have been beneficial.

Section B

Question 9

Part (i) (*a*) and (*b*) were mostly correct but part (*c*) proved to be much more demanding. Those who managed to change the base satisfactorily often failed to convert the equation to a quadratic which they could solve. In part (ii) many misinterpreted $\mathrm{f}(r)=3$ and $\mathrm{f}(s)=4$ as $\mathrm{f}(3)=r$ and $\mathrm{f}(4)=s$.

Question 10

This question was found to be more exacting than previous questions involving the symmetric functions of a quadratic equation. The algebra in part (*a*) caused problems when $2\left(\alpha^2+\beta^2\right)$ was converted to $2\left(\alpha+\beta\right)^2-2\alpha\beta$. Candidates failed to appreciate that when they proceeded to part (*b*) they were still working on the same continuous question and so the values of α and β were unchanged. Very few candidates were able to attempt parts (*c*) onwards as they had no values for *a*, *b* and *c*.

Question 11

Many candidates produced good solutions for this question. However some failed to understand the angles they had to calculate or used lengthy methods involving the sine and/or cosine rules through either not appreciating that the height was perpendicular to the base or using a larger triangle than was necessary.

Question 12

The most common approach was to use the remainder theorem three times to produce three equations which some candidates managed to solve to obtain correct solutions for parts (*a*) and (*b*).
A few realised that the given coordinates could be used to give a factorisation of f(*x*) which they then multiplied out. In part (*c*) many candidates gave the answers in surd form and then wasted their time by proceeding to produce 3 figure approximations. The sketch graphs were generally good but again, too many stopped at the *x*-axis at one or both ends. Those who had reasonable values for *p*, *q* and *r* were able to integrate the function correctly and many correct values were produced for the area.

Question 13

There were a few errors in part (*a*), generally due to carelessness. A significant number of candidates failed to realise that the height and base of ΔPQR were known from the coordinates; again a rough diagram would have helped. Various complex methods for finding the area were used as a consequence. Finding the length of *PQ* gave few problems. Many assumed that *S* was the mid-point of *PQ* and so could not complete the question correctly. Those who used the intended approach had little difficulty obtaining an equation of *RS*. Trying to write down the inequalities required in part (*f*) without a sketch was disastrous as many who used the correct equations reversed some or all of the inequality signs. Many candidates worked out equations for *PQ* and *PR* (and often got them wrong) instead of using the ones they had been given at the beginning of the question. Even if the equations were correct almost all candidates used „ and … instead of $<$ and $>$.

Question 14

This seemed to be the least popular question, possibly because most candidates had found four suitable questions before reaching the final one. Most graphs were well drawn although there were still some candidates who had odd lumps and bumps in their curves which they should have recognised as errors. A few persisted in using a ruler to join their plotted points which is not acceptable. Those who attempted to draw the lines were usually successful in part (*d*) but in part (*e*) many drew $y = 4 - \frac{x}{10}$ instead of $y = 2 - \frac{x}{20}$.

PURE MATHEMATICS 7362, GRADE BOUNDARIES

Grade	A	B	C	D	E
Lowest mark for award of grade	78	63	48	43	36

Note: Grade boundaries may vary from year to year and from subject to subject, depending on the demands of the question paper.

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