

NOVEMBER 2002

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK : 80

SYLLABUS/COMPONENT : 0606/2

ADDITIONAL MATHEMATICS

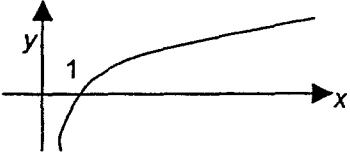
(Paper 2)



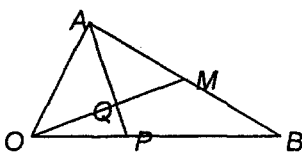
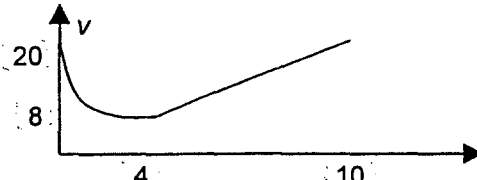
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1 [4]	$\text{Inverse} = \begin{pmatrix} 6 & -3 \\ -7 & 4 \end{pmatrix} \times \frac{1}{3}$ $\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{3} \begin{pmatrix} 6 & -3 \\ -7 & 4 \end{pmatrix} \begin{pmatrix} -7 \\ -16 \end{pmatrix} = \begin{pmatrix} 2 \\ -5 \end{pmatrix}$	B1 B1 M1 A1
2 [4]	$2^6 + 6 \times 2^5 \times x + \frac{6 \times 5}{1 \times 2} \times 2^4 \times x^2$ $= 64 + 192x + 240x^2$ Replace x by $x - x^2 \Rightarrow$ coefficient of $x^2 = -192 + 240 = 48$	B2, 1, 0 <i>(-1 each, incorrect or missing term)</i> M1 A1 <i>C.S.C.</i>
3 [5]	(i) Either $\frac{1 + \frac{1}{\sqrt{3}}}{1 - \frac{1}{\sqrt{3}}} \times \frac{1 + \frac{1}{\sqrt{3}}}{1 + \frac{1}{\sqrt{3}}}$ or $\frac{\sqrt{3} + 1}{\sqrt{3} - 1} \times \frac{\sqrt{3} + 1}{\sqrt{3} + 1}$ Simplify $\Rightarrow 2 + \sqrt{3}$ (ii) $\frac{1}{p} = \frac{1}{2 + \sqrt{3}} \times \frac{2 - \sqrt{3}}{2 - \sqrt{3}} = \frac{2 - \sqrt{3}}{4 - 3}$ $p - \frac{1}{p} = 2 + \sqrt{3} - (2 - \sqrt{3}) = 2\sqrt{3}$ Or $p - \frac{1}{p} = 2 + \sqrt{3} - \frac{1}{2 + \sqrt{3}} = \frac{6 + 4\sqrt{3}}{2 + \sqrt{3}}$ Multiply by $\frac{2 - \sqrt{3}}{2 - \sqrt{3}} \Rightarrow 2\sqrt{3}$	M1 A1 M1 A1 ✓ A1 B1 ✓ M1 A1
4 [6]	Solving inequalities: A $x < 3.5$ B $x^2 - x - 2 = 0 \Rightarrow (x - 2)(x + 1) = 0 \Rightarrow x = -1, 2$ $x^2 - x - 2 > 0 \Rightarrow x < -1, x > 2$ Required values $-5 < x < -1$ $2 < x < 3.5$	B1 M1 A1 A1 M1 A1

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5 [6]	(a) Either ${}_5C_3 = \frac{5 \times 4 \times 3}{1 \times 2 \times 3}$ or ${}_4C_2 = \frac{4 \times 3}{1 \times 2}$ Product = $10 \times 6 = 60$ (b) Either, ending in 1 (or 3) $\Rightarrow 2 \times 5 \times 4$ or, ending in 5 (or 7) $\Rightarrow 3 \times 5 \times 4$ Adding all 4 cases $\Rightarrow 40 + 40 + 60 + 60 = 200$	B1 M1 A1 B1 M1 A1
6 [6]	(i) $f(x) = -(x-1)(x-2)(x-k)$ $f(3) = -2 \times 1 \times (3-k) = 8 \Rightarrow k = 7$ (ii) $f(-3) = -(-4)(-5)(-10) = 200$	M1 A1 M1 A1 M1 A1
7 [6]	(i) $\frac{d}{dx}(x \sin x) = \sin x + x \cos x$ (ii) $\int x \cos x \, dx = x \sin x - \int \sin x \, dx$ $\int \sin x \, dx = -\cos x$ $x \sin x + \cos x$ $\frac{\pi}{2} - 1 \approx 0.571$	M1 A1 M1 DM1 A1 A1 c.s.o.
8 [6]	(i)  [$\rightarrow -\infty$ as $x \rightarrow 0$; thro' (1,0); $\rightarrow \infty$ as $x \rightarrow \infty$] (ii) Take logs $\ln x^2 + \ln e^{x-2} = \ln 1$ $\Rightarrow 2 \ln x + x - 2 = 0$ Make $\ln x$ the subject $\Rightarrow \ln x = -\frac{1}{2}(x-2) \Rightarrow$ line is $y = 1 - x/2$	B2,1,0 M1 A1 M1 A1
9 [7]	(a) Correct combination of indices Either $(a^{2/3} - a^{1/3}b^{2/3} + b^{4/3}) \times a^{1/3} = a - a^{2/3}b^{2/3} + a^{1/3}b^{4/3}$ Or $(a^{2/3} - a^{1/3}b^{2/3} + b^{4/3}) \times b^{2/3} = a^{2/3}b^{2/3} - a^{1/3}b^{4/3} + b^2$ Sum = $a + b^2$ (b) $2^{2x+2} = 4 \times 2^{2x}$ or $2^2 \times 4^x$ $5^{x-1} = 5^x \div 5$ $8^x = 2^{3x}$ $\therefore 10^x = 4/5$	M1 A1 A1 B2,1,0 (-1 each incorrect or missing term) M1 A1

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10 [9]	 (i) $AP = b/3 - a$ $OM = a/2 + b/2$ (ii) $OQ = \lambda(a/2 + b/2)$ (iii) $OQ = OA + \mu AP = a + \mu(b/3 - a)$ (iv) Comparing coefficients $\lambda/2 = 1 - \mu$ and $\lambda/2 = \mu/3$ Solving $\lambda = 1/2$ $\mu = 2/3$	B1 M1 A1 B1✓ M1 A1✓ M1 M1 A1
11 [11]	(i) $v = \int (\frac{3t}{2} - 6) dt = \frac{3t^2}{4} - 6t \quad (+c)$ $[v]_{t=0} = 20 \Rightarrow c = 20$ $[v]_{t=4} = 12 - 24 + 20 = 8$ (ii) $\int (\frac{3t^2}{4} - 6t + 20) dt = \frac{t^3}{4} - 3t^2 + 20t$ $AB = []_0^4 = 16 - 48 + 80 = 48$ (iii) $v_B = 8, \quad v_C = 20 \Rightarrow t_{BC} = (20 - 8)/2 = 6$ (iv)  curve straight line	M1 A1 A1 A1 M1 A1✓ A1 M1 A1✓ B1 B1✓
12 [10] Either	$A = \pi r^2 + \pi r l \Rightarrow l = (120 - \pi r^2)/\pi r$ $V = \frac{1}{2} \pi r^2 \left(\frac{120 - \pi r^2}{\pi r} \right) = 60r - \frac{1}{2} \pi r^3 \quad (AG)$ $dV/dr = 60 - 3\pi r^2/2 = 0$ when $r^2 = 40/\pi \approx 12.73 \Rightarrow r \approx 3.57$ Stationary value of $V \approx 143 \quad (142.73)$ $d^2V/dr^2 = -3\pi r < 0$ for $r > 0 \Rightarrow$ maximum [or any valid method]	B1 M1 M1 A1 B1 M1 A1 A1 M1 A1
Or	(i) $dy/dx = x^2 \times 1/x + 2x \ln x$ At Q, $y = 0 \Rightarrow \ln x = 0 \Rightarrow x = 1$ $[dy/dx]_{x=1} = 1 \text{ c.s.o.}$ (ii) At P, $dy/dx = 0 \Rightarrow x(1 + 2 \ln x) = 0 \Rightarrow \ln x = -1/2$ $\Rightarrow x = e^{-1/2} = 1/\sqrt{e} \approx 0.6065 \quad (AG)$ (iii) $d^2y/dx^2 = d(x + 2x \ln x)/dx = 1 + 2 \ln x + (2x \times 1/x)$ $= 3 + 2 \ln x$ $[d^2y/dx^2]_{x=1/\sqrt{e}} = 3 + 2(-1/2) = 2 \text{ c.s.o.}$	M1 A1 B1 A1 M1 A1 A1 M1 A1 A1