

NOVEMBER 2002

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK : 80

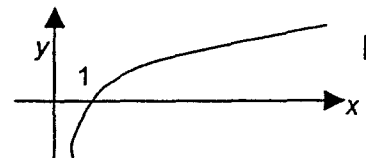
SYLLABUS/COMPONENT : 0606/2

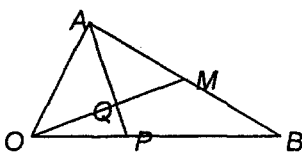
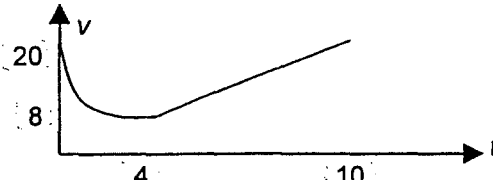
ADDITIONAL MATHEMATICS

(Paper 2)



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

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

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