

JUNE 2004

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 80

SYLLABUS/COMPONENT: 0606/02

**ADDITIONAL MATHEMATICS
Paper 2**



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1 [4]	$(i - 7j) + \lambda(0.6i + 0.8j) = 4i + k j$ $1 + 0.6\lambda = 4 \quad \Rightarrow \quad \lambda = 5$ $-7 + 0.8\lambda \quad \Rightarrow \quad -7 + 0.8 \times 5 = -3 = k$	M1 A1 M1 A1
2 [4]	Attempt at $\cos^{-1} 0.3 \Rightarrow [72.5^\circ \text{ A0}] = 1.266 [5.017, 7.549]$ accept 1.3 $x + 1 = 2.532, 10.034, 15.098 \Rightarrow x = 14.1 \text{ or better}$	M1 A1 M1 A1
3 [4]	(i) Some vegetarians in the college are over 180 cm tall [or equivalent] (ii) No cyclists in the college are over 180 cm tall [or equivalent] (iii) $B \cap C \subset A'$ [or equivalent]	B1 B1 B1 B1
4 [4]	$\left(1 + \frac{1}{\cos \theta}\right) \left(\frac{1}{\sin \theta} - \frac{\cos \theta}{\sin \theta}\right) \Rightarrow \frac{1 - \cos^2 \theta}{\cos \theta \sin \theta}$ $1 - \cos^2 \theta \equiv \sin^2 \theta$ Must be useful use of Pythagoras $\frac{\sin^2 \theta}{\cos \theta \sin \theta} \rightarrow \tan \theta$	M1 M1 B1 A1
5 [5]	$x = \frac{\sqrt{20} \pm \sqrt{20 - (4 \times 2)}}{2} = \sqrt{5} \pm \sqrt{3} \quad \text{or} \quad \frac{\sqrt{20} \pm \sqrt{12}}{2}$ $\frac{1}{\sqrt{5} + \sqrt{3}} + \frac{1}{\sqrt{5} - \sqrt{3}} \quad \left[\text{or} \quad \frac{2}{\sqrt{20} + \sqrt{12}} + \frac{2}{\sqrt{20} - \sqrt{12}} \right]$ rationalising each fraction or bringing to common denominator Denominator = 2 [or 8] $\Rightarrow \frac{1}{c} + \frac{1}{d} = \sqrt{5}$	M1 A1 M1 A1 A1
6 [6]	(a) $2x^2 - 3x - 14 = 0 \Rightarrow (2x - 7)(x + 2) = 0 \Rightarrow x = -2, 3.5$ $\{x : x < -2\} \cup \{x : x > 3.5\}$ (b) Eliminate $y \Rightarrow x^2 + 4(8 - kx) = 20$ [or $x \Rightarrow \left(\frac{8 - y}{k}\right)^2 + 4y = 20$] $x^2 - 4kx + 12 = 0$ [or $y^2 + (4k^2 - 16)y + (64 - 20k^2) = 0$] Apply “ $b^2 = 4ac$ ” $16k^2 = 48$ [or $16k^4 = 48k^2$] $\Rightarrow k = \pm\sqrt{3}$	M1 A1 A1 M1 M1 A1

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7 [6]	(i) $e^{2x-3} (= 7) \Rightarrow x = \frac{1}{2} (3 + \ln 7) \approx 2.47 \sim 2.48$ (not 2.5) (ii) $h = 2e^x - 3$ (x, y or) $h > -3$ accept $\geq$ (iii) h^{-1} (or y) = $\ln \{ \frac{1}{2} (x + 3) \}$ or $\ln(x + 3) - \ln 2$ or $\lg \{ \frac{1}{2}(x + 3) \} / \lg e$ but $\ln \{ \frac{1}{2}(y + 3) \}$ M1 A0 $\lg$ (or $\log$) $\{ \frac{1}{2}(x + 3) \}$ M1 A0	M1 A1 B1 B1 M1 A1 (M1 for logs taken in valid way)
8 [8]	(i) $\log_3 (2x + 1) - \log_3 (3x - 11) = \log_3 \frac{2x + 1}{3x - 11}$ [Or, later, give M1 for $\log + \log = \log(\text{product})$] $\log_3 () = 2 \Rightarrow () = 3^2$ $2x + 1 = 9(3x - 11) \Rightarrow x = 4$ (ii) $\log_4 y = \frac{\log_2 y}{\log_2 4} = \frac{1}{2} \log_2 y$ [or $\log_2 y = \frac{\log_4 y}{\log_4 2} = 2 \log_4 y$] $\frac{1}{2} \log_2 y + \log_2 y = 9$ [or $\log_4 y + 2 \log_4 y = 9$] $\Rightarrow y = 2^6$ or $4^3 = 64$	M1 B1 DM1 A1 M1 A1 DM1 A1
9 [8]	$6 + 4x - x^2 \equiv 10 - (x - 2)^2$ (i) $x = 2$ $y = 10$ Maximum (ii) $f(0) = 6, f(2) = 10, f(5) = 1 \Rightarrow 1 \leq f \leq 10$ [alternatively $1 \leq B1, \leq 10$ B1] (iii) f has no inverse; it is not 1:1	M1 A1 B1√B1√B1 M1 A1 B1
10 [10]	(i) $m_{BC} = 3/5$ Equation of AD is $y - 4 = 3/5(x + 2)$ $m_{AC} = -1/4$ Equation of CD is $y - 2 = 4(x - 6)$ (ii) Solve $x = 8, y = 10$ (iii) Length of AC = Length of CD = $\sqrt{68}$	B1 M1 A1 B1 M1 A1 M1 A1 M1 A1
11 [10]	(i) $d/dx (2x - 3)^{3/2} = (2x - 3)^{1/2} \times 3/2 \times 2$ $dy/dx = 1 \times (2x - 3)^{3/2} + (x + 1) \times \{ \text{candidate's } d/dx (2x - 3)^{3/2} \}$ $= \sqrt{2x - 3} \{ (2x - 3) + 3(x + 1) \} = 5x\sqrt{2x - 3} \Rightarrow k = 5$ (ii) $\delta y \approx dy/dx \times \delta x = (dy/dx)_{x=6} \times p = 90p$ $(y)_{x=6+p} = (y)_{x=6} + \delta y = 189 + 90p$ (iii) $\int x\sqrt{2x - 3} dx = 1/5 (x + 1)(2x - 3)^{3/2}$ $[]_2^6 = 1/5 (189 - 3) = 37.2$	M1 A1 M1 A1 M1 A1 A1√ M1 DM1 A1

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12 [11] EITHER	(i) $a = dv/dt = 5e^{-1/2 t}$ $v = 8 = 10(1 - e^{-1/2 t}) \Rightarrow e^{-1/2 t} = 0.2 \Rightarrow a = 1$ (ii) $s = \int v dt = \int (10 - 10e^{-t/2}) dt = 10t + 20e^{-t/2}$ $\left[\right]_0^6 = (60 + 20e^{-3}) - (20) \approx 41$ (iii) 10 (iv) 	M1 A1 M1 A1 M1 A1 DM1 A1 B1 B2,1,0
12 [11] OR	(i) $d/d\theta \{(\cos\theta)^{-1}\} = -(\cos\theta)^{-2}(-\sin\theta) = \sin\theta/\cos^2\theta$ (ii) $AX = 2\sec\theta \quad PX = 2\tan\theta$ $T = \frac{2\sec\theta}{3} + \frac{10 - 2\tan\theta}{5}$ (iii) $\frac{dT}{d\theta} = \frac{2}{3} \frac{\sin\theta}{\cos^2\theta} - \frac{2}{5} \sec^2\theta$ $= 0 \text{ when } 5\sin\theta = 3 \Rightarrow \sin\theta = 3/5$ $PX = 2\tan\theta = 2 \times \frac{3}{4} = 1.5$	M1 A1 B1 B1 M1 A1 B1 B1✓ M1 A1 A1