

CAMBRIDGE
INTERNATIONAL EXAMINATIONS

JUNE 2002

INTERNATIONAL GCSE

MARK SCHEME

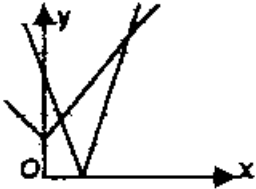
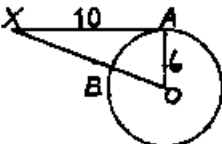
MAXIMUM MARK : 80

SYLLABUS/COMPONENT : 0606/2

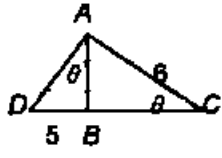
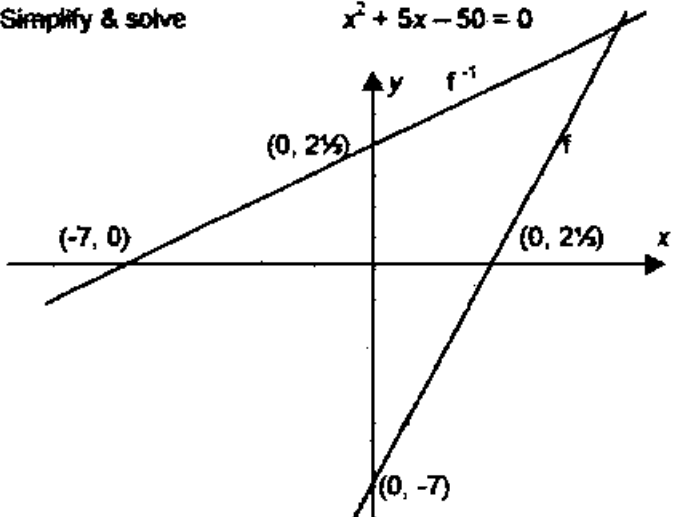
ADDITIONAL MATHEMATICS



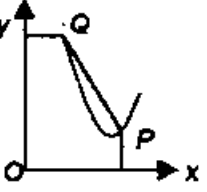
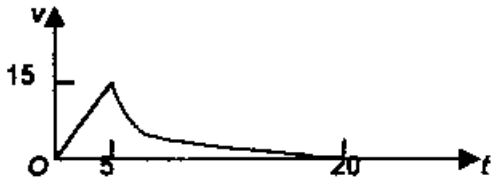
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1 [4]	$A^{-1} = \begin{pmatrix} 5 & -7 \\ -4 & 5 \end{pmatrix} \times \frac{1}{25 - 28}$ $A - 3A^{-1} = \begin{pmatrix} 5 & 7 \\ 4 & 5 \end{pmatrix} + \begin{pmatrix} 5 & -7 \\ -4 & 5 \end{pmatrix} = 10I \Rightarrow k = 10$	B1 B1 M1 A1
2 [4]	 <p>(i) Sketch $y = x + 1$ $y = 12x - 31$</p> <p>(ii) 2</p>	B1 B2,1,0 B1 c.a.o.
3 [5]	<p>(i) $H \cap P$</p> <p>(ii) $P \subseteq M$ or $P \cap M = P$ or $P \cup M = M$</p> <p>(iii) Students studying Mathematics only</p> <p>(iv) Students studying History or Mathematics or both but not Physics</p>	B1 B1 B1 B2,1,0
4 [6]	<p>Search $f(-2) = 0 \Rightarrow x = -2$</p> <p>Divide by $x + 2 \Rightarrow x^2 - 6x + 1$</p> <p>Solve $x = \frac{6 \pm \sqrt{36 - 4}}{2} = 3 \pm 2\sqrt{2}$</p>	M1 A1 M1 A1 DM1 A1
5 [6]	<p>Combine $(1200i + 240j) - 4(250i + 160j) = 200i - 400j$ or $\frac{1}{4}(200i + 240j) - (250i + 160j) = 50i - 100j$</p> <p>Square, add and square-root components Speed = 112</p> <p>Tan⁻¹(ratio of components) Bearing = 333(.4)°</p>	M1 A1 M1 A1 M1 A1
6 [7]	<p>(i) $\frac{d}{dx} \left(\frac{\cos x}{1 - \sin x} \right) = \frac{(1 - \sin x)(-\sin x) - \cos x(-\cos x)}{(1 - \sin x)^2}$</p> <p>Use Pythagoras on numerator $k = 1$</p> <p>(ii) $\int \frac{\sqrt{2}}{1 - \sin x} dx = \frac{\sqrt{2} \cos x}{1 - \sin x}$</p> <p>$\left[\right]_0^{\pi/4}$ with both limits used $\Rightarrow 2$</p>	B2,1,0 M1 A1 M1 DM1 A1
7 [7]	 <p>(i) $\angle AOB = \tan^{-1} 10/6 = 1.03$</p> <p>(ii) Arc AB = 6×1.03 $\overline{XB} = \sqrt{10^2 - 6^2} = 8$</p> <p>Perimeter = $6.18 + 5.66 + 10 = 21.8$</p> <p>(iii) Sector AOB = $1/2 \times 6^2 \times 1.03$ Area XAB = $1/2 \times 10 \times 6$ - Sector AOB = 11.5</p>	B1 M1 M1 A1 M1 M1A1

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8 [7]	 <p>(i) $AB = 6 \sin \theta$ $AB = 5 / \tan \theta$</p> <p>(ii) $6 \sin \theta = 5 / \tan \theta = 5 \cos \theta / \sin \theta$</p> <p>$5 \cos \theta = 6 \sin^2 \theta = 6(1 - \cos^2 \theta)$</p> <p>Solve or factorise $\cos \theta = \frac{5}{6}$ (or -1.5) $\theta = 48.2$</p>	B1 B1 B1 A1 M1 M1 A1 A1
9 [7]	<p>(a) Eliminate x or $y \Rightarrow y^2 = 4(y - k) + 8$ or $(x + k)^2 = 4x + 8$</p> <p>$\Rightarrow y^2 - 4y + (4k - 8) = 0$ or $x^2 + (2k - 4)x + (k^2 - 8) = 0$</p> <p>Use discriminant $\Rightarrow 16 = 4(4k - 8)$ or $(2k - 4)^2 = 4(k^2 - 8)$</p> <p>Solve for $k \Rightarrow k = 3$</p> <p>(b) $(x - 2)(x + 4)$</p> <p>$(x - 2)(x + 4) > 0 \Rightarrow x^2 + 2x > 8 \Rightarrow a = 2, b = 8$</p>	M1 M1 A1 A1 B1 M1A1
10 [7]	<p>(i) $\lg 2x - \lg (x - 3) = \lg \{2x/(x - 3)\}$ $1 = \lg 10$</p> <p>Solve $2x/(x - 3) = 10 \Rightarrow x = 3.75$</p> <p>(ii) $\log_3 y = 1/\log_3 3 (= u_1)$ or $\log_3 3 = 1/\log_3 y (= u_2)$</p> <p>Substitute</p> <p>$\Rightarrow u_1^2 - 4u_1 + 4 = 0$ or $4u_2^2 - 4u_2 + 1 = 0$</p> <p>Solve $u_1 = 2$ or $u_2 = \frac{1}{2} \Rightarrow y = 9$</p>	M1 B1 A1 M1 M1 DM1 A1
11 [9]	<p>(i) $f^{-1}: x \mapsto \frac{x+7}{3}$ $x = \frac{12}{y-2}$ & make y the subject</p> <p>$g^{-1}: x \mapsto \frac{12}{x} + 2$, not defined for $x = 0$</p> <p>(ii) $fg(x) = \frac{38}{x-2} - 7 = x$ or $fg(x) = x \Rightarrow g(x) = f^{-1}(x) \Rightarrow \frac{12}{x-2} = \frac{x+7}{3}$</p> <p>Simplify & solve $x^2 + 5x - 50 = 0 \Rightarrow x = -10$ or 5</p> <p>(iii)</p>  <p>Sketch of f B1</p> <p>Sketch of f^{-1} B1</p> <p>All intersections with axes shown DB1</p>	B1 M1 A1 M1 DM1 A1 B1 B1 DB1

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<p>12 [11] Either</p>	 <p> $\frac{d}{dx}(x^2 - 6x + 10) = 2x - 6 = 0 \Rightarrow x = 3 \Rightarrow P$ is (3,1) Equation of PQ is $y - 1 = -2(x - 3)$ Eliminate $y \Rightarrow x^2 - 4x + 3 = 0$ or $x \Rightarrow y^2 - 6y + 5 = 0$ Solve \Rightarrow Q is (1, 5) Area of rectangle with OQ as diagonal = 1×5 $\int (x^2 - 6x + 10) dx = \frac{1}{3}x^3 - 3x^2 + 10x$ Evaluating $[]_1^3$ Area required = rectangle + $[]_1^3 = 5 + \{(12) - (7\frac{1}{2})\} = 9\frac{1}{2}$ </p>	<p>M1 A1 M1 M1 M1 A1 M1 A1 D1 M1 A1</p>
<p>Or</p>	<p>(i) At B $t = 5$ $v = 15^3/225 = 15$ At C $v = 0$ $t = T = 20$</p> <p>(ii) $a = \frac{dv}{dt} = \frac{3}{225}(20 - t)^2 \times (-1)$ $[a]_{t=14} = \frac{-3 \times 36}{225} = -0.48$</p> <p>(iii)  <p style="margin-left: 400px;">Straight line Curve</p></p> <p>(iv) $AB = \frac{1}{2}(5 \times 15) = 37\frac{1}{2}$ $\int \frac{1}{225}(20 - t)^3 dt = \frac{1}{900}(20 - t)^4(-1)$ $AC = 37\frac{1}{2} + []_5^{20} = 37\frac{1}{2} + (0 - (-\frac{225}{4})) = 93\frac{1}{4}$</p>	<p>B1 B1 M1 A1 A1 B1✓ B1✓ for v, T B1✓ M1 A1 A1</p>