CAMBRIDGE
INTERNATIONAL EXAMINATIONS

JUNE 2002

INTERNATIONAL GCSE

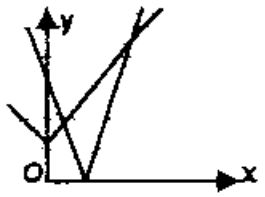
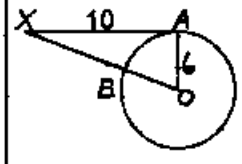
MARK SCHEME

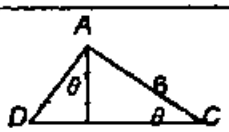
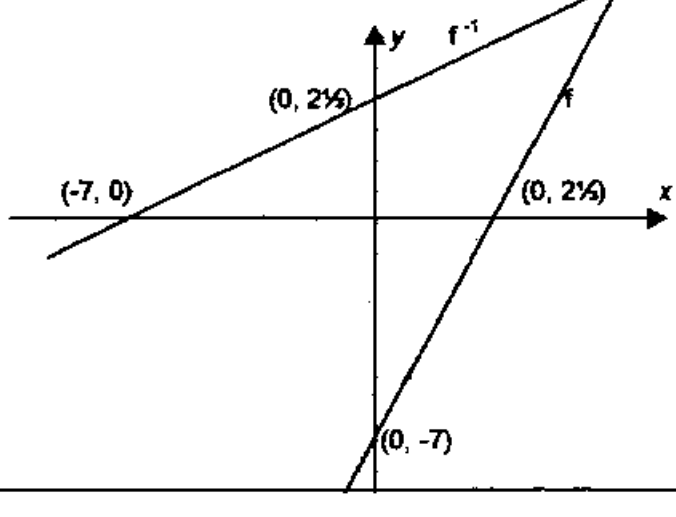
MAXIMUM MARK : 80

SYLLABUS/COMPONENT : 0606/2

ADDITIONAL MATHEMATICS

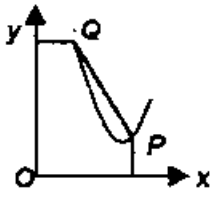
UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

1 [4]	$\mathbf{A}^{-1} = \begin{pmatrix} 5 & -7 \\ -4 & 5 \end{pmatrix} \times \frac{1}{25-28}$	B1 B1
	$\mathbf{A} - 3\mathbf{A}^{-1} = \begin{pmatrix} 5 & 7 \\ 4 & 5 \end{pmatrix} + \begin{pmatrix} 5 & -7 \\ -4 & 5 \end{pmatrix} = 10\mathbf{I} \Rightarrow k = 10$	M1 A1
2 [4]	 (i) Sketch $y = 1x1 + 1$	B1
	$y = 12x - 31$	B2,1,0
	(ii) 2	B1 c.a.o.
3 [5]	(i) $H \cap P$	B1
	(ii) $P \subseteq M$ or $P \cap M = P$ or $P \cup M = M$	B1
	(iii) Students studying Mathematics only	B1
	(iv) Students studying History or Mathematics or both but not Physics	B2,1,0
4 [6]	Search $f(-2) = 0 \Rightarrow x = -2$	M1 A1
	Divide by $x + 2 \Rightarrow x^2 - 6x + 1$	M1 A1
	Solve $x = \frac{6 \pm \sqrt{36-4}}{2} = 3 \pm 2\sqrt{2}$	DM1 A1
5 [6]	Combine $(1200\mathbf{i} + 240\mathbf{j}) - 4(250\mathbf{i} + 160\mathbf{j}) = 200\mathbf{i} - 400\mathbf{j}$	M1 A1
	or $\frac{1}{4}(1200\mathbf{i} + 240\mathbf{j}) - (250\mathbf{i} + 160\mathbf{j}) = 50\mathbf{i} - 100\mathbf{j}$	
	Square, add and square-root components Speed = 112	M1 A1
	Tan^{-1}(ratio of components) Bearing = 333(.4)°	M1 A1
6 [7]	(i) $\frac{d}{dx}\left(\frac{\cos x}{1-\sin x}\right) = \frac{(1-\sin x)(-\sin x) - \cos x(-\cos x)}{(1-\sin x)^2}$	B2,1,0
	Use Pythagoras on numerator $k = 1$	M1 A1
	(ii) $\int \frac{\sqrt{2}}{1-\sin x}\,dx = \frac{\sqrt{2}\cos x}{1-\sin x}$	M1
	$[\ ]_0^{\pi/4}$ with both limits used $\Rightarrow$ 2	DM1 A1
7 [7]	 (i) $\angle AOB = \tan^{-1} 10/6 = 1.03$	B1
	(ii) Arc $AB = 6 \times 1.03$ $XB = \sqrt{10^2 - 6^2} = 8$	M1
	Perimeter = 6.18 + 5.66 + 10 = 21.8	m1 A1
	(iii) Sector $AOB = 1/2 \times 6^2 \times 1.03$ Area $XAB = 1/2 \times 10 \times 6$ – Sector $AOB = 11.5$	M1 M1A1

8 [7]	 (i) $AB = 6\sin\theta$ $AB = 5/\tan\theta$ (ii) $6\sin\theta = 5/\tan\theta = 5\cos\theta/\sin\theta$ $5\cos\theta = 6\sin^2\theta = 6(1-\cos^2\theta)$ Solve or factorise $\cos\theta = \frac{3}{5}$ (or –1.5) $\theta = 48.2$	B1 B1 B1 √ M1 M1 A1 A1
9 [7]	(a) Eliminate x or y $\Rightarrow$ $y^2 = 4(y-k)+6$ or $(x+k)^2 = 4x+8$ $\Rightarrow$ $y^2 - 4y + (4k-8) = 0$ or $x^2 + (2k-4)x + (k^2-8) = 0$ Use discriminant $\Rightarrow$ $16 = 4(4k-8)$ or $(2k-4)^2 = 4(k^2-8)$ Solve for k $\Rightarrow$ $k = 3$ (b) $(x-2)(x+4)$ $(x-2)(x+4) > 0 \Rightarrow x^2 + 2x > 8$ $\Rightarrow$ $a = 2, b = 8$	M1 M1 A1 A1 B1 M1A1
10 [7]	(i) $\lg 2x - \lg(x-3) = \lg\{2x/(x-3)\}$ $1 = \lg 10$ Solve $2x/(x-3) = 10$ $\Rightarrow$ $x = 3.75$ (ii) $\log_3 y = 1/\log_y 3$ $(= u_1)$ or $\log_y 3 = 1/\log_3 y$ $(= u_2)$ Substitute $\Rightarrow$ $u_1^2 - 4u_1 + 4 = 0$ or $4u_2^2 - 4u_2 + 1 = 0$ Solve $u_1 = 2$ or $u_2 = \frac{1}{2}$ $\Rightarrow$ $y = 9$	M1 B1 A1 M1 M1 DM1 A1
11[9]	(i) $f^{-1} : x \mapsto \frac{x+7}{3}$ $x = \frac{12}{y-2}$ & make y the subject $g^{-1} : x \mapsto \frac{12}{x} + 2$, not defined for $x = 0$ (ii) $fg(x) = \frac{36}{x-2} - 7 = x$ or $fg(x) = x \Rightarrow g(x) = f^{-1}(x) \Rightarrow \frac{12}{x-2} = \frac{x+7}{3}$ Simplify & solve $x^2 + 5x - 50 = 0$ $\Rightarrow$ $x = -10$ or 5 (iii)  Sketch of f Sketch of f^{-1} All intersections with axes shown	B1 M1 A1 M1 DM1 A1 B1 B1 DB1

12 [11]

Either



$\frac{d}{dx}(x^2 - 6x + 10) = 2x - 6 = 0 \Rightarrow x = 3 \Rightarrow P$ is (3,1) — M1 A1

Equation of PQ is $y - 1 = -2(x - 3)$ — M1

Eliminate $y \Rightarrow x^2 - 4x + 3 = 0$ or $x \Rightarrow y^2 - 6y + 5 = 0$ — M1

Solve $\Rightarrow$ Q is (1, 5) — M1 A1

Area of rectangle with OQ as diagonal $= 1 \times 5$

$\int (x^2 - 6x + 10)\,dx = \frac{1}{3}x^3 - 3x^2 + 10x$ — M1 A1

Evaluating $[\ ]_1^3$ — Dm1

Area required = rectangle + $[\ ]_1^3 = 5 + \{(12) - (7\frac{1}{3})\} = 9\frac{2}{3}$ — M1 A1

Or

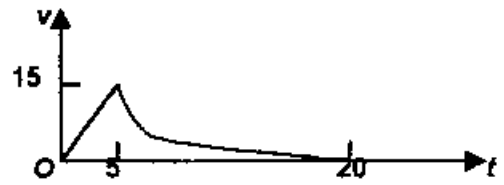
(i) At B $t = 5$ $v = 15^3/225 = 15$ — B1

At C $v = 0$ $t = T = 20$ — B1

(ii) $a = \frac{dv}{dt} = \frac{3}{225}(20 - t)^2 \times (-1)$ — M1 A1

$[a]_{t=14} = \frac{-3 \times 36}{225} = -0.48$ — A1

(iii)



Straight line — B1√

Curve — B1√ for v, T

(iv) $AB = \frac{1}{2}(5 \times 15) = 37\frac{1}{2}$ — B1√

$\int \frac{1}{225}(20 - t)^3\,dt = \frac{1}{900}(20 - t)^4(-1)$ — M1 A1

$AC = 37\frac{1}{2} + [\ ]_5^{20} = 37\frac{1}{2} + \{0 - (-\frac{225}{4})\} = 93\frac{3}{4}$ — A1