

NOVEMBER 2002

GCE Advanced Subsidiary Level

MARK SCHEME
MAXIMUM MARK : 50
SYLLABUS/COMPONENT : 9709 / 2 MATHEMATICS (Pure 2)



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1	<i>EITHER:</i> State or imply non-modular inequality $(2x - 1)^2 < (3x)^2$, or corresponding equation	B1	4	
	Expand and make reasonable solution attempt at 2/3 3-term quadratic, or equivalent	M1		
	Obtain critical values -1 and $\frac{1}{5}$	A1		
	State correct answer $x < -1, x > \frac{1}{5}$	A1		
	<i>OR:</i> State one correct equation for a critical value e.g. $2x - 1 = 3x$	M1		
	State two relevant equations separately e.g. $2x - 1 = 3x$ and $2x - 1 = -3x$	A1		
	Obtain critical values -1 and $\frac{1}{5}$	A1		
	State correct answer $x < -1, x > \frac{1}{5}$	A1		
	<i>OR:</i> State one critical value (probably $x = -1$), from a graphical method or by inspection or by solving a linear inequality	B1		
	State the other critical value correctly	B2		
State correct answer $x < -1, x > \frac{1}{5}$	B1			
[The answer $\frac{1}{5} < x < -1$ scores B0.]				
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2	State or obtain $-2 + a + b = 0$, or equivalent	B1	5	
	Substitute $x = -2$ and equate to -5	M1		
	Obtain 3-term equation, or equivalent	A1		
	Solve a relevant pair of equations, obtaining a or b	M1		
	Obtain both answers $a = 3$ and $b = -1$	A1		
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3	(i) State or imply that $9^x = y^2$	B1	5	
	(ii) Carry out recognisable solution method for quadratic in y	M1		
	Obtain $y = \frac{1}{2}$ and $y = 3$ from $2y^2 - 7y + 3 = 0$	A1		
	Use log method to solve an equation of the form $3^x = k$	M1		
	Obtain answer $x = -\frac{\ln 2}{\ln 3}$, or exact equivalent {To ANY base}	A1		
	State exact answer $x = 1$ (no penalty if logs used)	B1		
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4	(i) Make recognisable sketches over the given range of a suitable pair of graphs e.g. $y = \sin x$ and $y = \frac{1}{x^2}$	B1	3	
	State or imply connection between intersections and roots and justify given statement	B1		
	(ii) Calculate values (or signs) of $\sin x - \frac{1}{x^2}$ at $x = 1$ and $x = 1.5$	M1		
	Derive given result correctly	A1		
	(iii) Rearrange $\sin x = \frac{1}{x^2}$ and obtain given answer	B1		
	(iv) Use the iterative formula correctly with $1 \leq x_n \leq 1.5$	M1		
	Obtain final answer 1.07	A1		
	Show sufficient iterations to justify its accuracy to 3d.p., or show there is a sign change in the interval (1.065, 1.075)	A1		

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- 5 (i) Use relevant formulae for $\cos(x - 30^\circ)$ and $\sin(x - 60^\circ)$ { allow ONE sign error } M1* ①
 Use $\sin 30^\circ = \cos 60^\circ = \frac{1}{2}$ and $\sin 60^\circ = \cos 30^\circ = \frac{\sqrt{3}}{2}$ M1(dep*)
 Collect terms and obtain given answer correctly A1 3
 (ii) Carry out correct processes to evaluate a single trig ratio M1
 Obtain answer 73.9° A1
 Obtain second answer 253.9° and no others A1✓ 3
 (iii) State or imply that $\cos^2 x = \frac{1}{13}$ or $\sin^2 x = \frac{12}{13}$ B1
 Use a relevant trig formula to evaluate $\cos 2x$ M1
 Obtain exact answer $-\frac{11}{13}$ correctly A1 3
 [Use of only say $\cos x = +\frac{1}{\sqrt{13}}$, probably from a right triangle, can earn B1M1A0.]

- 6 (a) Obtain indefinite integral $-\frac{1}{2} \cos 2x + \sin x$ B1 + B1
 Use limits with attempted integral M1
 Obtain answer 2 correctly with no errors A1 4
 (b) (i) Identify R with correct definite integral and attempt to integrate M1
 Obtain indefinite integral $\ln(x+1)$ B1
 Obtain answer $R = \ln(p+1) - \ln 2$ A1 3
 (ii) Use exponential method to solve an equation of the form $\ln x = k$ M1
 Obtain answer $p = 13.8$ A1 2

- 7 (i) State $6y \frac{dy}{dx}$ as the derivative of $3y^2$ B1
 State $\pm 2x \frac{dy}{dx} \pm 2y$ as the derivative of $-2xy$ (allow any combination of signs here) B1
 Equate attempted derivative of LHS to 0 (or 10) and solve for $\frac{dy}{dx}$ M1
 Obtain the given answer correctly A1 4
 [The M1 is dependent on at least one of the B marks being earned.]
 (ii) State or imply the points lie on $y - 2x = 0$ or $(y - 2x) / (3y - 2x) = 0$ B1 ①
 Carry out complete method for finding one coordinate of a point of intersection of $y = kx$ with the given curve M1
 Obtain $10x^2 = 10$ or $2\frac{1}{2}y^2 = 10$ or 2-term equivalent A1
 Obtain one correct point e.g. (1, 2) or 2 values of x (or y) A1
 Obtain a second correct point e.g. (-1, -2) A1 5 ①