

NOVEMBER 2002

GCE Advanced Subsidiary Level

MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT :9709 /2

MATHEMATICS
(Pure 2)



UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

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

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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