CAMBRIDGE
INTERNATIONAL EXAMINATIONS

NOVEMBER 2002

GCE Advanced Subsidiary Level

MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT :9709 /2

MATHEMATICS
(Pure 2)

1   *EITHER:* State or imply non-modular inequality $(2x-1)^2 < (3x)^2$, or corresponding equation   B1

         Expand and make reasonable solution attempt at 2/or 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

   OR: 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

   OR: 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   **4**

         [The answer $\frac{1}{5} < x < -1$ scores B0.]

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2   State or obtain $-2 + a + b = 0$, or equivalent   B1

   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   **5**

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3   (i) State or imply that $9^x = y^2$ B1   **1**

   (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 $x = -\dfrac{\ln 2}{\ln 3}$, or exact equivalent { to any base }   A1'   ⊙

       State exact answer $x = 1$ (no penalty if logs used)   B1   **5**

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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 $y = \dfrac{1}{x^2}$ B1

       State or imply connection between intersections and roots and justify given statement   B1   **2**

   (ii) Calculate values (or signs) of $\sin x - \dfrac{1}{x^2}$ at $x = 1$ and $x = 1.5$ M1

       Derive given result correctly   A1   **2**

   (iii) Rearrange $\sin x = \dfrac{1}{x^2}$ and obtain given answer   B1   **1**

   (iv) Use the iterative formula correctly with $1 \le x_n \le 1.5$ 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   **3**

5 (i) Use relevant formulae for cos $(x - 30°)$ and sin $(x - 60°)$ { allow one sign error] M1* ☉

Use sin 30° = cos 60° = $\frac{1}{2}$ and sin 60° = cos 30° = $\frac{\sqrt{3}}{2}$ 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 cos² $x = \frac{1}{13}$ or sin² $x = \frac{12}{13}$ 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.]

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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

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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/ $(y - 2x)/(3y - x) = 0$ B1 ☉

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☉