CAMBRIDGE
INTERNATIONAL EXAMINATIONS

JUNE 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 $(x + 2)^2 < (5 - 2x)^2$, or corresponding equation   **B1**

                Expand and make reasonable solution attempt at 2- or 3-term quadratic, or equivalent   **M1**

                Obtain critical values 1 and 7   **A1**

                State correct answer $x < 1$, $x > 7$ **A1**

    OR: State one correct equation for a critical value e.g. $x + 2 = 5 - 2x$ **M1**

                State two relevant equations separately e.g. $x + 2 = 5 - 2x$ and $x + 2 = -(5 - 2x)$ **A1**

                Obtain critical values 1 and 7   **A1**

                State correct answer $x < 1$, $x > 7$ **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 $x < 1$, $x > 7$ **B1**   **4**

                [The answer $7 < x < 1$ scores B0.]

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2   (i) *EITHER*: Substitute -2 for x and equate to zero   **M1**

                Obtain answer $a = 7$ **A1**

      OR: Carry out complete division and equate remainder to zero   **M1**

                Obtain answer $a = 7$ **A1**   **2**

    (ii) *EITHER*: Find quadratic factor by division or inspection   **M1**

                Obtain answer $3x^2 + x - 4$ **A1**

                Factorise completely to $(x + 2)(x - 1)(3x + 4)$ **A1**

                [To earn the M1 the quotient (or factor) must contain $3x^2$ and another term, at least.]

      OR: State $(x - 1)$ is a factor   **B1**

                Find remaining linear factor by division or by inspection   **M1**

                Factorise completely to $(x + 2)(x - 1)(3x + 4)$ **A1**   **3**

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3   State or imply the relation $\ln y = \ln A + n \ln x$ **B1**

    State or imply $\ln A = 2.3$ **B1✓**

    Obtain answer $A = 9.97$ **B1**

    Calculate gradient of the given line   **M1**

    Obtain answer $n = -0.15$ **A1**   **5**

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4   (i) State answer $R = \sqrt{13}$ **B1**

        Use trig formula to find α **M1**

        Obtain answer $\alpha = 33.7°$ **A1**   **3**

    (ii) Carry out, or indicate need for, evaluation of $\cos^{-1}(3.5/\sqrt{13})$ $(\approx 13.9°)$ **M1**

        Obtain answer $47.6°$ **A1**

        Carry out correct method for second answer   **M1**

        Obtain second answer $19.8°$ **A1✓**   **4**

    (iii) State coordinates $(33.7, \sqrt{13})$, or equivalent   **B1✓**   **1**

5 (i) Obtain a derivative of the form $k\,e^{-x} + lx\,e^{-x}$ where $kl \neq 0$ B1
    Obtain correct derivative $2\,e^{-x} - 2x\,e^{-x}$, or equivalent   B1

    Equate $\dfrac{dy}{dx}$ to zero and solve for x M1

    Obtain coordinates $(1, 2e^{-1})$ for P A1   **4**

  (ii) State that $\frac{1}{2} = 2x\,e^{-x}$ and deduce the given answer correctly   B1   **1**

 (iii) State or imply that $x_2 = 0.25$ B1
    Continue the iteration correctly   M1
    Obtain final answer 0.36 after sufficient iterations to justify its accuracy to 2d.p., or after showing there is a sign change in $(0.355, 0.365)$ A1   **3**

6 (a) (i) State indefinite integral $k \sin 2x$ and use limits   M1
    Obtain given answer correctly   A1   **2**
   (ii) Use double-angle formula to convert integrand to the form $a + b \cos 2x$, where $ab \neq 0$ M1*
    Integrate and use limits (both terms)   M1(dep*)
    Obtain answer $\frac{1}{8}(\pi - 2)$, or equivalent   A1   **3**

  (b) (i) Show or imply correct ordinates $1, 1.08239..., \sqrt{2}\ (1.41421...)$ B1
    Use correct formula, or equivalent, with $h = \pi/8$ and three ordinates   M1
    Obtain correct answer 0.90 with no errors seen   A1   **3**
   (ii) Make a correct relevant sketch of $y = \sec x$ B1*
    State that the rule gives an over-estimate   B1(dep*) **2**

7 (i) State $\dfrac{dx}{dt} = 1 + \dfrac{2}{t}$, $\dfrac{dy}{dt} = 2 - \dfrac{1}{t}$ B1

    Use $\dfrac{dy}{dx} = \dfrac{dy}{dt} \div \dfrac{dx}{dt}$ M1

    Obtain $\dfrac{dy}{dx}$ in any correct form e.g. $\dfrac{2t-1}{t+2}$ A1   **3**

  (ii) Substitute $t = 1$ in $\dfrac{dy}{dx}$ and both parametric equations   M1

    Obtain $\dfrac{dy}{dx} = \dfrac{1}{3}$ and coordinates $(1, 2)$ A1✓

    Obtain equation $3y = x + 5$, or any 3-term equivalent   A1✓   **3**

 (iii) Equate $\dfrac{dy}{dx}$ to zero and solve for t M1

    Obtain answer $t = \frac{1}{2}$ A1

    Obtain the given value of y correctly   A1
    Show by any method that this is a minimum   A1   **4**