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	GCE AS/A LEVEL – May/June 2011	9709	23

1 Attempt use of power law for logarithms M1*
Obtain $x\log 3 = x\log 2 + 2\log 2$ or equivalent A1
Attempt solution for x of linear equation M1 dep*
Obtain 3.42 A1 [4]

2 **(i)** Show or imply correct ordinates 1, $\sqrt{2}$ or 1.414, 3 B1
Use correct formula, or equivalent, with $h = 1$ M1
Obtain 3.41 A1 [3]

(ii) Obtain 6 – 3.41 and hence 2.59, following their answer to **(i)** provided less than 6 B1√
Refer, in some form, to two line segments replacing curve and conclude with clear justification of given result that answer is an under-estimate. B1 [2]

3 **(i)** Use the iteration process correctly at least once M1
Obtain at least two correct iterates to 5 decimal places A1
Conclude $\alpha = 0.952$ A1 [3]
[1 → 0.95647 → 0.95257 → 0.95223 → 0.95220]

(ii) State or imply equation is $x = \frac{1}{2}\sqrt[3]{x^2 + 6}$ B1
Obtain $8x^3 - x^2 - 6 = 0$ B1 [2]

4 **(a)** Obtain integral form of $k\cos\frac{1}{2}x$ M1
Obtain correct $-2\cos\frac{1}{2}x$ A1
Use limits correctly to obtain 1 A1 [3]

(b) Rewrite integrand as $e^{-x} + 1$ B1
Integrate to obtain $-e^{-x}$ … B1
Integrate to obtain … $+ x + c$ B1 [3]

5 Obtain $4y\frac{dy}{dx}$ as derivative of $2y^2$ B1
Differentiate LHS term by term to obtain expression including at least one $\frac{dy}{dx}$ M1
Obtain $2x + 4y\frac{dy}{dx} + 5 + 6\frac{dy}{dx}$ A1
Substitute 2 and –1 to attempt value of $\frac{dy}{dx}$ M1
Obtain $-\frac{9}{2}$ A1
Obtain equation $9x + 2y - 16 = 0$ or equivalent of required form A1 [6]

6 **(i)** Attempt differentiation using product rule — M1
Obtain $8x\ln x + 4x$ (a.c.f.) — A1
Equate first derivative to zero and attempt solution — M1
Obtain 0.607 — A1
Obtain –0.736 following their x-coordinate — A1√ [5]

(ii) Use an appropriate method for determining nature of stationary point — M1
Conclude point is a minimum (with no errors seen, second derivative = 8) — A1 [2]

7 **(i)** Substitute $x = -2$ and equate to zero — M1
Substitute $x = -1$ and equate to 24 — M1
Obtain $4a - 2b = 38$ and $a - b = 20$ or equivalents — A1
Attempt solution of two linear simultaneous equations (dependent on M1 M1) — M1
Obtain $a = -1$ and $b = -21$ — A1 [5]

(ii) Attempt to find quadratic factor by division, inspection or use of identity — M1
Obtain $6x^2 - 13x + 5$ — A1√
Conclude $(x+2)(2x-1)(3x-5)$ — A1 [3]

8 **(i)** Use $\text{cosec}\theta = \dfrac{1}{\sin\theta}$ and $\sec\theta = \dfrac{1}{\cos\theta}$ — B1
Attempt to simplify left-hand side — M1
Confirm given right-hand side $4\cos 2\theta$ with no errors seen — A1 [3]

(ii) **(a)** State or imply $\cos 2\theta = \dfrac{3}{4}$ — B1
Attempt correct process to find at least one angle — M1
Obtain 20.7° — A1
Obtain 159.3° and no others in range — A1 [4]

(b) Recognise as $\dfrac{4\cos 30^\circ}{\sin^2 30^\circ}$ — B1
Obtain $8\sqrt{3}$ — B1 [2]