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	GCE AS LEVEL – May/June 2014	9709	23

1 **(i)** Either: Square both sides to obtain linear equation — M1
Obtain $x = \frac{165}{30}$ or $\frac{33}{6}$ or $\frac{11}{2}$ — A1 [2]

Or: Solve linear equation in which, initially, signs of x are different — M1
Obtain $x + 2 = -x + 13$ or equivalent and hence $\frac{11}{2}$ or equivalent — A1 [2]

(ii) Apply logarithms and use power law — M1
Obtain $y \log 3 = \log \frac{11}{2}$ and hence $y = 1.55$ — A1 [2]

2 Use $\sin 2\theta = 2 \sin\theta \cos\theta$ — B1
Simplify to obtain form $c_1 \sin^2\theta = c_2$ or equivalent — M1
Find at least one value of θ from equation of form $\sin\theta = k$ — M1
Obtain 35.3° and 144.7° — A1 [4]

3 **(a)** Integrate to obtain form $k \sin(\frac{1}{3}x + 2)$ where $k \neq 4$ — M1
Obtain $12 \sin(\frac{1}{3}x + 2)$ $(+c)$ — A1 [2]

(b) State or imply correct y-values 2, $\sqrt{20}$, $\sqrt{68}$, $\sqrt{148}$ — B1
Use correct formula, or equivalent, with $h = 4$ and four y-values — M1
Obtain 79.2 — A1 [3]

4 Obtain $\frac{dx}{dt} = \frac{2}{t+1}$ — B1
Obtain $\frac{dy}{dt} = 4e^t$ — B1
Use $\frac{dy}{dx} = \frac{dy}{dt} / \frac{dx}{dt}$ with $t = 0$ to find gradient — M1
Obtain 2 — A1
Form equation of tangent through $(0, 4)$ with numerical gradient obtained from attempt to differentiate — M1
Obtain $2x - y + 4 = 0$ or equivalent of required form — A1 [6]

5 State or imply $\ln y = \ln K + px \ln 2$ — B1
Obtain at least one of
$1.87 = \ln K + 1.35p \ln 2$, $3.81 = \ln K + 3.35p \ln 2$, $p \ln 2 = \frac{3.81 - 1.87}{3.35 - 1.35}$
or equivalents — B1
Solve equation(s) to find one constant, dependent on previous B1 — M1
Obtain $p = 1.40$ — A1
Substitute to attempt value of K — DM1
Obtain $\ln K = 0.5605$ and hence $K = 1.75$ — A1 [6]

6 **(i)** Substitute -2 and equate to zero, or divide and equate remainder to zero — M1
Obtain $a = 12$ — A1 [2]

(ii) Carry out division, or equivalent, at least as far as x^2 and x terms in quotient — M1
Obtain $x^2 - 2x + 6$ — A1
Calculate discriminant of a 3 term quadratic quotient (or equivalent) — DM1
Obtain -20 (or equivalent) — A1
Conclude by referring to, or implying, root -2 and no root from quadratic factor — A1 [5]

7 **(i)** Integrate to obtain $ke^{3x} + mx^3$ — M1
Apply both limits to obtain $\frac{1}{6}e^{3a} + \frac{1}{3}a^3 - \frac{1}{6} = 10$ or equivalent — A1
Rearrange to form involving natural logarithm — DM1
Obtain $a = \frac{1}{3}\ln(61 - 2a^3)$ with no errors seen (AG) — A1 [4]

(ii) Consider sign of $a - \frac{1}{3}\ln(61 - 2a^3)$ for 1.0 and 1.5 or equivalent — M1
Obtain –0.36 and 0.17 or equivalent and justify conclusion — A1 [2]

(iii) Use iteration process correctly at least once — M1
Obtain final answer 1.343 — A1
Show sufficient iterations to 5 decimal places to justify answer or show a sign change in the interval (1.3425, 1.3435) — A1 [3]

8 **(i)** Differentiate using product rule — M1
Obtain $\sec^2 x \cos 2x - 2\tan x \sin 2x$ — A1
Use $\cos 2x = 2\cos^2 x - 1$ or $\sin 2x = 2\sin x \cos x$ or both — B1
Express derivative in terms of $\sec x$ and $\cos x$ only — M1
Obtain $4\cos^2 x - \sec^2 x - 2$ with no errors seen (AG) — A1 [5]

(ii) State $4\cos^4 x - 2\cos^2 x - 1 = 0$ — B1
Apply quadratic formula to a 3 term quadratic equation in terms of $\cos^2 x$ to find the least positive value of $\cos^2 x$ — M1
Obtain or imply $\cos^2 x = \dfrac{1+\sqrt{5}}{4}$ or $0.809\ldots$ — A1
Obtain 0.45 — A1 [4]