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	GCE AS LEVEL – May/June 2013	9709	21

1 Either State or imply non-modular equation $(2^x - 7)^2 = 1^2$, or corresponding pair of equations M1
Obtain $2^x = 8$ and $2^x = 6$ A1
State answer 3 B1
Use logarithmic method to solve an equation of the form $2^x = k$, where $k > 0$ M1
State answer 2.58 A1

Or State or imply one value for 2^x, e.g. 8, by solving an equation or by inspection B1
State answer 3 B1
State second value for 2^x B1
Use logarithmic method to solve an equation of the form $2^x = k$, where $k > 0$ M1
State answer 2.58 A1 [5]

2 Use $2 \ln x = \ln(x^2)$ M1
Use law for addition or subtraction of logarithms M1
Obtain correct quadratic equation in x A1
Make reasonable solution attempt at a 3-term quadratic DM1
(dependent on previous M marks)
State $x = \frac{3}{5}$ and no other solutions A1 [5]

3 **(i)** Either
Use $\sin 2x = 2\sin x \cos x$ to convert integrand to $k \sin^2 2x$ M1
Use $\cos 4x = 1 - 2\sin^2 2x$ M1
State correct expression $\frac{1}{2} - \frac{1}{2}\cos 4x$ or equivalent A1

Or
Use $\cos^2 x = \frac{1 - \cos 2x}{2}$ and/or $x = \frac{1 - \cos 2x}{2}$ to obtain an equation in $\cos 2x$ only M1
Use $\cos^2 2x = \frac{1 + \cos 4x}{2}$ M1
State correct expression $\frac{1}{2} - \frac{1}{2}\cos 4x$ or equivalent A1 [3]

(ii) State correct integral $\frac{3}{2}x - \frac{3}{8}\sin 4x$, or equivalent B1
Attempt to substitute limits, using exact values M1
Obtain given answer correctly A1 [3]

4 **(i)** Substitute $x = -\frac{3}{2}$, equate to zero M1
Substitute $x = -1$ and equate to 8 M1
Obtain a correct equation in any form A1
Solve a relevant pair of equations for a or for b M1
Obtain $a = 2$ and $b = -6$ A1 [5]

(ii) Attempt either division by $2x + 3$ and reach a partial quotient of $x^2 + kx$, use of an identity or observation M1

Obtain quotient $x^2 - 4x + 3$

Obtain linear factors $x - 1$ and $x - 3$ A1

[Condone omission of repetition that $2x + 3$ is a factor.] A1

[If linear factors $x - 1$, $x - 3$ obtained by remainder theorem or inspection, award B2 + B1.] [3]

5 **(i)** Use product rule to differentiate y M1

Obtain correct derivative in any form A1

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

Obtain given answer correctly A1 [4]

(ii) Substitute $t = 0$ in $\frac{dy}{dx}$ and both parametric equations B1

Obtain $\frac{dy}{dx} = 2$ and coordinates (1, 0) B1

Form equation of the normal at their point, using negative reciprocal of their $\frac{dy}{dx}$ M1

State correct equation of normal $y = -\frac{1}{2}x + \frac{1}{2}$ or equivalent A1 [4]

6 **(i)** Make a recognisable sketch of a relevant graph, e.g. $y = \cot x$ or $y = 4x - 2$ B1

Sketch a second relevant graph and justify the given statement B1 [2]

(ii) Consider sign of $4x - 2 - \cot x$ at $x = 0.7$ and $x = 0.9$, or equivalent M1

Complete the argument correctly with appropriate calculations A1 [2]

(iii) Show that given equation is equivalent to $x = \frac{1 + 2\tan x}{4\tan x}$, or vice versa B1 [1]

(iv) Use the iterative formula correctly at least once M1

Obtain final answer 0.76 A1

Show sufficient iterations to justify its accuracy to 2 d.p. or show there is a sign change in the interval (0.755, 0.765) B1 [3]

7 **(i)** State $R = \sqrt{29}$ B1

Use trig formula to find α M1

Obtain $\alpha = 21.80^0$ with no errors seen A1 [3]

(ii) Carry out evaluation of $\sin^{-1}\left(\frac{4}{R}\right)\left(\approx 47.97^0\right)$ M1

Carry out correct method for one correct answer M1

Obtain one correct answer e.g. 13.1^o A1

Carry out correct method for a further answer M1

Obtain remaining 3 answers 55.1^0, 193.1^0, 235.1^0 and no others in the range A1 [5]

(iii) Greatest value of $10 \sin 2\theta + 4 \cos 2\theta = 2\sqrt{29}$ M1

$\frac{1}{116}$ A1 [2]