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	GCE AS/A LEVEL – May/June 2011	9709	21

- 1 *EITHER* Attempt to square both sides obtaining three terms on each side M1  
 Attempt solution of three-term quadratic equation M1  
 Obtain  $5x + 4x - 9 = 0$  and hence  $-\frac{9}{5}$  and 1 A1
- OR* Obtain value 1 from graphical method, inspection or linear equation B1  
 Obtain value  $-\frac{9}{5}$  similarly B2 [3]
- 2 State  $\frac{dx}{dt} = 3 + 2 \cos 2t$  or  $\frac{dy}{dt} = -4 \sin 2t$  (or both) B1  
 Use  $\frac{dy}{dx} = \frac{dy}{dt} \div \frac{dx}{dt}$  M1  
 Obtain or imply  $\frac{-4 \sin 2t}{3 + 2 \cos 2t}$  A1  
 Substitute  $\frac{1}{6}\pi$  to obtain  $-\frac{1}{2}\sqrt{3}$  or exact equivalent A1 [4]
- 3 State or imply that  $\ln y = \ln K + m \ln x$  B1  
 Equate intercept on axis for  $\ln y$  to  $\ln K$  M1  
 Obtain 7.39 for  $K$  A1  
 Attempt calculation of gradient of line M1  
 Obtain 1.37 for  $m$  A1 [5]
- 4 (i) Substitute  $-2$  and equate to zero or divide by  $x + 2$  and equate remainder to zero M1  
 Obtain  $a = 8$  A1 [2]
- (ii) Attempt to find quotient by division or inspection or use of identity M1  
 Obtain at least  $3x^2 + 2x$  A1  
 Obtain  $3x^2 + 2x + 4$  with no errors seen A1 [3]
- 5 (i) Differentiate  $\ln(x - 3)$  to obtain  $\frac{1}{x - 3}$  B1  
 Attempt to use product rule M1  
 Obtain  $\ln(x - 3) + \frac{x}{x - 3}$  or equivalent A1  
 Substitute 4 to obtain 4 A1 [4]
- (ii) Use correct quotient or product rule M1  
 Obtain correct derivative in any form, e.g.  $\frac{(x + 1) - (x - 1)}{(x + 1)^2}$  A1  
 Substitute 4 to obtain  $\frac{2}{25}$  A1 [3]

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6	(a) Rewrite integrand as $12e^x + 4e^{3x}$		B1
	Integrate to obtain $12e^x \dots$		B1
	Integrate to obtain $\dots + \frac{4}{3}e^{3x}$		B1
	Include $\dots + c$		B1 [4]
	(b) Use identity $\tan^2\theta = \sec^2\theta - 1$		B1
	Integrate to obtain $2\tan\theta + \theta$ or equivalent		B1
	Use limits correctly for integral of form $a\tan\theta + b\theta$		M1
	Confirm given answer $\frac{1}{2}(8 + \pi)$		A1 [4]
7	(i) Draw correct sketch of $y = e^{2x}$		B1
	Draw correct sketch of $y = 14 - x^2$		B1
	Indicate two real roots only from correct sketches		B1 [3]
	(ii) Consider sign of $e^{2x} + x^2 - 14$ for 1.2 and 1.3 or equivalent		M1
	Justify conclusion with correct calculations ( $f(1.2) = -1.54, f(1.3) = 1.15$ )		A1 [2]
	(iii) Confirm given answer $x = \frac{1}{2}\ln(14 - x^2)$		B1 [1]
	(iv) Use the iteration process correctly at least once		M1
	Obtain final answer 1.26		A1
	Show sufficient iterations to 4 decimal places to justify answer or show a sign change in the interval (1.255, 1.256)		A1 [3]
	[1.2 $\rightarrow$ 1.2653 $\rightarrow$ 1.2588 $\rightarrow$ 1.2595 ;		
	1.25 $\rightarrow$ 1.2604 $\rightarrow$ 1.2593 $\rightarrow$ 1.2594 ;		
	1.3 $\rightarrow$ 1.2522 $\rightarrow$ 1.2598 $\rightarrow$ 1.2594 ]		
8	(i) State or imply $R = \sqrt{52}$ or $2\sqrt{13}$		B1
	Use appropriate formula to find $\alpha$		M1
	Obtain $56.31^\circ$		A1 [3]
	(ii) Attempt to find at least one value of $\theta - \alpha$		M1
	Obtain one correct value $80.9^\circ$ of $\theta$		A1
	Carry out correct method to find second answer		M1
	Obtain $211.7^\circ$ and no others in range		A1 [4]
	(iii) Obtain 60, following their value of $R$		B1 $\checkmark$
	Obtain 8. Allow quoted solution		B1 [2]