

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge International AS Level – October/November 2016	9709	21

1	(i)	Carry out method for solving quadratic equation in $3^x$ Obtain at least $3^x = 7$ Use logarithms to solve an equation of the form $3^x = k$ where $k > 0$ Obtain 1.77	M1 A1 M1 A1	[4]
	(ii)	State $\pm 1.77$ , following positive answer from part (i)	B1 <sup>ft</sup>	[1]
2		State or imply $\ln y = \ln A + px$ Equate gradient of line to $p$ Obtain $p = 0.32$ Substitute to find $A$ Obtain $A = 4.81$  OR 1: $3.17 = \ln A + 5p$ or $4.77 = \ln A + 10p$ Correct attempt to obtain $\ln A$ or $p$ Correct attempt to obtain the other unknown Obtain $A = 4.81$ Obtain $p = 0.32$  OR 2: $e^{3.17} = Ae^{5p}$ or $e^{4.77} = Ae^{10p}$ Correct attempt to obtain $p$ Correct attempt to get $A$ Obtain $A = 4.81$ Obtain $p = 0.32$	B1 M1 A1 M1 A1  B1 M1 M1 A1 A1  B1 M1 M1 A1 A1	[5]
	3	Differentiate to obtain $4 \cos 2x + 10 \sin 2x$ Equate first derivative to zero and arrange to $\tan 2x = \dots$ Obtain $\tan 2x = -0.4$ Carry out correct method for finding at least one value of $x$ , dependent *M Obtain $x = 1.38$ Obtain $x = 2.95$ and no others between 0 and $\pi$	B1 *M1 A1 DM1 A1 A1	[6]
4	(i)	Integrate to obtain $2e^{2x} + 5x$ Apply limits correctly and equate to 100 Rearrange and apply logarithms correctly to reach $a = \dots$ Confirm given result $a = \frac{1}{2} \ln(50 + e^{-2a} - 5a)$	B1 M1 M1 A1	[4]
	(ii)	Use the iterative formula correctly at least once Obtain final answer 1.854 Show sufficient iterations to justify accuracy to 3 dp or show sign change in interval (1.8535, 1.8545)	M1 A1  B1	[3]

Page 5	Mark Scheme	Syllabus	Paper
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5	(i)	Use $\cos 2x = 2\cos^2 x - 1$ and attempt factorisation of numerator Obtain $(2\cos x + 1)(\cos x + 4)$ Confirm given result $2\cos x + 1$	M1 A1 A1	[3]
	(ii)	Express integrand as $2\cos 2x + 1$ Integrate to obtain $\sin 2x + x$ Apply limits correctly to integral of form $k_1 \sin 2x + k_2 x$ Obtain $2\pi$	B1 B1 M1 A1	[4]
6		Differentiate $4xy$ to obtain $4y + 4x \frac{dy}{dx}$  Differentiate $y^2$ to obtain $2y \frac{dy}{dx}$  Equate attempt of derivative of left-hand side to zero Substitute $(1, 3)$ to find numerical value of derivative Obtain $-\frac{18}{10}$ or $-\frac{9}{5}$ Obtain $\frac{10}{18}$ or $\frac{5}{9}$ as gradient of normal, following their numerical value of derivative Form equation of normal at $(1, 3)$ Obtain $5x - 9y + 22 = 0$ or equivalent of requested form	B1  B1 M1 M1 A1 A1 <sup>1/2</sup> M1 A1	[8]
7	(i)	Substitute $x = -3$ , equate to zero and obtain $27a + 3b = 39$ or equivalent Substitute $x = -2$ and equate to 18 Obtain $8a + 2b = 6$ or equivalent Solve a relevant pair of linear equations for $a$ and $b$ Obtain $a = 2$ and $b = -5$	B1 M1 A1 M1 A1	[5]
	(ii) (a)	Attempt division by $x + 3$ at least as far as $2x^2 + kx$ Obtain quotient $2x^2 - 3x + 4$ Calculate discriminant of 3-term quadratic expression, or equivalent Obtain $-23$ and conclude appropriately	M1 A1 M1 A1	[4]
	(b)	State $\cos y = -\frac{1}{3}$ Obtain 109.5, dependent *B Obtain $-109.5$ and no others between $-180$ and $180$ , dependent *B	*B1 B1 DB1	[3]