Q1.

EITHER:	Use law of the logarithm of a power or quotient and remove logarithms	M1	
	Obtain a 3-term quadratic equation $x^2 - x - 3 = 0$, or equivalent	A1	
	Solve 3-term quadratic obtaining 1 or 2 roots	M1	
	Obtain answer 2.30 only	A1	
*OR*1:	Use an appropriate iterative formula, e.g. $x_{n+1} = \exp\left(\frac{1}{2}\ln(3x_n + 4)\right) - 1$ correctly at least once	M1	
	Obtain answer 2.30	A1	
	Show sufficient iterations to at least 3 d.p. to justify 2.30 to 2 d.p., or show there is a sign change in the interval (2.295, 2.305)	A1	
	Show there is no other root	A1	
*OR*2:	Use calculated values to obtain at least one interval containing the root	M1	
	Obtain answer 2.30	A1	
	Show sufficient calculations to justify 2.30 to 3 s.f., e.g. show it lies in (2.295, 2.305)	A1	
	Show there is no other root	A1	[4]

Q2.

Use law of the logarithm of a power and a product or quotient and remove logarithms	M1	
Obtain a correct equation in any form, e.g. $\frac{2x+3}{x^2} = 3$	A1	
Solve 3-term quadratic obtaining at least one root	M1	
Obtain final answer 1.39 only	A1	[4]

Q3.

EITHER	Use laws of indices correctly and solve for 5^x or for 5^{-x} or for 5^{x-1}	M1	
	Obtain 5^x or for 5^{-x} or for 5^{x-1} in any correct form, e.g. $5^x = \frac{5}{1 - 1/5}$	A1	
	Use correct method for solving $5^x = a$, or $5^{-x} = a$, or $5^{x-1} = a$, where $a > 0$	M1	
	Obtain answer $x = 1.14$	A1	
OR	Use an appropriate iterative formula, e.g. $x_{n+1} = \frac{\ln(5^{x-1}+5)}{\ln 5}$, correctly, at least once	M1	
	Obtain answer 1.14	A1	
	Show sufficient iterations to at least 3 d.p. to justify 1.14 to 2 d.p., or show there is a sign change in the interval (1.135, 1.145)	A1	
	Show there is no other root	A1	[4]
	[For the solution $x = 1.14$ with no relevant working give B1, and a further B1 if 1.14 is shown to be the only solution.]		

Q4.

State or imply $\ln e = 1$	B1	
Apply at least one logarithm law for product or quotient correctly (or exponential equivalent)	M1	
Obtain $x+5=ex$ or equivalent and hence $\frac{5}{e-1}$	A1	[3]

Q5.

(i)	Either	State or imply non-modular equation $(4x-1)^2=(x-3)^2$ or pair of linear equations $4x-1=\pm(x-3)$	B1	
		Solve a three-term quadratic equation or two linear equations	M1	
		Obtain $-\frac{2}{3}$ and $\frac{4}{5}$	A1	
	Or	Obtain value $-\frac{2}{3}$ from inspection or solving linear equation	B1	
		Obtain value $\frac{4}{5}$ similarly	B2	[3]
(ii)	State or imply at least $4^y=\frac{4}{5}$, following a positive answer from part (i)		B1√	
	Apply logarithms and use $\log a^b = b\log a$ property		M1	
	Obtain –0.161 and no other answer		A1	[3]

Q6.

EITHER:	State or imply $\ln y = \ln A - kx^2$	B1	
	Substitute values of $\ln y$ and x^2, and solve for k or $\ln A$	M1	
	Obtain $k = 0.42$ or $A = 2.80$	A1	
	Solve for $\ln A$ or k	M1	
	Obtain $A = 2.80$ or $k = 0.42$	A1	
OR1:	State or imply $\ln y = \ln A - kx^2$	B1	
	Using values of $\ln y$ and x^2, equate gradient of line to $-k$ and solve for k	M1	
	Obtain $k = 0.42$	A1	
	Solve for $\ln A$	M1	
	Obtain $A = 2.80$	A1	
OR2:	Obtain two correct equations in k and A and substituting y– and x^2 – values in $y = Ae^{-kx^2}$	B1	
	Solve for k	M1	
	Obtain $k = 0.42$	A1	
	Solve for A	M1	
	Obtain $A = 2.80$	A1	[5]
	[SR: If unsound substitutions are made, e.g. using $x = 0.;64$ and $y = 0.76$, give B1M0A0M1A0 in the *EITHER* and *OR1* schemes, and B0M1A0M1A0 in the *OR2* scheme.]		

Q7.

Use law for the logarithm of a product, quotient or power	M1	
Use ln e = 1 or exp(l) = 3	M1	
Obtain correct equation free of logarithms in any form, e.g. $\frac{y+1}{y} = ex^3$	A1	
Rearrange as $y = (ex^3 - 1)^{-1}$, or equivalent	A1	[4]

Q8.

EITHER: State or imply non-modular equation $2^2(3^x - 1)^2 = (3^x)^2$, or pair of equations			
	$2(3^x - 1) = \pm 3^x$	M1	
	Obtain $3^x = 2$ and $3^x = \frac{2}{3}$ (or $3^{x+1} = 2$)	A1	
OR:	Obtain $3^x = 2$ by solving an equation or by inspection	B1	
	Obtain $3^x = \frac{2}{3}$ (or $3^{x+1} = 2$) by solving an equation or by inspection	B1	
Use correct method for solving an equation of the form $3^x = a$ (or $3^{x+1} = a$), where $a > 0$		M1	
Obtain final answers 0.631 and –0.369		A1	**[4]**

Q9.

Apply at least one logarithm property correctly	*M1	
Obtain $\frac{(x+4)^2}{x} = x + a$ or equivalent **without logarithm** involved	A1	
Rearrange to express x in terms of a	M1	d*M
Obtain $\frac{16}{a-8}$ or equivalent	A1	[4]

Q10.

(i)	Use law for the logarithm for a product or quotient or exponentiation AND for a power	M1	
	Obtain $(4x - 5)^2(x + 1) = 27$	B1	
	Obtain given equation correctly $16x^3 - 24x^2 - 15x - 2 = 0$	A1	[3]
(ii)	Obtain $x = 2$ is root or $(x - 2)$ is a factor, or likewise with $x = -\frac{1}{4}$	B1	
	Divide by $(x - 2)$ to reach a quotient of the form $16x^2 + kx$	M1	
	Obtain quotient $16x^2 + 8x + 1$	A1	
	Obtain $(x - 2)(4x + 1)^2$ or $(x - 2)$, $(4x + 1)$, $(4x + 1)$	A1	[4]
(iii)	State $x = 2$ only	A1	[1]