Question Number	Scheme	Mark
3(a)	$\left\{\frac{dx}{dy}=\right\}\ \frac{2(y-1)^2-2(2y-1)(y-1)}{(y-1)^4}$	M1
	$=\frac{-2y^2+2y}{(y-1)^4}$ **or** $=\frac{2(y-1)-2(2y-1)}{(y-1)^3}$	M1
	$=-\frac{2y}{(y-1)^3}$	A1
		(3)
(b)	e.g. $\frac{dy}{dx}="-\frac{(2-1)^3}{2\times 2}"=\ldots\left\{-\frac{1}{4}\right\}$ **and** $x=\frac{2\times 2-1}{1}=\ldots\{3\}$	M1
	$y-2="-\frac{1}{4}"(x-"3")$	dM1
	$x+4y-11=0$	A1
		(3)
		(6 marks)

(a)

M1: Attempts the quotient rule (or product rule) – see below for the required forms.

Allow for $\left\{\frac{dx}{dy}=\right\}\ \frac{\alpha(y-1)^2-\beta(2y-1)(y-1)}{(y-1)^4}$ or $\left\{\frac{dx}{dy}=\right\}\ \alpha(y-1)^{-2}-\beta(2y-1)(y-1)^{-3}$ o.e.

where $\alpha,\beta>0$ but condone $\left\{\frac{dx}{dy}=\right\}\ \frac{\alpha(y-1)^2-\beta(2y-1)(y-1)}{(y-1)^2}$ where $\alpha,\beta>0$

Note the correct differentiation using the product rule is $\left\{\frac{dx}{dy}=\right\}\ 2(y-1)^{-2}-2(2y-1)(y-1)^{-3}$

Attempts using implicit differentiation or partial fractions should be sent to review.

M1: Attempts to expand and simplify their numerator to a quadratic expression with brackets removed **or** cancels a factor of $(y-1)$ correctly and simplifies to a linear numerator, which *would* simplify to $ay+b$ where a **or** b may be 0 (there is no need to expand the brackets for this mark in this approach).

Using the product rule, they must attempt to factor out $(y-1)^{-3}$ and have a linear expression as their other factor (as above) **or** create a common denominator of $(y-1)^3$ with a linear numerator (as above).

e.g. $2(y-1)^{-2}-2(2y-1)(y-1)^{-3}\rightarrow(y-1)^{-3}\left[2(y-1)-2(2y-1)\right]$ **or** $\frac{2(y-1)-2(2y-1)}{(y-1)^3}$

Dependent on a reasonable attempt to use the quotient rule or product rule but condone slips in applying these so that the forms specified above might not be achieved e.g. sign errors or miscopied terms.

A1: $-\frac{2y}{(y-1)^3}$ or simplified equivalent. FYI $-\frac{2y}{y^3-3y^2+3y-1}$ is also acceptable.

ISW if they go on to attempt to expand the denominator incorrectly.

(b)

M1: Attempts to find $\frac{dy}{dx}$ or $\frac{dx}{dy}$ when $y = 2$ **and** attempts to find the x coordinate when $y = 2$

Ignore labelling of $\frac{dy}{dx}$ or $\frac{dx}{dy}$

dM1: Attempts to find the equation of the tangent using their value of $\frac{dy}{dx}$ i.e. the reciprocal of $\frac{dx}{dy}$

(**not** $\frac{dx}{dy}$ or $-\frac{dx}{dy}$ or $-\frac{dy}{dx}$) **and** their attempt at x when $y = 2$

If using $y = mx + c$ they must proceed as far as $c = \ldots$

Note that they may use $x - x_1 = \frac{dx}{dy}(y - y_1)$ directly (or $x = ny + d$ with n = their value of $\frac{dx}{dy}$)

A1: $x + 4y - 11 = 0$ or any integer multiple of this. Requires the = 0. The order of the terms does not matter.

Note: allow $\frac{dy}{dx} = -\frac{1}{4}$ coming from an incorrect $\frac{dx}{dy}$ or from a restart to score full marks in part (b).

Question Number	Scheme	Mark
4(a)	$p=10^{1.3}$ **or** $q=10^{\frac{3.4-1.3}{10}}$ $p=$ awrt 20.0 **or** $q=$ awrt 1.62 $p=10^{1.3}$ **and** $q=10^{\frac{3.4-1.3}{10}}$ $p=$ awrt 19.95 **and** $q=$ awrt 1.622	M1 A1 dM1 A1
		(4)
(b)	e.g. $"19.95"\times"1.622"^{T}=700$ $\Rightarrow "1.622"^{T}=\dfrac{700}{"19.95"}$ $\Rightarrow T=\log_{"1.622"}\left(\dfrac{700}{"19.95"}\right)=$ awrt 7.36	M1A1
		(2)
		(6 marks)

(a)

M1: A correct expression for p **or** q. May be implied by a correct value so $p=$ awrt 20.0 **or** $q=$ awrt 1.62 Condone p truncating to 19.9 but not just p = awrt 20

May be seen as e.g. $\{N=\}\ 10^{1.3}\times...$ to imply the expression for p or $\{N=\}\ ...\times\left(10^{0.21}\right)^{t}$ to imply the expression for q (but not just $\{N=\}\ ...\times10^{0.21t}$).

Note that they may use simultaneous equations i.e. $pq^{0}=10^{1.3}$ and $pq^{10}=10^{3.4}$ which may lead to $q^{10}=\dfrac{2511...}{19.95...}=125.8...$ so $q=\sqrt[10]{125.8...}$ which scores the M1.

A1: $p=$ awrt 20.0 **or** $q=$ awrt 1.62 Condone p truncating to 19.9.

dM1: A correct expression for p **and** a correct expression for q.
May be implied by correct values so $p=$ awrt 20.0 **and** $q=$ awrt 1.62 Condone p truncating to 19.9 but not just p = awrt 20. May also be implied if embedded in their equation.
It is dependent on the previous method mark.

A1: $p=$ awrt 19.95 **and** $q=$ awrt 1.622 There is no need to see the complete model.
If p and q are not stated explicitly then allow them to be implied by e.g. $\{N=\}\ 19.95\times1.622^{t}$

SC: Incorrect index work seen e.g. $10^{1.3}+10^{0.21t}$ followed by correct values for p and q scores maximum SC 1100.