Question Number	Scheme	Marks
2(a)	$x=2 \Rightarrow 4-8y+y^2=13 \Rightarrow \left(y^2-8y-9=0 \Rightarrow\right) y=...$	M1
	$y=9$	A1
		(2)
(b)	$2^x \rightarrow 2^x \ln 2$	B1
	$-4xy \rightarrow -4x\frac{dy}{dx}-4y$ **OR** $y^2 \rightarrow 2y\frac{dy}{dx}$	M1
	$2^x \ln 2-4x\frac{dy}{dx}-4y+2y\frac{dy}{dx}=0$	A1
	$\frac{dy}{dx}(2y-4x)=4y-2^x \ln 2 \Rightarrow \frac{dy}{dx}=...$	M1
	$\frac{dy}{dx}=\frac{4y-2^x \ln 2}{2y-4x}$ or $\frac{dy}{dx}=\frac{2^x \ln 2-4y}{4x-2y}$ or $\frac{dy}{dx}=\frac{\ln 2e^{x\ln 2}-4y}{4x-2y}$	A1
		(5)
(c)	$(2, 9) \rightarrow \frac{dy}{dx}=\frac{4(9)-2^2 \ln 2}{2(9)-4(2)}$ $\Rightarrow y-"9"="\frac{36-4\ln 2}{10}"(x-2)$	M1
	$y=0 \Rightarrow 0-"9"="\frac{36-4\ln 2}{10}"(x-2) \Rightarrow x=...$	dM1
	$x=\frac{4\ln 2+9}{2\ln 2-18}$ o.e. e.g. $x=\frac{-8\ln 2-18}{-4\ln 2+36}$.	A1
		(3)
		Total 10

(a)

M1: Substitutes $x = 2$ into the equation for C, forms a quadratic equation in y and then solves to obtain at least one value for y

A1: $y=9$ only

(b) It is acceptable to use $y' \leftrightarrow \frac{dy}{dx}$ in this question

B1: Correct differentiation of 2^x. Allow also $2^x = e^{x\ln 2} \rightarrow e^{x\ln 2}\ln 2$

M1: Differentiates $-4xy \rightarrow \pm Ax\frac{dy}{dx} \pm By$ **OR** differentiates $y^2 \rightarrow k\,y\frac{dy}{dx}$

A1: Fully correct differentiation. Allow versions such as $2^x \ln 2dx-4xdy-4ydx+2ydy=0$

M1: Attempts to make $\frac{dy}{dx}$ the subject with the 2 terms in $\frac{dy}{dx}$ coming from differentiating y^2 and $-4xy$

A1: Any correct expression for $\frac{dy}{dx}$. Note that you can isw after a correct answer. $\frac{2y-2^{x-1}\ln 2}{y-2x}$ **is** correct

(c)

M1: Uses $x = 2$ and their y value from part (a) to find the gradient at P and attempts to form the equation of the tangent at P. Condone poor attempts at differentiation but $\frac{dy}{dx}$ must have both x and y terms.

If the form $y = mx + c$ is used they must proceed as far as $c = ...$

dM1: Substitutes $y = 0$ into their tangent equation and rearranges to find x. Dependent upon previous M

It is possible for a method to combine this with the previous M.

Look for methods like the following, which score M1, dM1

$-"9" = "m"(x-2) \Rightarrow x = ...$ where 'm' is the value of their $\frac{dy}{dx}$ at $x = 2$

or $\frac{"9"}{2-x} = "m" \Rightarrow x = ...$ where 'm' is the value of their $\frac{dy}{dx}$ at $x = 2$

A1: Correct expression in the required form. Must come from a correct $\frac{dy}{dx}$

Do not be concerned about the order of the terms on the numerator and denominator

Question Number	Scheme	Marks
3(a)	$\dfrac{8x-5}{(2x-1)(4x-3)} \equiv \dfrac{A}{2x-1}+\dfrac{B}{4x-3} \Rightarrow 8x-5=A(4x-3)+B(2x-1) \Rightarrow A=...\ B=...$	M1
	$A=1 \quad \text{or} \quad B=2$	A1
	$\dfrac{8x-5}{(2x-1)(4x-3)} \equiv \dfrac{1}{2x-1}+\dfrac{2}{4x-3}$	A1
		(3)
(b)	$\displaystyle\int\left(\frac{1}{2x-1}+\frac{2}{4x-3}\right)\mathrm{d}x=\frac{1}{2}\ln\lvert 2x-1\rvert+\frac{1}{2}\ln\lvert 4x-3\rvert(+c)$ Follow through their A and B	M1, A1ft, A1ft
		(3)
(c)	$\left[\frac{1}{2}\ln(2x-1)+\frac{1}{2}\ln(4x-3)\right]_k^{3k}=\frac{1}{2}\ln(6k-1)(12k-3)-\frac{1}{2}\ln(2k-1)(4k-3)$ $=\frac{1}{2}\ln\dfrac{(6k-1)(12k-3)}{(2k-1)(4k-3)}$	M1
	$\frac{1}{2}\ln\dfrac{(6k-1)(12k-3)}{(2k-1)(4k-3)}=\frac{1}{2}\ln 20 \Rightarrow \dfrac{(6k-1)(12k-3)}{(2k-1)(4k-3)}=20$ $\Rightarrow (6k-1)(12k-3)=20(2k-1)(4k-3) \Rightarrow 88k^2-170k+57=0$	dM1A1
	$88k^2-170k+57=0 \Rightarrow k=...$	ddM1
	$k=\dfrac{3}{2}$	A1
		(5)
		Total 11

(a)

M1: "Correct" P.F form (condoning slips) with strategy to find at least one constant or partial fraction.
Look for an attempt at the correct form (condoning slips) $5-8x=A(4x-3)+B(2x-1)$ followed by values for A or B

A1: One correct fraction or constant

A1: Correct partial fractions which may be awarded for sight of correct PF in part (b).
Award if the correct answer is just written down with little or no working.
Award if the correct partial fractions are seen in (b)

(b)

M1: For $\displaystyle\int\frac{\alpha}{2x-1}\,\mathrm{d}x=\beta\ln\lvert 2x-1\rvert$ **OR** $\displaystyle\int\frac{\alpha}{4x-3}\,\mathrm{d}x=\beta\ln\lvert 4x-3\rvert$

Allow for example brackets instead of moduli, e.g. $\ln(2x-1)\leftrightarrow\ln\lvert 2x-1\rvert$

Condone the omission of moduli/brackets, for example $\displaystyle\int\frac{\alpha}{2x-1}\,\mathrm{d}x=\beta\ln 2x-1$ for this mark only

A1ft: For $\displaystyle\int\frac{A}{2x-1}\,\mathrm{d}x=\frac{A}{2}\ln\lvert 2x-1\rvert$ **OR** $\displaystyle\int\frac{B}{4x-3}\,\mathrm{d}x=\frac{B}{4}\ln\lvert 4x-3\rvert$ Follow through their A and B

Allow for example brackets instead of moduli, e.g . $\ln(2x-1)\leftrightarrow\ln\lvert 2x-1\rvert$