Question Number	Scheme	Marks
1(a)	$\left(\frac{1}{4}-\frac{1}{2}x\right)^{-\frac{3}{2}}=8(1-2x)^{-\frac{3}{2}}$	B1
	$(1-2x)^{-\frac{3}{2}}=1+\left(-\frac{3}{2}\right)(-2x)+\frac{-\frac{3}{2}\left(-\frac{3}{2}-1\right)}{2!}(-2x)^2+\frac{-\frac{3}{2}\left(-\frac{3}{2}-1\right)\left(-\frac{3}{2}-2\right)}{3!}(-2x)^3+...$	M1 A1
	$\left(\frac{1}{4}-\frac{1}{2}x\right)^{-\frac{3}{2}}=8+24x+60x^2+140x^3+...$	A1, A1
		(5)
(b)	$n = 2$	B1
		(1)
(c)	$\left(\frac{1}{4}-\frac{1}{2}x\right)^2=\frac{1}{16}-\frac{1}{4}x+\frac{1}{4}x^2$	B1
	$\left(\frac{1}{4}-\frac{1}{2}x\right)^{\frac{1}{2}}=\left(\frac{1}{16}-\frac{1}{4}x+\frac{1}{4}x^2\right)\left(8+24x+60x^2+140x^3+...\right)$ $=8\times\frac{1}{16}+24x\times\frac{1}{16}+60x^2\times\frac{1}{16}-8\times\frac{1}{4}x-24x\times\frac{1}{4}x+8\times\frac{1}{4}x^2$	M1
	$=\frac{1}{2}-\frac{1}{2}x-\frac{1}{4}x^2+...$	A1
		(3)
		Total 9

(a)

B1: Takes out the **correct and simplified** common factor to obtain $8(1\pm...)^{-\frac{3}{2}}$ Implied by an expansion 8 + ...

M1: Attempts the binomial expansion of $(1\pm kx)^{-\frac{3}{2}}$ to get the third and/or fourth term with an acceptable structure.

The correct binomial coefficient must be combined with the correct power of *x*.

Look for $\frac{-\frac{3}{2}\left(-\frac{3}{2}-1\right)}{2!}(\pm kx)^2$ or $\frac{-\frac{3}{2}\left(-\frac{3}{2}-1\right)\left(-\frac{3}{2}-2\right)}{3!}(\pm kx)^3$ with or without the brackets on the kx

Even allow with $k=1$

A1: Correct simplified or unsimplified expansion for $(1-2x)^{-\frac{3}{2}}$. (NB simplified is $1+3x+\frac{15}{2}x^2+\frac{35}{2}x^3+...$)

A1: Two correct and simplified terms of $8+24x+60x^2+140x^3$

A1: All correct and simplified $8+24x+60x^2+140x^3$ Ignore extra terms of x^4 and above

(b)

B1: Correct value, *n* = 2. Do NOT allow incomplete answers such as $\frac{4}{2}$

(c) **Hence**

B1: Correct expansion of $\left(\frac{1}{4}-\frac{1}{2}x\right)^2$, simplified or unsimplified

M1: Attempts correct strategy to find expansion.

Terms do not need to be collected. There may be other terms as well, for example terms in x^3

Look for an attempt to find 4 or more terms from the following (condoning slips)

$\left(A+Bx+Cx^2\right)\left(E+Fx+Gx^2+Hx^3+...\right)=AE+AFx+AGx^2+BEx+BFx^2+CEx^2+...$

A1: Correct simplified expansion. Ignore extra terms of x^3 and above

(c) **Otherwise:** Applies binomial expansion to $\left(\frac{1}{4}-\frac{1}{2}x\right)^{\frac{1}{2}}$

B1: Correct simplified expression $\left(\frac{1}{4}-\frac{1}{2}x\right)^{\frac{1}{2}}=\frac{1}{2}(1-2x)^{\frac{1}{2}}$

M1: Correct structure for 3rd term: $\frac{\frac{1}{2}\left(\frac{1}{2}-1\right)}{2!}(-2x)^2$ but allow $\frac{\frac{1}{2}\left(\frac{1}{2}-1\right)}{2!}(\pm kx)^2$ with or without brackets. Even allow with $k=1$

A1: $\frac{1}{2}-\frac{1}{2}x-\frac{1}{4}x^2+...$ Ignore extra terms of x^3 and above

Direct expansion in (a)

$$\left(\frac{1}{4}-\frac{1}{2}x\right)^{-\frac{3}{2}}=\left(\frac{1}{4}\right)^{-\frac{3}{2}}+\left(-\frac{3}{2}\right)\left(\frac{1}{4}\right)^{-\frac{5}{2}}\left(-\frac{1}{2}x\right)+\frac{\left(-\frac{3}{2}\right)\times\left(-\frac{5}{2}\right)}{2}\left(\frac{1}{4}\right)^{-\frac{7}{2}}\left(-\frac{1}{2}x\right)^2+\frac{\left(-\frac{3}{2}\right)\times\left(-\frac{5}{2}\right)\times\left(-\frac{7}{2}\right)}{3!}\left(\frac{1}{4}\right)^{-\frac{9}{2}}\left(-\frac{1}{2}x\right)^3$$

B1: Obtains an expansion with a constant term of 8

M1: Attempts the binomial expansion of $\left(\frac{1}{4}-\frac{1}{2}x\right)^{-\frac{3}{2}}$ to get the third and/or fourth term with an acceptable structure.

Look for $\frac{\left(-\frac{3}{2}\right)\times\left(-\frac{5}{2}\right)}{2}\left(\frac{1}{4}\right)^{-\frac{7}{2}}\left(\pm\frac{1}{2}x\right)^2$ or $\frac{\left(-\frac{3}{2}\right)\times\left(-\frac{5}{2}\right)\times\left(-\frac{7}{2}\right)}{3!}\left(\frac{1}{4}\right)^{-\frac{9}{2}}\left(\pm\frac{1}{2}x\right)^3$

with or without the brackets on the $\left(\pm\frac{1}{2}x\right)$

A1: Correct simplified or unsimplified expansion .
Expression at the top of the page is acceptable

A1: Two correct and simplified terms of $8+24x+60x^2+140x^3$

A1: All correct and simplified $8+24x+60x^2+140x^3$

Direct expansion in (c)

B1: First two terms which may be unsimplified $\left(\frac{1}{4}-\frac{1}{2}x\right)^{\frac{1}{2}}=\left(\frac{1}{4}\right)^{\frac{1}{2}}+\frac{1}{2}\left(\frac{1}{4}\right)^{-\frac{1}{2}}\left(-\frac{1}{2}x\right)^1+....$

M1: Correct form for the third term $\frac{\frac{1}{2}\left(\frac{1}{2}-1\right)}{2}\left(\frac{1}{4}\right)^{-\frac{3}{2}}\left(-\frac{1}{2}x\right)^2$

A1: Correct simplified expansion $\frac{1}{2}-\frac{1}{2}x-\frac{1}{4}x^2+...$

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