Question Number	Scheme	Marks
1(a)	$27(3-5x)^{-2} = 27\times\frac{1}{9}\left(1-\frac{5}{3}x\right)^{-2}$ o.e. $3\times\left(1-\frac{5}{3}x\right)^{-2}$	B1
	$=(3)\left(1+(-2)\left(-\frac{5}{3}x\right)+\frac{(-2)(-3)}{2!}\left(-\frac{5}{3}x\right)^2+\frac{(-2)(-3)(-4)}{3!}\left(-\frac{5}{3}x\right)^3+...\right)$	M1, A1
	$=3+10x+25x^2+\frac{500}{9}x^3+...$	A1 **(4)**
(b)	$27(3+5x)^{-2} = 27(3+5x)^{-2} = 3-10x+25x^2-\frac{500}{9}x^3+...$	B1ft **(1)**
(c)	$27(3-x)^{-2} = 3+\frac{10}{5}x+\frac{25}{5^2}x^2+\frac{500}{9\times5^3}x^3 = 3+2x+x^2+\frac{4}{9}x^3+...$	M1A1 **(2)** **(7 marks)**
Alt(a)	$27(3-5x)^{-2} = 27\left(\begin{array}{l}3^{-2}+(-2)\times3^{-3}\times(-5x)+\frac{(-2)(-3)}{2}\times3^{-4}\times(-5x)^2\\+\frac{(-2)(-3)(-4)}{3!}(3)^{-5}(-5x)^3\end{array}\right)$	B1 M1
	$=27\left(\frac{1}{9}+\frac{10x}{27}+\frac{25x^2}{27}+\frac{500x^3}{243}+..\right)$	A1 A1
	$=3+10x+25x^2+\frac{500}{9}x^3+...$	

(a)

B1: Correctly takes out a factor and proceeds to $3\times\left(1-\frac{5}{3}x\right)^{-2}$ which may be unsimplified. May be implied

M1: Expands $(1+kx)^{-2}$ $k\neq\pm1$ to give the correct structure for 3rd or 4th term

$\frac{(-2)(-3)}{2}(kx)^2$ or $\frac{(-2)(-3)(-4)}{3!}(kx)^3$ with or without the brackets around *kx*

A1: A correct simplified or unsimplified form of the expansion of $\left(1-\frac{5}{3}x\right)^{-2}$ May be implied by their final answer. Allow terms to be listed, which may be on different lines for this mark.

A1: Fully correct simplified expansion $=3+10x+25x^2+\frac{500}{9}x^3$ with all terms written on one line. Do not isw if they e.g. multiply through by 9

Alt(a)

B1: For the first term $27(3^{-2}+....$

M1: For correct structure for 3rd or 4th terms $\frac{(-2)(-3)}{2}\times 3^{-4}\times(-5x)^2$ or $\frac{(-2)(-3)(-4)}{3!}(3)^{-5}(-5x)^3$ with or without the brackets around $-5x$

A1A1: See main scheme notes

In both parts ignore earlier workings if it is a restart and just mark their final answer

(b)

B1ft: $3-10x+25x^2-\frac{500}{9}x^3$ or if (a) was incorrect either score for a correct answer or follow through on their part (a) i.e. $A+Bx+Cx^2+Dx^3 \rightarrow A-Bx+Cx^2-Dx^3$

(c)

M1: Comparing their final answer line in (c) to their answer to part (a) of the form $A+Bx+Cx^2+Dx^3$ look for at least two of $B\rightarrow\frac{B}{5}$ or $C\rightarrow\frac{C}{25}$ or $D\rightarrow\frac{D}{125}$

A1: $3+2x+x^2+\frac{4}{9}x^3$ **which can only be scored following full marks in (a)**

Question Number	Scheme	Marks
2.	$\cancel{\left(\frac{dy}{dx}\right)} = 8x - 2y\frac{dy}{dx} + 2x\frac{dy}{dx} + 2y = 0$	M1 B1 A1
	Sets $\frac{dy}{dx} = 2, \Rightarrow 8x - 4y + 4x + 2y = 0 \Rightarrow y - 6x = 0$	M1
	Sub "$y = 6x$" into $4x^2 - y^2 + 2xy + 5 = 0$ $\Rightarrow 4x^2 - 36x^2 + 12x^2 + 5 = 0 \Rightarrow x^2 = \frac{1}{4} \Rightarrow x = \pm\frac{1}{2}$	dM1, A1
	$\left(\frac{1}{2}, 3\right)$ $\left(-\frac{1}{2}, -3\right)$	A1 **(7)** **(7 marks)**

M1: Differentiates $4x^2 - y^2 + 5$ wrt x to obtain $Ax + By\frac{dy}{dx}$ (inc. $5 \to 0$) Condone $\frac{dy}{dx} = ...$ at start

B1: Sight of $\frac{d}{dx}(2xy) = 2x\frac{dy}{dx} + 2y$ oe e.g. $2\left(y + x\frac{dy}{dx}\right)$

A1: $8x - 2y\frac{dy}{dx} + 2x\frac{dy}{dx} + 2y = 0$ oe e.g. $\frac{dy}{dx} = \frac{-8x - 2y}{2x - 2y}$ oe The =0 may be implied by further work

M1: Sets $\frac{dy}{dx} = 2$ in their differentiated function in x and y and proceeds to a linear equation in x and y.
Brackets do not need to be multiplied out. Condone arithmetical slips in their rearrangement.
There must have been some attempt at implicit differentiation so look for at least a $...y\frac{dy}{dx}$ or $...x\frac{dy}{dx}$ term in their differentiated function – not just e.g. $\frac{dy}{dx} = 8x - 2y + 2$

Note: $\boldsymbol{\frac{dy}{dx} = 0 \Rightarrow y = -4x \Rightarrow 20x^2 = 5 \Rightarrow x = \pm\frac{1}{2}}$ **scores M0dM0A0A0**

dM1: Dependent on the previous method mark only. For this mark:

- substitutes their $y = 6x$ or $x = \frac{y}{6}$ into the equation of curve C to form an equation in one variable
- reaches a **two-term quadratic** $Ax^2 = B$ oe or $Ay^2 = B$ oe for any values of A or B where $A \times B > 0$:

  e.g. $(4x^2 - 36x^2 + 12x^2 + 5 = 0 \Rightarrow)$ $20x^2 = 5$

  e.g. $\left(4\left(\frac{y}{6}\right)^2 - y^2 + \frac{y^2}{3} + 5 = 0 \Rightarrow\right)$ $\frac{5}{9}y^2 = 5$

  but condone slips in the working. Also allow if both terms are on one side of an equation. The = 0 may be implied by further work.
- solves their **two term quadratic** to find a value for x or y (you do not need to be check this)

  It cannot be implied by a correct value for x or y.