Question Number	Scheme	Marks
1.	$\int\left(\frac{8}{3}x^3-\frac{1}{2}x^{-\frac{1}{2}}-5\right)\mathrm{d}x=\frac{8}{3}\times\frac{x^4}{4}-\frac{1}{2}\times 2x^{\frac{1}{2}}-5x+c$	M1 A1
	$=\frac{2}{3}x^4-x^{\frac{1}{2}}-5x+c$	A1 A1 **(4 marks)**

M1 For raising a power of x by 1 seen at least once (i.e. $x^n \to x^{n+1}$) or $-5 \to -5x$.
The index does not have to be processed for this mark.
Award following incorrect manipulations eg $-\frac{1}{2\sqrt{x}} \to ...x^{\frac{1}{2}} \to ...x^{\frac{3}{2}}$

A1 For two of $\frac{8}{3}\times\frac{x^4}{4}$, $-\frac{1}{2}\times 2x^{\frac{1}{2}}$, $-5x^1$ correct (unsimplified).
This may be implied by a correct simplified answer. May be seen on different lines. Indices must be processed. Ignore any spurious notation for any of the A marks.

A1 For two of $\frac{2}{3}x^4$, $-x^{\frac{1}{2}}, -5x$ correct and in simplest form. Accept forms such as $\frac{2x^4}{3}$ and $-\sqrt{x}$
Condone $-5x^1$, $-1x^{\frac{1}{2}}$ but not $-\frac{5x}{1}$. Correct terms may be seen on different lines. Allow $\frac{2}{3}$ to be written as $0.\dot{6}$ or 0.6666….. only (must be exact)

A1 Fully correct **on one line**, and simplified with +*c*. Accept simplified equivalents (see above)

Question Number	Scheme	Marks
2 (a)	$3^{3x} = \left(3^x\right)^3 = y^3$	B1 **(1)**
(b)	$\dfrac{1}{3^{x-2}} = \dfrac{1}{3^x \times 3^{-2}} = \dfrac{9}{y}$	M1 A1 **(2)**
(c)	$\dfrac{81}{9^{2-3x}} = \dfrac{9^2}{9^{2-3x}} = 9^{2-(2-3x)} = 9^{3x} = 3^{6x} = y^6$	M1 A1 **(2)**
		(5 marks)

Note: Correct answer in any part implies full marks for that part

(a)

B1 y^3 Condone $(y)^3$. Ignore once correct answer seen.

(b)

M1 For correct application of the addition/subtraction law so award for eg:

$\dfrac{1}{3^x \times 3^{-2}}$ or $\dfrac{1}{3^x \div 3^2}$ or $\dfrac{1}{\left(\dfrac{3^x}{3^2}\right)}$ or $\dfrac{1}{y \times 3^{-2}}$ or $\dfrac{3^2}{3^x}$ or sight of 9 or $\dfrac{1}{y}$ oe

A1 For $\dfrac{9}{y}$ or $9y^{-1}$ but NOT expressions that still contain $\div$ or fractions within fractions or $3^2 y^{-1}$. Ignore once correct answer seen.

(c)

M1 For simplifying the indices to expressions of the form $9^{\cdots}$ or $3^{\cdots}$ (not as a denominator) so award for 9^{3x}, $\left(9^x\right)^3$, 3^{6x}, $\left(3^x\right)^6$, or $k \times y^6$, $k \neq 0$ which must come from correct working. Also allow unsimplified equivalent expressions of the final answer eg $\dfrac{1}{y^{-6}}$ as long as it in terms of y

A1 y^6 only (not eg $\dfrac{1}{y^{-6}}$). Ignore once correct answer seen. Condon $(y)^6$

Note: In all parts they may work from $y = 3^x$ and manipulate both sides to the given answer which is acceptable.

Eg part (b): $y = 3^x \Rightarrow y \times 3^{-2} = 3^{x-2}$ (M1) $\Rightarrow \dfrac{1}{y \times 3^{-2}} = \dfrac{1}{3^{x-2}} \Rightarrow \dfrac{9}{y} = \dfrac{1}{3^{x-2}}$ (A1)

Eg part (c): $y = 3^x \Rightarrow y^{-6} = 3^{-6x} \Rightarrow 81y^{-6} = 3^{4-6x}$ (M1) $\Rightarrow 81y^{-6} = 9^{2-3x} \Rightarrow \dfrac{81}{9^{2-3x}} = y^6$ (A1)