Question Number	Scheme	Marks
3 ALT	$y\cos^2(2x)\dfrac{\mathrm{d}y}{\mathrm{d}x} = 3\sin 2x \rightarrow \int y\ \mathrm{d}y = \int 3\dfrac{\sin 2x}{\cos^2 2x}\ \mathrm{d}x \rightarrow \int y\ \mathrm{d}y = 3(\cos 2x)^n$ where $n = -1$ or -3	M1, A1
	$\dfrac{y^2}{2} = \dfrac{3}{2}(\cos 2x)^{-1}\ (+c)$	M1A1
	$\dfrac{16}{2} = \dfrac{3}{2\cos\left(\dfrac{\pi}{3}\right)} + c \Rightarrow c = \ldots (= 5)$	dM1
	$y^2 = \dfrac{3}{\cos 2x} + 10$	A1

Alt versions will integrate $\dfrac{\sin 2x}{\cos^2 2x}$ using substitution or reverse chain rule

The key here is realising that the integral of this is $(\cos 2x)^n$ or u^n where $u = \cos 2x$

M1**:** For an attempt to separate the variables **OR** use of $\int \dfrac{\sin 2x}{\cos^2 2x}\mathrm{d}x \equiv (\cos 2x)^n$

For separation of variables look for example for $y\cos^2(2x)\dfrac{\mathrm{d}y}{\mathrm{d}x} = 3\sin 2x \rightarrow \int y\ \mathrm{d}y = \int 3\dfrac{\sin 2x}{\cos^2 2x}\ \mathrm{d}x$.

condoning a slip on the position (or omission) of the 3 and omission of the integral signs

A1: Correct separation of variables **AND** use of $\int \dfrac{\sin 2x}{\cos^2 2x}\mathrm{d}x \equiv (\cos 2x)^n$ where $n = -1$ or -3

If the candidate sets $u = \cos 2x$ it is for integrating $\int \dfrac{\sin 2x}{\cos^2 2x}\mathrm{d}x$ to u^n where $n = -1$ or -3

M1: Correct attempted integration of the $\int \dfrac{\sin 2x}{\cos^2 2x}\mathrm{d}x$ to reach $\mathrm{f}(y) = \dfrac{\alpha}{\cos 2x}\ (+c)$ o.e with or without the c

A1: Correct integration. For example, $\dfrac{y^2}{2} = \dfrac{3}{2\cos 2x}\ (+c)$ o.e. Accept with or without the c

Note that that $y^2 = \dfrac{3}{\cos 2x}\ (+c)$ and $\dfrac{y^2}{3} = (\cos 2x)^{-1}\ (+c)$ are also examples of correct work.

dM1: Substitutes in $y = 4$ and $x = \dfrac{\pi}{6}$ into an integrated equation of the form $\mathrm{f}(y) = \dfrac{\alpha}{\cos 2x} + c$ o.e. and proceeds to find c. It is dependent on the previous method mark.

A1: $y^2 = \dfrac{3}{\cos 2x} + 10$ or equivalent such as $y^2 = \dfrac{3}{\cos 2x} + 10$ but ISW after a correct answer.

The answer is required to be in the form $y^2 =$

……..

Also note that you may attempt using integration by parts. FYI $\int 3\sin 2x\sec^2 2x\ \mathrm{d}x = \dfrac{3}{2}\sin 2x\tan 2x + \dfrac{3}{2}\cos 2x$

1st A1: Correct separation of variables and $\int 3\sin 2x\sec^2 2x\ \mathrm{d}x = \pm\lambda\sin 2x\tan 2x \pm \kappa\cos 2x \qquad \lambda, \kappa > 0$

2nd M1: $\int 3\sin 2x\sec^2 2x\ \mathrm{d}x = \lambda\sin 2x\tan 2x \pm \kappa\cos 2x \qquad \lambda, \kappa > 0$

2nd A1: $\int 3\sin 2x\sec^2 2x\ \mathrm{d}x = \dfrac{3}{2}\sin 2x\tan 2x + \dfrac{3}{2}\cos 2x$

Question Number	Scheme	Marks
4(a)	e.g. $5+17x-10x^2 = A(2x+1)(1-x)+Bx(2x+1)+Cx(1-x)$ $\Rightarrow A=..., \ B=...., \ C=....$	M1
	$A=5, \ B=4, \ C=8 \Rightarrow \mathrm{f}(x)=\dfrac{5}{x}+\dfrac{4}{(1-x)}+\dfrac{8}{(2x+1)}$	A1A1
		(3)
(b)	$\displaystyle\int \frac{5}{x}+\frac{4}{(1-x)}+\frac{8}{(2x+1)}\,\mathrm{d}x = 5\ln\lvert x\rvert - 4\ln\lvert 1-x\rvert + 4\ln\lvert 2x+1\rvert \ (+c)$	M1A1ftA1
	$\left[5\ln\lvert x\rvert - 4\ln\lvert 1-x\rvert + 4\ln\lvert 2x+1\rvert\right]_2^4$ $=(5\ln 4 - 4\ln 3 + 4\ln 9)-(5\ln 2 - 4\ln 1 + 4\ln 5) = 5\ln 2 + 4\ln\left(\dfrac{3}{5}\right)$	dM1A1
		(5)
		(8 marks)

(a)

M1: Sets $5+17x-10x^2 = A(2x+1)(1-x)+Bx(2x+1)+Cx(1-x)$ condoning slips on the coefficients of $5+17x-10x^2$ only and finds values for *A*, *B* and *C*. The right-hand side must be correct. Do not be concerned how the values are formed, e.g. via substitution or simultaneous equations. Just look for a suitable identity followed by values for *A*, *B* and *C*.

A1: Two (out of three) correct values of $A=5, \ B=4, \ C=8$

A1: Accept either $A=5, \ B=4, \ C=8$ or $\dfrac{5}{x}+\dfrac{4}{(1-x)}+\dfrac{8}{(2x+1)}$ but condone $\dfrac{5}{x}-\dfrac{4}{(x-1)}+\dfrac{8}{(2x+1)}$ which is also correct (but not in the form requested).

(b)

M1: Attempts to integrate their $\dfrac{"5"}{x}+\dfrac{"4"}{(1-x)}+\dfrac{"8"}{(2x+1)}$.

Score for any one $\dfrac{"5"}{x}\to\alpha\ln\lvert x\rvert$ $\dfrac{"4"}{(1-x)}\to\beta\ln\lvert 1-x\rvert$ $\dfrac{"8"}{(2x+1)}\to\delta\ln\lvert 2x+1\rvert$

(Condone invisible modulus signs or invisible brackets if subsequent work implies them)

Condone $\beta\ln\lvert 1-x\rvert\to\beta\ln\lvert x-1\rvert$ **throughout (b)**

Be aware that if they incorrectly find *C*, e.g. $C=\dfrac{7}{2}$, then $\dfrac{7}{(4x+2)}\to\dfrac{7}{4}\ln(4x+2)$ is a correct follow through

A1ft: Two of $5\ln\lvert x\rvert - 4\ln\lvert 1-x\rvert + 4\ln\lvert 2x+1\rvert$ follow through their *A*, *B* and *C*.

Allow use of brackets instead of modulus signs or allow further work to imply them.

A1: $5\ln\lvert x\rvert - 4\ln\lvert 1-x\rvert + 4\ln\lvert 2x+1\rvert$ with or without the $+c$

Allow use of brackets instead of modulus signs or allow further work to imply them.