Question Number	Scheme	Marks
8 (a) (i)	$x=4, \mathrm{f}'(x)=10,\ \mathrm{f}'(x)=3\sqrt{x}+kx^2 \Rightarrow 10=3\sqrt{4}+4^2k \Rightarrow k=...$	M1
	$10=3\times 2+k\times 16 \Rightarrow k=\frac{1}{4}$ *	A1*
(ii)	$x=4, y=12$ on $y=10x+c \Rightarrow 12=10\times 4+c$	M1
	$\Rightarrow c=-28$	A1
		(4)
(b)	$\mathrm{f}''(x)=\frac{3}{2}x^{-\frac{1}{2}}+\frac{1}{2}x$	M1 A1ft
	$\{\Rightarrow \mathrm{f}''(4)\}=\frac{11}{4}$	A1
		(3)
(c)	$\mathrm{f}(x)=2x^{\frac{3}{2}}+\frac{1}{12}x^3+d$	M1, A1ft
	Uses $P(4,12) \Rightarrow 12=2\times 8+\frac{1}{12}\times 4^3+d \Rightarrow d=...$	dM1
	$\{\mathrm{f}(x)=\}\ 2x^{\frac{3}{2}}+\frac{1}{12}x^3-\frac{28}{3}$	A1
		(4)
		(11 marks)

Note: If work is done out of order (e.g. if an attempt to find f(x) is made in part (a) but no attempt is made at (c)) then allow the M1A1 marks for differentiation in (b) and integration in (c) for the work in part (a) as long is it is clear it is an attempt at the correct process. However, e.g. an attempt at integration with a decrease in power should not be awarded the marks for (b).

(a)(i)

M1: Attempts to solve $\mathrm{f}'(4)=10$ to find k. Alternatively, substitutes x =4 and $k=\frac{1}{4}$ into f'(x) and evaluates.

A1*: Shows that $k=\frac{1}{4}$ with a correct intermediate line where powers/roots have been evaluated, and with no incorrect steps. Alternatively, correctly reaches f'(4) = 10 and conclude $k=\frac{1}{4}$

(ii)

M1: Substitutes $x=4, y=12$ in $y=10x+c$

Alternatively, substitutes x = 4, y = 12 and m = 10 into $y-y_1=m(x-x_1)$

A1: Correct value for c which may be embedded in the equation, e.g. $y=10x-28$, as long as no incorrect value for c is subsequently given.

(b)

M1: Differentiates with attempt to decrease power by 1 in each term. This should be to a form $Ax^{-\frac{1}{2}}+Bx$ but allow if a slip in one power has occurred before differentiating.

A1ft: $\frac{3}{2}x^{-\frac{1}{2}}+\frac{1}{2}x$ Allow for $\frac{3}{2}x^{-\frac{1}{2}}+2kx$ without k replaced or follow through their k if they use a different value than the one given. Need not be simplified.

A1: $\{f''(4) =\} \frac{11}{4}$ o.e.

(c)

M1: Integrates with attempt to increase each power by 1. This should be to a form $px^{\frac{3}{2}} + qx^{3}$ but allow if a slip in one power has occurred before integrating. There is no requirement for + *d* for this mark. NB If they try starting from f''(*x*) then ignore any spurious constant term in f'(*x*) for this mark.

A1ft: $f(x) = 2x^{\frac{3}{2}} + \frac{1}{12}x^{3}(+d)$ with no requirement for + *d* for this mark. Allow with *k* for this mark or follow through their value of *k* if they use a different value from the one given. Need not be simplified.

dM1: Substitutes $x = 4, y = 12$ into $y = f(x)$ to find "*d*". (Must have had a constant of integration but need not be called *d*.) They must be using a value for *k* at this stage.

A1: $\{f(x) =\} 2x^{\frac{3}{2}} + \frac{1}{12}x^{3} - \frac{28}{3}$ Allow *y* = ... or just the expression with no f(*x*).

Question Number	Scheme	Marks
9 (a) (i)	Stretch parallel to the x-axis $\times\frac{1}{2}$ or stretch parallel to the y-axis $\times\sqrt{2}$	M1, A1
(ii)	Translate by the vector $\begin{pmatrix}0\\12\end{pmatrix}$ (or translate up by 12 (units))	M1, A1
		(4)
(b) (i)	$12-\sqrt{x}=\sqrt{2}\sqrt{x}$	
	$12=\left(\sqrt{2}+1\right)\sqrt{x}$	M1
	$\Rightarrow\sqrt{x}=\frac{12}{\sqrt{2}+1}\times\frac{\sqrt{2}-1}{\sqrt{2}-1}=12\left(\sqrt{2}-1\right)$ *	dM1, A1 *
Alt (i)	$12-\sqrt{x}=\sqrt{2x}\Rightarrow\left(12-\sqrt{x}\right)^2=2x\Rightarrow x+24\sqrt{x}-144=0$	M1
	$\Rightarrow\left(\sqrt{x}\right)=\frac{-24\pm\sqrt{24^2-4\times-144}}{2}=-12\pm\frac{12}{2}\sqrt{4+8}=-12\pm12\sqrt{2}$	dM1
	$\sqrt{x}>0\Rightarrow\sqrt{x}=-12+12\sqrt{2}=12\left(\sqrt{2}-1\right)$*	A1
(ii)	$\Rightarrow x=12^2\left(\sqrt{2}-1\right)^2=144\left(2+1-2\sqrt{2}\right)=144\left(3-2\sqrt{2}\right)$	M1, A1
	$y\left\{=12-\sqrt{x}=12-12\left(\sqrt{2}-1\right)\right\}=12\left(2-\sqrt{2}\right)$	B1
	Or common acceptable alt forms: $P\left(432-288\sqrt{2},\quad 24-12\sqrt{2}\right)$	
		(6) **(10 marks)**

(a)(i)

M1: Correct type of transformation identified. Score for any of

- "Stretch", x/y-"scaling" or "compression"
- Condone "contraction", "enlargement", "magnify", "squish", "shrink" and "elongate". There may be other acceptable words, use discretion.

Do not accept such as "multiply each x value by 2"

A1: Completely correct using correct terminology. The direction (x or y or horizontal or vertical), type (must be scaling or stretch or compression) and the correct scale factor must be given. If there are any contradictory statements, then it is A0.

Accept e.g.

- Stretch or scaling or compression in the x direction with (scale) factor $\frac{1}{2}$
- Stretch or scaling in the y direction with (scale) factor $\sqrt{2}$

Note a compression in the x direction by factor 2 is A0.

(a)(ii)

M1: Correct type of transformation identified. Score for e.g.

- Translate, shift
- Move Up/down
- Allow translation vector given as indicating translation

Do not accept such as "add 12 to each y value".