Question Number	Scheme	Marks
6 (a)	$y=(4x-7)^{\frac{1}{2}} \Rightarrow \left(\frac{\mathrm{d}y}{\mathrm{d}x}=\right) 2(4x-7)^{-\frac{1}{2}}$ (see notes)	M1 A1
	At $(8,5)$ gradient of tangent is $2(4\times 8-7)^{-\frac{1}{2}}\left(=\frac{2}{5}\right)$	dM1
	Equation for l is $y-5=-\frac{5}{2}(x-8)$	ddM1
	$2y-10=-5x+40 \Rightarrow 5x+2y-50=0$ *	A1*
		(5)
(b)	$\int (4x-7)^{\frac{1}{2}}\,\mathrm{d}x=\left[\frac{(4x-7)^{\frac{3}{2}}}{6}\right]$ (see notes)	M1, A1
	Complete area = $\int_{\frac{7}{4}}^{8}(4x-7)^{\frac{1}{2}}\,\mathrm{d}x=\left[\frac{(4x-7)^{\frac{3}{2}}}{6}\right]_{\frac{7}{4}}^{8}+5$	dM1
	$=\frac{155}{6}$	A1
		(4)
		(9 marks)

(a)

M1: Attempts to differentiate to achieve $a(4x\pm 7)^{-\frac{1}{2}}$ or equivalent. The index does not need to be processed.

Alternatively, attempts to differentiate implicitly $y^2=4x-7 \Rightarrow Ay\frac{\mathrm{d}y}{\mathrm{d}x}=B$

A1: Achieves $2(4x-7)^{-\frac{1}{2}}$ o.e. (which may be unsimplified but the index processed) or using implicit differentiation achieves $2y\frac{\mathrm{d}y}{\mathrm{d}x}=4$

dM1: Substitutes $x = 8$ into their $a(4x\pm 7)^{-\frac{1}{2}}$ or substitutes $y = 5$ into their $Ay\frac{\mathrm{d}y}{\mathrm{d}x}=B$. It does not need to be evaluated. It is dependent on the first method mark but allow this mark to be scored if they have incorrectly manipulated their derivative before substituting in, or made transcription errors including if they lose the $-\frac{1}{2}$ index from the bracket.

ddM1: A full method for the equation of *l*. Look for

- substitution of $x = 8$ (or $y=5$ if implicit differentiation) into an attempt at a derivative
- the application of the negative reciprocal rule
- the use of $(8,5)$ with a correct gradient for their value of *m* to form an equation for the normal.

$y-5="-\frac{5}{2}"(x-8)$ with the coordinates in the correct positions. If $y=-\frac{1}{m}x+c$ is used they must proceed as far as $c=...$

It is dependent on both of the previous two method marks.

A1*: Correctly achieves $5x+2y-50=0$ (in any order on the same side of the equation).
There must be a correct intermediate stage of working following their initial equation for *l* before achieving the given answer, e.g. $y-5=-\frac{5}{2}\left(x-8\right)\Rightarrow 2y-10=-5x+40\Rightarrow 5x+2y-50=0$

(b) **Note that if no integration is seen then 0 marks.**

M1: Integrates to achieve a correct form $b\left(4x\pm 7\right)^{\frac{3}{2}}$ o.e. (the index does not need to be processed)

May use substitution e.g. $u=4x\pm 7\Rightarrow \int \frac{u^{\frac{1}{2}}}{4}\,\mathrm{d}u\Rightarrow Qu^{\frac{3}{2}}$ (the integral must be correct but allow a slip on the coefficient for the integrated expression)

A1: Correct integration $\frac{\left(4x-7\right)^{\frac{3}{2}}}{6}$ (which may be unsimplified) with or without a constant of integration.
Condone poor notation e.g. if the integral sign and/or d*x* is still present. Index needs to be processed.

Using the substitution method score for e.g. $\frac{u^{\frac{3}{2}}}{6}$ where $u=4x-7$

dM1: Full method to find the shaded area. Note the area of the triangle is $\frac{1}{2}\times(10-8)\times 5=5$

Look for $\left[b\left(4x\pm 7\right)^{\frac{3}{2}}\right]_{\frac{7}{4}}^{8}+5$ o.e. (Provided this is seen then it is sufficient to proceed to the answer)

The limits must be correct for the integration
May see integration used for the triangle
e.g. $\int_{\frac{7}{4}}^{8}\left(4x\pm 7\right)^{\frac{1}{2}}\,\mathrm{d}x+\int_{8}^{10}\left(-\frac{5}{2}x+25\right)\mathrm{d}x\Rightarrow\left[b\left(4x\pm 7\right)^{\frac{3}{2}}\right]_{\frac{7}{4}}^{8}+\left[-\frac{5}{4}x^{2}+25x\right]_{8}^{10}$
It is dependent on the previous method mark, but you do not need to see the limits substituted in.
If they do not use the given equation of the straight line *l* then this mark cannot be scored.
Condone poor notation provided the intention is clear.

If using the substitution you may see e.g. $\left[\frac{u^{\frac{3}{2}}}{6}\right]_{0}^{25}+5$ (send to review if unsure)

A1: $\frac{155}{6}$ or exact equivalent e.g. $25\frac{5}{6}$ or $25.8\dot{3}$ provided all the previous marks have been scored.

Question Number	Scheme	Marks
7 (a)	$\sqrt{2}\sin(x+45°)=\cos(x-60°)$	
	$\sqrt{2}(\sin x\cos 45°+\cos x\sin 45°)=\cos x\cos 60°+\sin x\sin 60°$	M1 A1
	$\sin x+\cos x=\frac{1}{2}\cos x+\frac{\sqrt{3}}{2}\sin x$	
	$\cos x=(\sqrt{3}-2)\sin x$	M1
	$\tan x\left(=\frac{1}{\sqrt{3}-2}=\frac{\sqrt{3}+2}{-1}\right)=-2-\sqrt{3}$ *	A1*
		(4)
(b)	States or uses $x+45°=2\theta$ o.e.	B1
	Proceeds from e.g. $\tan(2\theta-45°)=-2-\sqrt{3}\Rightarrow 2\theta-45°=105°,285°$	M1
	Correct order of operations to find one angle	dM1
	$\theta=75°,165°$	A1
		(4)
		(8 marks)

(a) Condone working in mixed variables

M1: Attempts to use the compound angle identities to produce an equation in $\sin x$ and $\cos x$

Look for $\sqrt{2}\times(\sin x\cos 45°\pm\cos x\sin 45°)=\cos x\cos 60°\pm\sin x\sin 60°$ o.e.

May be implied by a first line of e.g. $\sin x\pm\cos x=\frac{1}{2}\cos x\pm\frac{\sqrt{3}}{2}\sin x$ o.e.

Condone missing brackets.

A1: Correct equation in $\sin x$ and $\cos x$.

E.g. $\sqrt{2}(\sin x\cos 45°+\cos x\sin 45°)=\cos x\cos 60°+\sin x\sin 60°$ o.e. (may be implied by further work). May also see use of equivalent angles e.g. $\cos(-60)°=\cos 60°$

M1: For an attempt to solve the problem. Look for an attempt (condoning slips) at two of the three elements required to complete the proof, namely

- use of correct exact trigonometric values for $\sin 45°,\cos 45°,\cos 60°,\sin 60°$
- collection of like terms in $\sin x$ and $\cos x$ or $\tan x$
- use of $\tan x=\frac{\sin x}{\cos x}$

A1*: Proceeds to the given answer with all previous marks scored.

There should be no errors in the manipulation and no bracket omissions, other than a missing trailing bracket.

e.g. $\sqrt{2}(\sin x\cos 45°+\cos x\sin 45°=\cos x\cos 60°+\sin x\sin 60°$

When proceeding from $A\sin x=B\cos x$ (where A or B may be 1) to the given answer it is acceptable to proceed from $\frac{1}{2}\cos x=\frac{-2+\sqrt{3}}{2}\sin x$ to the given answer as evidence of the use of $\tan x=\frac{\sin x}{\cos x}$.

Condone poor notation to be recovered provided the final answer line is written correctly. Condone working in mixed variables provided the final given answer is all in terms of x.

Allow surd work to be done via a calculator.