Question Number	Scheme	Marks
2(a)	$\text{ff}(6)=\text{f}\left("\frac{9}{2}"\right)=\frac{"9/2"+3}{"9/2"-4}=...;\ =15$	M1; A1
		(2)
(b)	$\text{f}^{-1}(x)=\frac{4x+3}{x-1}$	M1A1
	$x\in\mathbb{R},\ x\neq 1$	B1
		(3)
(c)	E.g. $\left(\frac{x+3}{x-4}\right)^2+5=7$ or $\frac{a+3}{a-4}=(\pm)\sqrt{7-5}$	M1
	$\Rightarrow x^2-22x+23=0\Rightarrow x=...$ or $(a+3)=(\pm)\sqrt{2}(a-4)\Rightarrow a=...$	dM1
	$(a=)11+7\sqrt{2}$ oe	A1
		(3)
		(8 marks)

Notes

(a)

M1: Substitutes $x=6$ into f and substitutes the result back into f to find a value for $\text{ff}(6)$

Alternatively substitutes $x=6$ into $\text{ff}(x)=\dfrac{\left(\frac{x+3}{x-4}\right)+3}{\left(\frac{x+3}{x-4}\right)-4}$ condoning slips.

A1: 15

(b)

M1: Changes the subject of $y=\frac{x+3}{x-4}$ or $x=\frac{y+3}{y-4}$ to $y=\frac{...x\pm 3}{...x\pm 1}$ or $x=\frac{...y\pm 3}{...y\pm 1}$

A1: Achieves $\text{f}^{-1}(x)=\frac{4x+3}{x-1}$. Accept $\text{f}^{-1}=...$ or $y=\ldots$ instead of $\text{f}^{-1}(x)=....$

B1: $x\neq 1$. The omission of $x\in\mathbb{R}$ is condoned. Accept alternative notations.

(c) Note this is M1A1A1 on epen but is being marked as M1dM1A1.

M1: Correct attempt to set up an equation in *x* or *a*. This will usually be $\left(\frac{x+3}{x-4}\right)^2+5=7$ but $\text{f}(a)=\text{g}^{-1}(7)$ may be used first. Score when a suitable equation is set up and allow if a minor slip or miscopy is made if the intention is clear.

dM1: Proceeds to solve for *x* or *a*, e.g. forms a 3TQ and solves, or take the 5 across, square roots, cross multiplies and makes *a* the subject, condoning e.g. sign slips when rearranging.

Alternatively, uses $(\text{f}(x))^2+5=7\Rightarrow\text{f}(x)=(\pm)\sqrt{2}$ and their part (b) leading to $a=\text{f}^{-1}("\sqrt{2}")=\frac{"4\sqrt{2}+3"}{"\sqrt{2}-1"}$. In this method both M's may be scored together.

A1 $11+7\sqrt{2}$ or $\frac{4\sqrt{2}+3}{\sqrt{2}-1}$ Accept $11+\sqrt{98}$ or $\frac{-4\sqrt{2}-3}{1-\sqrt{2}}$. Common factors should be cancelled.

Ignore labelling of *x* or *a*. Condone e.g. if $11-7\sqrt{2}$ is also given as a solution but A0 if any other extra solutions are included.

Question Number	Scheme	Marks
3(a)	$(\cos 2A \equiv)\cos A\cos A - \sin A\sin A \equiv \cos^2 A - (1-\cos^2 A)$	M1
	$\Rightarrow \cos 2A \equiv 2\cos^2 A - 1$ *	A1*
		(2)
(b)	$\int (3-2\cos 6x)\,\mathrm{d}x = 3x - \frac{\sin 6x}{3}$ $(+c)$	M1A1
	$\left[3x - \frac{\sin 6x}{3}\right]_{\frac{\pi}{12}}^{\frac{\pi}{8}} = \left(3\left(\frac{\pi}{8}\right) - \frac{\sin\left(6\times\frac{\pi}{8}\right)}{3}\right) - \left(3\left(\frac{\pi}{12}\right) - \frac{\sin\left(6\times\frac{\pi}{12}\right)}{3}\right) = \frac{1}{8}\pi + \frac{2-\sqrt{2}}{6}$	dM1A1
		(4)
		(6 marks)

Notes

(a)

M1: Writes $(\cos 2A \equiv)\cos A\cos A - \sin A\sin A$ and attempts to **use** (not just stated separately) the identity $\pm\sin^2 A \pm \cos^2 A = \pm 1$ Note going directly to $\cos 2A \equiv \cos^2 A - \sin^2 A$ is allowed M1 as long as a use of the Pythagorean identity is clear. NB Watch out for answers which use double angle identities in the proof (circular reasoning) and score M0 if no Pythagorean identity is used.

A1*: Achieves the given answer with no errors seen (and no circular reasoning). Must see $\cos 2A \equiv \cos A\cos A - \sin A\sin A$ and clear attempt at substitution of $\sin^2 A + \cos^2 A = 1$ but allow "LHS" for "cos 2*A*". Going directly to $\cos 2A \equiv \cos^2 A - \sin^2 A$ in the first step would score A0. Correct notation must used throughout but condone a missing closing bracket.

Note : $\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1$ with no further evidence scores M0A0 as they are just writing out known formulae.

(b)

M1: Attempts to substitute in the given result in part (a) and integrates to the form $...x \pm ...\sin 6x$ Must be a full substitution in terms of *x*, $\cos 2A \to k\sin 2A$ is M0 unless recovered, e.g by later substitution may be implied by the limits substituted).

A1: $3x - \frac{\sin 6x}{3}$

dM1: Shows evidence of substituting in both limits into an expression of the form $...x \pm ...\sin 6x$ and subtracts either way round to achieve an exact (not necessarily simplified but trig must be evaluated) answer.

A1: Correct answer e.g as scheme or $\frac{1}{8}\pi + \frac{1}{3} - \frac{\sqrt{2}}{6}$ or exact equivalent (and isw after a correct answer).