(c)	$y=\frac{2x}{3x+1}\Rightarrow 3xy+y=2x\Rightarrow 3xy-2x=-y\Rightarrow x(3y-2)=-y$ or $x=\frac{2y}{3y+1}\Rightarrow 3xy+x=2y\Rightarrow 3xy-2y=-x\Rightarrow y(3x-2)=-x$	M1
	$\Rightarrow \mathrm{f}^{-1}(x)=\frac{x}{2-3x}$	A1
		(2)
(d)	$\mathrm{f}^{-1}(x)=\mathrm{f}(x)$ **or** $\mathrm{f}^{-1}(x)=x$ **or** $\mathrm{f}(x)=x$ $"\frac{x}{2-3x}"=\frac{2x}{3x+1}$ **or** $"\frac{x}{2-3x}"=x$ **or** $\frac{2x}{3x+1}=x$ $\Rightarrow x(3x+1)=2x(2-3x)$ **or** $x=x(2-3x)$ **or** $2x=x(3x+1)$ $\Rightarrow x=...$	M1
	$x=0,\ \frac{1}{3}$	A1
		(2)
		Total 8

(c)

M1: Attempts to change the subject.
If making x the subject, they must proceed as far as getting the two x terms on one side of the equation and the term not in x on the other and factorise out the x.
If making y the subject, they must swap x and y first and then proceed as far as getting the two y terms on one side of the equation and the term not in y on the other and factorise out the y.

A1: Correct expression $\left(\mathrm{f}^{-1}(x)=\right)\frac{x}{2-3x}$ oe e.g. $\left(\mathrm{f}^{-1}(x)=\right)\frac{-x}{3x-2}$
Accept equivalent expressions and isw after a correct answer is seen.
Do **not** be concerned with the lhs and just look for the correct expression in terms of x.
You can also ignore any reference to a domain as this is **not** required.

(d)

M1: Sets up one of the required equations e.g.

$$\text{their } \mathrm{f}^{-1}(x)=\mathrm{f}(x) \text{ **or** their } \mathrm{f}^{-1}(x)=x \text{ **or** } \mathrm{f}(x)=x$$

and proceeds to obtain at least one value for x.
If using their $\mathrm{f}^{-1}(x)$ it must be a function of x.
Condone copying slips as long as the intention is clear.

A1: Correct values $x=0,\ \frac{1}{3}$. Allow exact equivalents for $\frac{1}{3}$ including $0.\dot{3}$
Do not isw e.g. if they clearly reject $x = 0$ then score A0
Ignore any attempts to find the y values.

Question Number	Scheme	Marks
2(a)	$R = 25$	B1
	$\tan\alpha = \frac{24}{7} \Rightarrow \alpha = ...$	M1
	$\alpha = 1.287$	A1
		(3)
(b)(i)	$\text{Min} = \frac{5}{90 - 3\times"25"\times(-1)}$	M1
	$= \frac{1}{33}$	A1
(b)(ii)	$(2x + "1.287") = \pi, ... \Rightarrow x = ...$	M1
	$\Rightarrow x = \frac{\pi - "1.287"}{2} = 0.927$	A1
		(4)
		Total 7

Notes:

(a)

B1: Correct value. May be seen embedded in e.g. $(\text{f}(x) =)25\cos(x + ...)$.

Condone e.g. $R = \sqrt{7^2 + (-24)^2} = 25$

Do not allow ± 25 unless the -25 is rejected.

M1: Allow for: $\tan\alpha = \pm\frac{24}{7}$, $\tan\alpha = \pm\frac{7}{24}$, $\cos\alpha = \pm\frac{7}{\text{their } R}$, $\sin\alpha = \pm\frac{24}{\text{their } R}$ leading to a value for α.

If no method is shown it may be implied by their value for α as awrt 1.3 rads or awrt 74°

A1: Awrt 1.287 Isw once the mark is awarded. Must be in radians.

May be seen embedded in e.g. $(\text{f}(x) =)...\cos(x + 1.287)$.

Apply isw if correct R and α are seen followed by e.g. $(\text{f}(x) =)25\cos(x - 1.287)$.

Mark (b)(i) and (ii) together.

(b)(i)

M1: Award for $\frac{5}{90 + 3\times\text{Their } R}$.

May be implied by their value (which may be a decimal) and may be seen embedded in e.g. coordinates $\left(\frac{\pi - 1.287}{2}, \frac{1}{33}\right)$ which would score (i) M1 A1 and (ii) M1

A1: For $\frac{1}{33}$ only.

Note that both marks are available in (b)(i) even if their α is incorrect.

(b)(ii) **Note that (b)(ii) can be marked independently.**

M1: For an attempt to solve $2x \pm "1.287" = \pi$ to obtain a value for x. May be implied by awrt 0.927

Condone a sign slip but the order of operations must be essentially correct e.g.

$2x \pm "1.287" = \pi \Rightarrow 2x = \pi \pm "1.287" \Rightarrow x = \frac{\pi \pm "1.287"}{2}$

Condone an attempt to solve e.g. $2x \pm "74°" = 180°$ but not mixed units e.g. $2x \pm "1.287" = 180$

A1: For awrt 0.927