Question Number	Scheme	Marks
3 (a)	$x=\dfrac{t+15}{t+4}\Rightarrow t=\dfrac{15-4x}{x-1}$	M1
	$y=\dfrac{5}{t+2}\Rightarrow y=\dfrac{5}{\dfrac{15-4x}{x-1}+2}$	M1
	$y=\dfrac{5(x-1)}{15-4x+2(x-1)}$	dM1
	$\mathrm{g}(x)=\dfrac{5x-5}{13-2x}\qquad 1<x,,\dfrac{15}{4}$	A1B1
		(5)
(b)	$0<\mathrm{g}(x),,\dfrac{5}{2}$	M1A1
		(2)
		(7 marks)

(a)

M1: Attempts to get *t* in terms of *x* or *t* in terms of *y*. FYI $y=\dfrac{5}{t+2}\Rightarrow t=\dfrac{5}{y}-2$

Look for an equation of the form $t=\dfrac{A+Bx}{C+Dx}$ oe or $t=\dfrac{E}{y}+F$ oe where *A*,*B*, *C*, *D*, *E*, *F* $\neq 0$

If they get *t* in terms of *x* in one and *t* in terms of *y* in the other then just look for one of the equations to be of the required forms.

M1: Substitutes their *t* in terms of *x* (or *y*) in *y* (or *x*) however poorly manipulated and proceeds to an equation linking *x* and *y*. Condone slips substituting in provided the intention is clear.

FYI: $y=\dfrac{5}{t+2}\quad x=\dfrac{\dfrac{5}{y}-2+15}{\dfrac{5}{y}-2+4}=\dfrac{\dfrac{5}{y}+13}{\dfrac{5}{y}+2}$

Rearranging both equations to get *t* in terms of *x* in one and *t* in terms of *y* in the other and then equating scores this mark. Condone $y=\ldots$ or $x=\ldots$ to be implied as long as it is clearly their *y* or *x*

dM1: Proceeds to an equation of the form $y=\dfrac{ax+b}{cx+d}$ **which may be unsimplified.**

e.g. $y=\dfrac{5(x-1)}{15-4x+2(x-1)}$. It is dependent on the previous two method marks. There should be no fractions in the numerator or denominator but brackets do not need to be multiplied out. Condone slips provided they

achieved the required form. Condone $y = \ldots$ to be implied as long as it is clearly their *y*

A1: $g(x) = \frac{5x-5}{13-2x}$ o.e. Must be a single fraction in the correct form e.g. $g(x) = \frac{5-5x}{2x-13}$ Condone $y = \ldots$ Note the fraction may not be in its lowest terms e.g. $g(x) = \frac{10x-10}{26-4x}$

The $y = \ldots$ or $g(x) = \ldots$ can be seen on an earlier line

B1: States the values separately $e = 1,\ f = 3.75$. Accept $1 < x$,, $\frac{15}{4}$ oe (condone $1 < x \leqslant \frac{15}{4}$ as this was given in the question

(b)

M1: One correct end. e.g. $g(x)$,, $\frac{5}{2}$ oe. Do not be concerned over the inequality being strict or inclusive.

A1: $0 < g(x)$,, $\frac{5}{2}$ o.e. Condone use of *y* or g but not *x* e.g. $0 < y$,, $\frac{5}{2}$ and alternative equivalent notation e.g. $\left(0, \frac{5}{2}\right]$ $0 < g(x), \frac{5}{2} \ldots g(x)$ $0 < g(x) \cap \frac{5}{2} \ldots g(x)$ or $0 < g(x)$ AND $\frac{5}{2} \ldots g(x)$ but do not accept "OR" or use of $\cup$

Special case: $0 < x$,, $\frac{5}{2}$ oe score M1A0

Question Number	Scheme	Marks
4 (a)	Attempt at chain rule $y^2 \to ...y\frac{dy}{dx}$	M1
	Attempt at product rule $2xy \to \alpha x\frac{dy}{dx}+\beta y$	M1
	Correct differentiation $8x+2y\frac{dy}{dx}-2y-2x\frac{dy}{dx}=24$ oe	A1
	Collects terms in $(2y-2x)\frac{dy}{dx} = 24-8x+2y$	M1
	$\left(\frac{dy}{dx} =\right) \frac{12-4x+y}{y-x}$ oe	A1
		(5)
(b)	Sets $\frac{12-4x+y}{y-x}=2 \Rightarrow y=12-2x$ or $x=6-\frac{1}{2}y$	M1
	Substitute $y=12-2x$ or $x=6-\frac{1}{2}y$ into $4x^2+y^2-2xy=24x$	dM1
	$x^2-8x+12=0$ oe or $y^2-8y=0$	A1
	Solves $x=6, y=0$ or $x=2, y=8$	ddM1
	Chooses $a(x)=2, b(y)=8$ or states $(2, 8)$ only	A1
		(5)
		(10 marks)

(a) **Allow use of y' for $\frac{dy}{dx}$**

M1: Attempt at chain rule $y^2 \to ...y\frac{dy}{dx}$ where ... is a constant

M1: Attempt at product rule $2xy \to \alpha x\frac{dy}{dx}+\beta y$ where α, β ... are non-zero constants.

Condone $-2xy \to \pm\alpha x\frac{dy}{dx}\pm\beta y$

A1: Correct differentiation $8x+2y\frac{dy}{dx}-2y-2x\frac{dy}{dx}=24$ oe

M1: Collects their two different terms in $\frac{dy}{dx}$ which must have come from differentiating y^2 and $2xy$ (however poorly the differentiation was carried out) on one side of the equation with the remaining terms on the other side proceeding to $(...\pm...)\frac{dy}{dx}=.....$. May be implied by a correct answer.