Question Number	Scheme	Notes	Marks
8(a)	For intersection when $x > 0$: $\frac{15x}{x+4} = x-2$ $15x = x^2 + 2x - 8$ $x^2 - 13x - 8 = 0$ $\Rightarrow x = \frac{13+\sqrt{201}}{2}$	M1: Solves 3TQ obtained from a correct equation (usual rules) for $x > 0$ A1: Correct exact positive value (condone negative root also included)	M1 A1
	For intersections when $x < 0$: $\frac{15x}{-x+4} = x-2$ $15x = -x^2 + 6x - 8$ $x^2 + 9x + 8 = 0$ $(x+8)(x+1) = 0$ $\Rightarrow x = -8, \quad -1$	M1: Solves 3TQ obtained from a correct equation (usual rules) for $x < 0$ A1: Correct values	M1 A1
	$-8 < x < -1, \quad x > \frac{13+\sqrt{201}}{2}$	M1: For $a < x < b, \ x > c$ oe with cvs $a < b < 0 < c$ from the correct equations. A1: Fully correct set of values in any form	M1 A1
			(6)
(b)	$\frac{15x}{x+4} = -x+2$ $15x = -x^2 - 2x + 8$ $x^2 + 17x - 8 = 0$ $\Rightarrow x = \frac{-17+\sqrt{321}}{2}$	M1: Solves 3TQ obtained from a correct equation (usual rules) A1: Correct exact positive value (condone negative root also included)	M1 A1
	$x < "-8", \quad x > "\frac{13+\sqrt{201}}{2}"$	Correct regions ft their $a < 0$ and $c > 0$	B1ft
	$x < "-8", \quad "-1" < x < \frac{-17+\sqrt{321}}{2}, \quad x > "\frac{13+\sqrt{201}}{2}"$	Correct set of values in any form. Allow ft on their cvs a, b and c provided $a < b < 0$ and $c > \frac{-17+\sqrt{321}}{2} (= 0.458...)$	A1ft
			(4)
			Total 10

Additional notes.

"Usual Rules" : as well as the general information, we will accept here solutions by calculator having reached a quadratic equation but they must be correct solutions for the stated quadratic if no method is shown (you may need to check).

(a)

Accept with any inequalities used instead of equalities for the solving of the intersection points. For methods via putting over common denominators score the Ms for the process of putting over a common denominator and solving for the numerator = 0.

May see attempts via squaring

$\frac{15x}{|x|+4} = x-2 \Rightarrow |x| = \frac{15x}{x-2} - 4 = \frac{11x+8}{x-2} \Rightarrow x^2 = \left(\frac{11x+8}{x-2}\right)^2$ then cross multiplies (or puts over a common denominator $(x-2)^2$) to get

$\Rightarrow x^2(x^2-4x+4) - \left(121x^2+176x+64\right) = x^4 - 4x^3 - 117x^2 - 176x - 64 = 0$. This will probably then be solved by calculator, which as algebra has been used will be accepted. Score M1 for the process reaching quartic, A1 correct quartic, M1 for solving the quartic (look for attempt to factorise to linear terms with correct product of roots, or accept answer from calculator – may need to check), A1 for at least the three relevant roots (and condone if x =2 is also include for this mark).

For the final M they must be producing a solution set of the correct form from their CVs from attempts at the correct equations (but may have had incorrect method for solving), so if extra values from denominators are used it will be M0 (regardless of whether the form of the answer is correct).

FYI $\frac{-13-\sqrt{201}}{2} \approx -13.6$ is being used often as one of the limits, but note it is less than −8, so $-8 < x < \frac{-13-\sqrt{201}}{2}$ used is M0 but you may condone the "$-8 < x$" for the B1ft in (b).

Final A1: Accept any correct equivalent notation. Accept with "and" or "or" written between inequalities, but if using set notation must use the union. E.g. in interval notation $(-8,-1) \cup \left(\frac{13+\sqrt{201}}{2}, \infty\right)$. Use of square brackets is A0.

(b)

Attempts at squaring may be seen again here. They will need a full process leading solving a quartic. Again for the A, accept if other roots are also included at this stage.

B1ft: For the follow through same "outside" ends of the region matching their answer to (b) in their **final** answer.

A1ft: Accept answers of the correct form providing their answer to (a) was of the correct form as specified in the scheme and their c is $c > \frac{-17+\sqrt{321}}{2} (= 0.458...)$.