Question Number	Scheme	Marks
3	$\dfrac{x+2}{x+4} \leqslant \dfrac{x}{k(x-1)}$	
(a)	$\left[\times k\left(x+4\right)^2(x-1)^2 \Rightarrow\right] \quad k(x+4)(x-1)^2(x+2) \leqslant x(x+4)^2(x-1)$ $\Rightarrow k(x+4)(x-1)^2(x+2) - x(x+4)^2(x-1)\{\leqslant 0\}$ **OR** $\dfrac{x+2}{x+4} - \dfrac{x}{k(x-1)}\{\leqslant 0\} \Rightarrow \dfrac{k(x+2)(x-1)-x(x+4)}{k(x+4)(x-1)}\{\leqslant 0\}$	M1
	$\left(x+4\right)\left(x-1\right)\left[kx^2+kx-2k-x^2-4x\right]\{\leqslant 0\}$	**d**M1
	$\left(x+4\right)\left(x-1\right)\left[\left(k-1\right)x^2+\left(k-4\right)x-2k\right] \leqslant 0$ (oe in corerct form)	A1cso
		(3)
(b)	$k = 3 \Rightarrow 2x^2 - x - 6 = 0$ $[(2x + 3)(x – 2) = 0] \quad \Rightarrow x = -\frac{3}{2}, 2$	M1
	$–4 < x \leqslant -\frac{3}{2} \quad 1 < x \leqslant 2$	**d**M1 A1 A1
		(4)
		Total 7

Notes

(a)

M1: Attempts to multiply both sides by e.g. $k\left(x+4\right)^2(x-1)^2$ or $k^2\left(x+4\right)^2(x-1)^2$ and bring terms together OR bring terms together and attempt a common denominator. There may be slips but the intention must be clear - allow if e.g. one term is missing.

dM1: Factorises out $\left(x+4\right)\left(x-1\right)$ and/or multiplies by $\left(x+4\right)^2(x-1)^2$ (which could be implied) and expands remaining terms to get unsimplified 3 term quadratic (terms need not be collected but it must be equivalent to $px^2 + qx + r$ where at least one of p, q and r is a function of k and none are zero). **Dependent on previous M mark.**

A1cso: Correct statement or $p = k – 1$, $q = k – 4$, $r = –2k$ with no algebraic errors (but condone e.g. recovery of missing brackets if work is clear). It is A0 if any incorrect statement is seen e.g., use of an incorrect inequality sign. Accept with any positive multiples of the coefficients (including k or $1/k$ etc).

(b)

M1: Uses $k = 3$ **in their quadratic from (a)** (implied by 2 out of three terms correct) and solves to obtain a value. Apply usual rules (may be by calculator - may need to check). If no working, obtains one consistent solution which must be real. **Alternatively** restarts from $\dfrac{x+2}{x+4} \leqslant \dfrac{x}{3(x-1)}$ and uses a valid method to obtain and solve a quadratic (see above). Marks for (a) cannot be scored in (b).

dM1: With critical values –4, 1 and two different real solutions from their quadratic ($\neq$ –4 or 1), chooses the region between the two smaller values and the region between the two larger values and no other region. Could be non-strict inequalities. **Dependent on previous M mark.**

A1: Both regions correct but condone e.g incorrect strict non-strict inequalities.

A1: Both completely correct regions. Allow equivalent notations. Ignore any word between the regions but withhold this last mark if $\cap$ used with set notation.