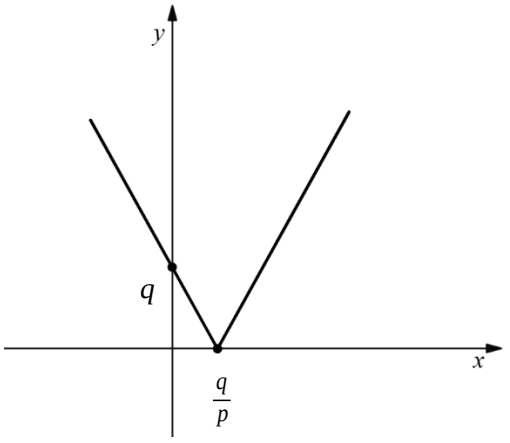
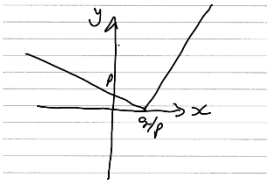
Question	Scheme	Marks	AOs
12(a)		B1 B1 B1	1.1b 1.1b 1.1b
		(3)	
(b)	$\frac{k}{x} = -px + q \Rightarrow px^2 - qx + k = 0$	M1 A1	2.1 1.1b
	$b^2 - 4ac > 0 \Rightarrow q^2 - 4pk > 0$	M1	3.1a
	$(0 <) \; k < \frac{q^2}{4p}$	A1	2.2a
		(4)	
			(7 marks)

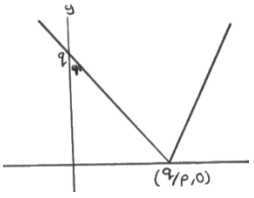
Notes

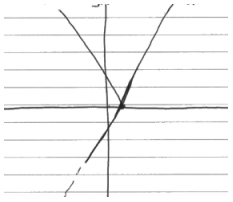
(a) Do not penalise if they have working for part (b) on the graph as well

B1: A V shaped curve sitting on the positive *x*-axis and appearing in at least quadrant 1. Do not be too concerned about the graph being non-symmetrical.
Condone/give BOD if their right arm of the V extends as part of their working.

Examples of graphs which score B1







Note any labelling on the graph takes precedence over coordinates stated in the main body of the text.

B1: The vertex is on the positive *x*-axis and is marked $\left(\frac{q}{p}, 0\right)$ or allow $(x =) \frac{q}{p}$ which may be seen as the intercept on the graph. May be scored from an incorrect shape for the graph, but must have a single vertex on the *x*-axis. Condone the coordinates written the wrong way round provided point is in the correct position.

B1: The graph **passes through the positive *y*-axis** at (0, *q*) or allow $(y=)\,q$ which may be seen as the intercept on the graph. Note a graph which just meets at (0, *q*) and does not appear in both quadrants 1 and 2 is B0

Condone the coordinates written the wrong way round provided point is in the correct position.

(b) **Note some candidates also attempt $\frac{k}{x} = px - q$ Withhold the final A mark only when the range is not fully correct. E.g. they would have to reject the range of values k,, 0 or give an inequality which is $k < \frac{q^2}{4p}$ oe only**

M1: Sets $\frac{k}{x} = -px + q$ and rearranges to a 3TQ equation in *x* with terms collected on one side.

Condone sign slips in their rearrangement only.

Note setting $\frac{k}{x} = -px - q$ is incorrect and scores M0

A1: $px^2 - qx + k = 0$ oe with all terms on the same side. May be implied by further work e.g. attempting the discriminant with correct values for *a*, *b* and *c* for their 3TQ equation in *x*

M1: Attempts $b^2 - 4ac > 0$ for their 3TQ in *x* with *a*, *b* and *c* in terms of *p*, *q* and *k*. This does not need to be from setting $\frac{k}{x} = -px + q$. The constants *p*, *q* and *k* embedded in the correct positions in the inequality is sufficient for this mark. Condone use of ... for this mark and if "=" seen then check further work to see if a valid inequality is formed.

A1: $k < \frac{q^2}{4p}$ oe e.g. $k < 0.25q^2p^{-1}$ Does not require a lower bound for *k* but if given it must be $0 < k < \frac{q^2}{4p}$ oe May use alternative notation e.g. $\left\{k : k < \frac{q^2}{4p}\right\}$ or $\left(0, \frac{q^2}{4p}\right)$

Do not accept e.g. $\left[0, \frac{q^2}{4p}\right]$ or $k \leq \frac{q^2}{4p}$

Only isw if a correct range is given but they then attempt to use set/interval notation incorrectly.

Note: Alternatively, it is unlikely to be successful but they may attempt to square both sides and multiply out both sides, making little further progress. However, it they attempt the difference of two squares **and** reach a 3TQ equation in *x* with all terms collected on one side this may score M1.