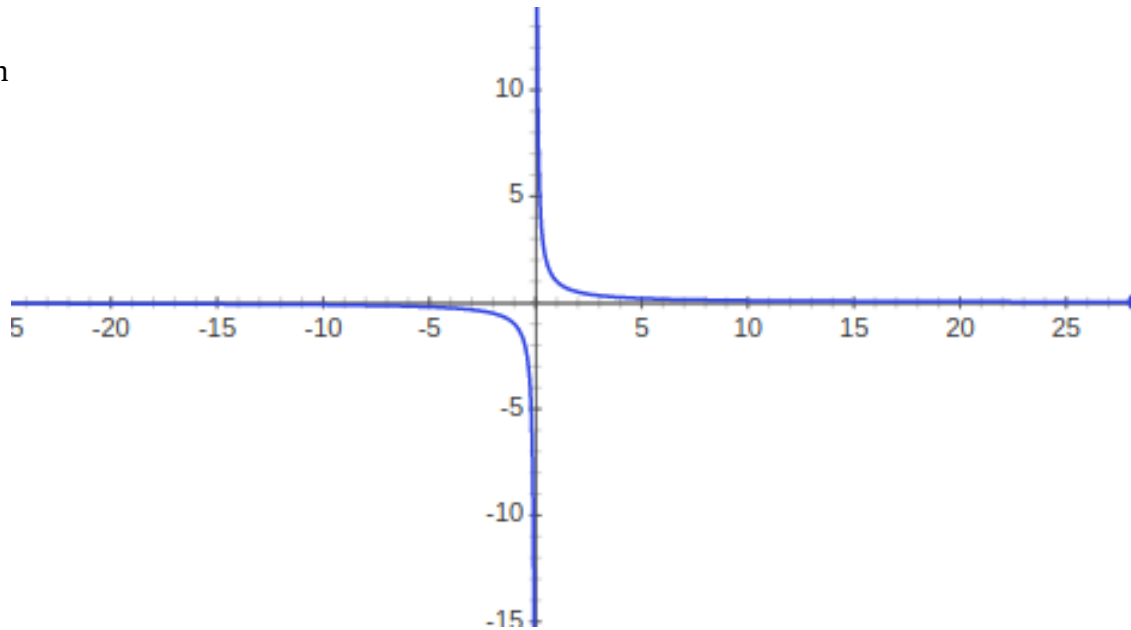Q3.

The plot of $y = 1/x$ is

Given

Transformation is

$$M = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$

The parametric form of a point of the hyperbola given by the equation $y = 1/x$ is

$\begin{bmatrix} t \\ 1/t \end{bmatrix}$ $t \ne 0$ in 2-D i.e $\begin{bmatrix} t \\ 1/t \\ 1 \end{bmatrix}$ in Homogenous coordinates.

Now getting the paramaterised form of the point after the transformation is applied is

$$\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix} * \begin{bmatrix} t \\ 1/t \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1/t \\ t \end{bmatrix}$$

which in 2-D will be $\begin{bmatrix} 1/t \\ 1/t^2 \end{bmatrix}$;

The equation of this parameterised function is $y = x^2$.

The general transformation of a function $y = f(x)$ **under M is** $y = x * f(1/x)$

The graph of the parabola $y = x^2$ obtained after the transformation looks like this :
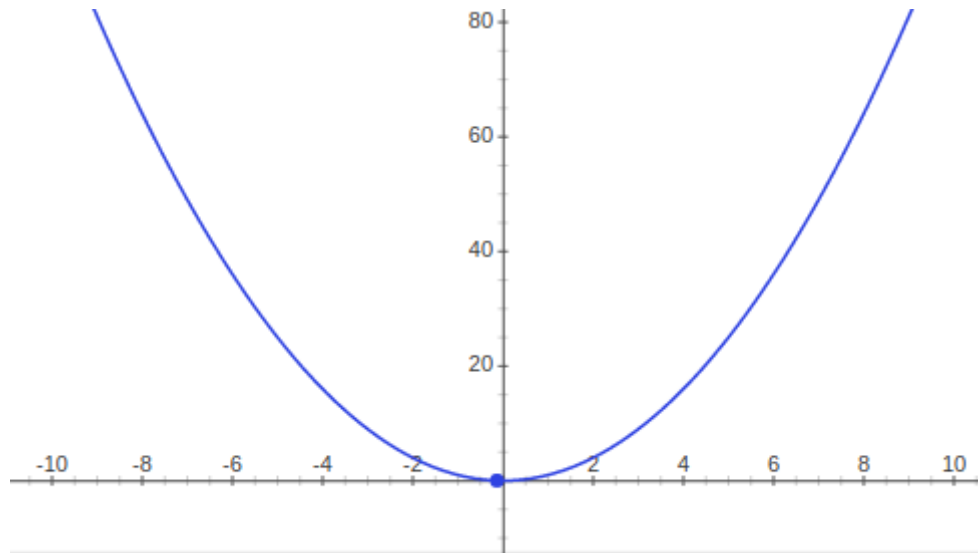
Clearly the transformation given is a non-affine transformation . Hence the hyperbola changed into a parabola.