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CONSTRUCTION OF HYPERBOLA

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Abstract

Think in the first quadrant. Let Q and Q' be the intersection of a circle $x^2 + y^2 = 1$ and any straight line parallel to the y-axis. The straight line connecting Q and $A(1, 0)$ is l, and the straight line connecting Q' and $A'(-1, 0)$ is l'. The intersection of the straight line l and the straight line l' is on the hyperbola $x^2 - y^2 = 1$.

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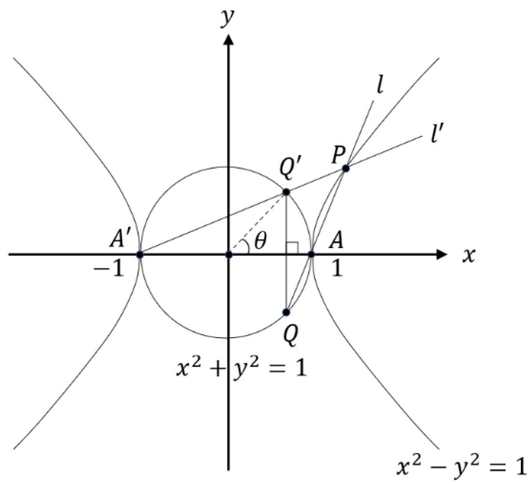
Proof.



$$\begin{cases} l : y = \dfrac{\sin\theta}{1-\cos\theta}(x-1) \\ l' : y = \dfrac{\sin\theta}{1+\cos\theta}(x+1) \end{cases}$$

$$\Rightarrow \begin{cases} l : (1-\cos\theta)y = \sin\theta(x-1) \\ l' : (1+\cos\theta)y = \sin\theta(x+1) \end{cases}$$

$$\Rightarrow (1-\cos^2\theta)y^2 = \sin^2\theta(x^2-1)$$

$$\Rightarrow x^2 - y^2 = 1.$$