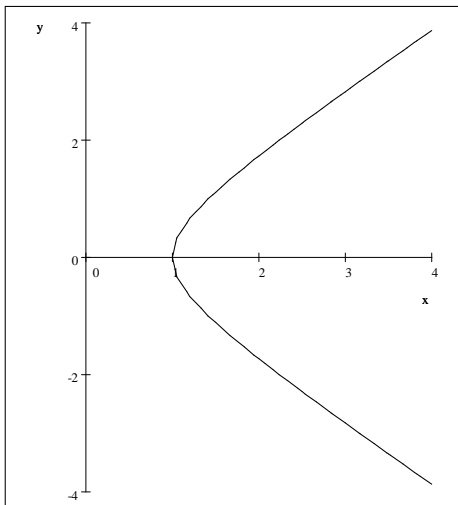


Q.1: Q.1: Eliminate the parameter t from the parametric equations $x = \csc(t)$, $y = \cot(t)$ to find a cartesian equation. Sketch the graph and mark the direction in which the curve is traced for $0 < t < \pi$.

Sol: $x^2 = \csc^2 t$, $y^2 = \cot^2 t$
 $1 + y^2 = 1 + \cot^2 t = \csc^2 t = x^2$
 $x^2 - y^2 = 1$, a hyperbola.

t	x	y
0	∞	∞
$\frac{\pi}{2}$	1	0
π	∞	$-\infty$



Q.2: Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for the parametric equations given in Question 1.

Sol: $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{-\csc^2 t}{-\csc t \cot t} = \frac{\csc t}{\cot t} = \frac{1}{\sin t} \frac{\sin t}{\cos t} = \sec t$.

$$\frac{d^2y}{dx^2} = \frac{\frac{d}{dt} \left(\frac{dy}{dx} \right)}{\frac{dx}{dt}} = \frac{\frac{d}{dt} (\sec t)}{-\csc t \cot t} = \frac{\sec t \tan t}{-\csc t \cot t} = -\tan^3 t.$$

Q.3: Sketch the graph of the polar equation $r = 3 - 2 \sin(\theta)$.

