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Parametric Equations - Parabola (Example)

A curve has parametric equations $x = \cot t + 1$, $y = \operatorname{cosec}^2 t - 4$, $0 < t < \pi$ show that the cartesian equation of the curve is a parabola and sketch the curve. State the domain and range.

Since $x = \cot t + 1$

$\therefore \cot t = x - 1$

and $y = \operatorname{cosec}^2 t - 4$

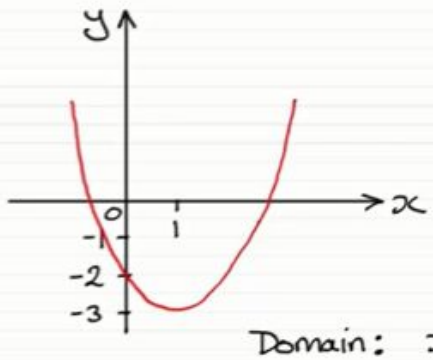
$\therefore \operatorname{cosec}^2 t = y + 4$

Since $1 + \cot^2 t \equiv \operatorname{cosec}^2 t$

$\therefore 1 + (x-1)^2 = y + 4$

$\therefore y = (x-1)^2 - 3$

$\therefore y = x^2 - 2x - 2$



Domain: $x \in \mathbb{R}$

Range: $y \geqslant -3$

With the acknowledgement of Exam Solutions.

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