Exercise 6.5

Written by Shahid Javed

Sketching of Curves in Polar Coordinates:

To sketch the graph of a curve whose equation is given in polar coordinates, the following properties of the curve should be examined.

1. Symmetry about the initial line: \( x = 0 \) (x-axis)

The curve is symmetric about the initial line if the curve remains the same on changing \((r, \theta)\) to \((r, -\theta)\) or \((-r, \theta)\) e.g.

\[
\begin{align*}
  r &= a \\
  r &= a \cos \theta \\
  r &= a \sin \theta
\end{align*}
\]

\( \therefore \) there is no change in the curve.

\( \therefore \) it is symmetric about the initial line.

2. Symmetry about the line \( \theta = \frac{\pi}{2} \) (y-axis)

The curve is symmetric about the line \( \theta = \frac{\pi}{2} \) (y-axis) if it remains the same on replacing \((r, \theta)\) by \((-r, -\theta)\) or \((r, \pi - \theta)\).

3. Symmetry about the pole:

The curve is symmetric w.r.t. pole (origin) if there is no change in the curve on replacing \((r, \theta)\) by \((-r, \theta)\).

\[
\begin{align*}
  r^2 &= a \sin \frac{\theta}{2} \\
  (-r)^2 &= a \sin \frac{-\theta}{2} \\
  r^2 &= a \sin \frac{\pi}{2}
\end{align*}
\]

\( \therefore \) there is no change in the curve.

\( \therefore \) it is symmetric about pole.

IV. Position of the Pole relative to the Curve

Check whether the pole lies on the curve by putting \( r = 0 \) in the given eq. and find the corresponding value of \( \theta \).

V. Table of Values

Construct a sufficiently complete table of values. This can be a great help in sketching the graph of a curve.
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Sketch the graph of each of the curves. 
(8-15)

Please see these questions on Graph Book.

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