Graphs of Polar Equations

Symmetry

About the x-axis ⇒ replacing \((r, \theta)\) with \((r, -\theta)\) produces equivalent equation

About the y-axis ⇒ replacing \((r, \theta)\) with \((-r, \theta)\) produces equivalent equation

About the origin ⇒ replacing \((r, \theta)\) with \((-r, \theta)\) produces equivalent equation
Polar Equations

limacon \[ r = a \pm b \cos \theta \] \[ r = a \pm b \sin \theta \]
\[ a > b \] \[ a = b \] \[ a < b \] cardioid

lemniscate \[ r^2 = \pm a \cos (2\theta) \] \[ r^2 = \pm a \sin (2\theta) \]

rose \[ r = a \cos (n\theta) \] \[ r = a \sin (n\theta) \]
\( n \) leaves if \( n \) odd
\( 2n \) leaves if \( n \) even

EX 1 Sketch a graph of the given polar equations.

a) \[ r = 4 \sin \theta \]

b) \[ r = -16 \cos(2\theta) \]
c) \( r = 4 - 3 \sin \theta \)

d) \( r = 2\theta \)

e) \( r = \sqrt{2}\ - \sqrt{2} \sin \theta \)

f) \( r^2 = 4 \cos(2\theta) \)