10.3 Videos Guide

10.3a

- Rectangular-polar conversions
  - $x = r\cos\theta$
  - $y = r\sin\theta$
  - $x^2 + y^2 = r^2$
  - $\tan\theta = \frac{y}{x}$

10.3b

Exercises:

- Identify the curve by finding a Cartesian equation for the curve.
  - $r = 4\sec\theta$
  - $r^2 \sin 2\theta = 1$
- Find a polar equation for the curve represented by the given Cartesian equation.
  - $4y^2 = x$

10.3c

- Common types of polar equations
  - $r = a \pm b\sin\theta \;\; (\text{or} \cos\theta)$
    - Cardioid if $a = b$
    - Dimpled limaçon if $a > b$
    - Limaçon with an inner loop if $a < b$
  - $r = a\sin n\theta \;\; (\text{or} \cos \theta)$
    - Rose with n petals if n is odd
    - Rose with $2n$ petals if n is even
    - Circle if $n = 1$
  - $r^2 = a^2\cos 2\theta$ (lemniscate)

10.3d

- Testing for symmetry in the polar plane
  - With respect to the polar axis: replace $\theta \to -\theta$
  - With respect to the line $\theta = \pi/2$: replace $\theta \to \pi - \theta$
  - With respect to the pole: replace $r \to -r$ or $\theta \to \pi + \theta$

  Note: Functions involving the sine function are typically symmetric with respect to the line $\theta = \pi/2$, and functions involving the cosine function are typically symmetric with respect to the polar axis.

10.3e

Exercise:

- Sketch the curve with the given polar equation by first sketching the graph of r as a function of θ in Cartesian coordinates.

  $r = 1 + 2\cos\theta$

10.3f

Exercise:

- Use a graphing device to graph the polar curve. Choose the parameter interval to make sure that you produce the entire curve.
  $r = 2 + \cos(9\theta/4)$