Goal Parametric curves: find tangent lines and arc length. Polar curves: convert between polar and rectangular coordinates; sketch curves, especially circles and cardiods.
Reference: §10.1-10.3

1. Consider the following parametric curve.

$$\begin{cases} x = & 3 - 4t \\ y = & 2 - 3t \end{cases}$$

   (a) Sketch the curve by using the parametric equation to plot a few points. Indicate with an arrow the direction the curve is traced as t increases.

   (b) Eliminate t to find a Cartesian equation for curve.

2. Consider the following parametric curve.

$$\begin{cases} x = & t - t^{-1} \\ y = & 1 + t^2 \end{cases}$$

   Find an equation for the tangent line to this curve at the point corresponding to $t = 1$.

3. Consider the following parametric curve.

$$\begin{cases} x = & e^t + e^{-t} \\ y = & 5 - 2t \end{cases}$$

   Find the arc length of the portion of this curve from $t = 0$ to $t = 3$.

For 4-6, Plot the point with the given Polar coordinates. Label everything. Then find the Cartesian coordinates of the point.

4. $(r, \theta) = \left(2, \dfrac{3\pi}{2}\right)$ 5. $(r, \theta) = \left(\sqrt{2}, \dfrac{\pi}{4}\right)$ 6. $(r, \theta) = \left(-1, -\dfrac{\pi}{6}\right)$

For 7-8, Plot the point of the given Cartesian coordinates. Label everything.
First, find Polar coordinates (r, θ) of the point, where $r > 0$. Keep $0 \leq \theta < 2\pi$.
Second, find Polar coordinates (r, θ) of the point, where $r < 0$. Keep $0 \leq \theta < 2\pi$.

7. $(x, y) = (-4, 4)$ 8. $(x, y) = (3, 3\sqrt{3})$

For 9-14, Carefully sketch each of the following Polar curves. **Show all work. Also show both the Cartesian Plot and the final Polar plot. Label everything.**

9. $r = 2\cos\theta$ 10. $r = 3\sin\theta$

11. $r = 1 + \sin\theta$ 12. $r = 2 + 2\cos\theta$ 13. $r = 3 - 3\sin\theta$

14. Flower-petal-leaved rose $r = 2\sin(2\theta)$