Parametric Curve Summary

Given a curve with differentiable component functions $x(t)$ and $y(t)$.

- **Slope of the curve** at a point (x_o, y_o) is given by $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$.
- **Concavity** of the curve at a point (x_o, y_o) is given by $\frac{d^2y}{dx^2} = \frac{\frac{d}{dt}\left(\frac{dy}{dx}\right)}{\frac{dx}{dt}}$.
- **Arc length** of the curve from the point *a* to the point *b* si given by

$$\int_a^b \sqrt{(\frac{dx}{dt})^2 + (\frac{dy}{dt})^2}\, dt$$

- **Velocity** of the particle is given by the vector $(\frac{dx}{dt}, \frac{dy}{dt})$ and **Acceleration** is $(\frac{d^2x}{dt^2}, \frac{d^2y}{dt^2})$
- **Speed** of the particle is the magnitude of the velocity vector $\sqrt{(\frac{dx}{dt})^2 + (\frac{dy}{dt})^2}$
- **Distance** traveled by the particle is the ARC LENGTH of the curve on which it travels.

Polar Curve Summary

Given a curve written in the form $r = f(\theta)$.

- The **Rectangular Coordinates** are given by $x = r(\theta)\cos(\theta)$ and $y = r(\theta)\sin(\theta)$
- **Slope of the curve** at a point θ_o is given by $\frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}}$.
- **Area bounded by a curve** of the curve from the point *a* to the point *b* is given by

$$\frac{1}{2}\int_{\theta_1}^{\theta_2} (r(\theta))^2 \, d\theta$$

- **Area bounded by two curves**
  - Find the intersection of the two curves, *a* and *b*.
  - If the outer function is $r_2(\theta)$ and the inner function is $r_1(\theta)$, the area is given by

$$\frac{1}{2}\int_{a}^{b} (r_2(\theta))^2 - (r_1(\theta))^2$$

- **Angular Velocity** of the particle is given by $\frac{dr}{d\theta}$.