

Polar Equations:

$$r = f(\theta), \quad \alpha \leq \theta \leq \beta$$

Polar coordinates to cartesian:

$$x = r \cos(\theta), \quad y = r \sin(\theta)$$

Cartesian coordinates to polar:

$$r = \sqrt{x^2 + y^2}, \quad \theta = \arctan\left(\frac{y}{x}\right)$$

Slope of a tangent line:

$$\frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{f'(\theta) \sin(\theta) + f(\theta) \cos(\theta)}{f'(\theta) \cos(\theta) - f(\theta) \sin(\theta)}$$

Area:

$$\int_{\alpha}^{\beta} \frac{1}{2} (f(\theta))^2 d\theta$$

Arclength:

$$\int_{\alpha}^{\beta} \sqrt{(f'(\theta))^2 + (f(\theta))^2} d\theta$$