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Sections: ADJ/ADK

Curves Defined by Parametric Equations

The curve with parametric equations

$$x=f(t) \qquad y=g(t) \qquad a\le t\le b$$

has initial point (,   ) and terminal point (,   ).

Calculus with Parametric Curves

1. Tangents

$$\frac{dy}{dx} = \qquad\qquad\qquad \text{if } \frac{dx}{dt} \neq 0$$

- When is there a horizontal tangent?

- When is there a vertical tangent?

2. Areas

$$A= \int \qquad\qquad\qquad dt$$

3. Arc Length

$$L= \int \qquad\qquad\qquad dt$$

4. Surface Area

$$S= \int \qquad\qquad\qquad dt$$

Polar Coordinates

Give the relations between the polar and cartesian coordinates.

$$x =$$

$$y =$$

$$r^2 =$$

$$\tan \theta =$$

- **Tangents to Polar Curves**

$$\frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{\frac{dr}{d\theta} \sin \theta + r \cos \theta}{\frac{dr}{d\theta} \cos \theta - r \sin \theta}$$

Careful!! r is not a constant, it's a functions that depends on θ.

Areas and Lengths in Polar Coordinates

$$A = \int$$

$$L = \int$$

- **Exercises**

1. Sketch the curve $r = \cos(3\theta)$ and find the area enclosed by one loop.

2. Sketch the curve $r = \cos(4\theta)$ and find the area enclosed by one loop.

3. Looking at the previous exercises, how many loops does $\sin(n\theta)$ have when n is even? And when n is odd?

4. Sketch the curve $r = \ln\theta$ for $\theta \geq 1$.