11.3-11.4 Polar Coordinates

Rather than Cartesian coordinates, polar coordinates record a point's location using:

- r, distance from the origin
- θ, angle from the positive x-axis

in the form (r, θ).

Conversion

Cartesian to polar:

$$r = \sqrt{x^2 + y^2}$$
$$\tan\theta = \frac{y}{x}$$

Polar to Cartesian:

$$x = r\cos\theta$$
$$y = r\sin\theta$$

Symmetries

If (r, θ) is on the curve, then so is:

- $(r, -\theta)$
- $(r, \pi - \theta)$
- $(r, \theta + \pi)$ or $(-r, \theta)$

Parametrization

$$\begin{cases} x &= r\cos\theta = f(\theta)\cos(\theta) \\ y &= r\sin\theta = f(\theta)\sin(\theta) \end{cases}, \quad -\infty < t < \infty$$

From there on, parametric equation properties can be used for things such as finding tangent lines in polar form.