8-1 Polar Coordinates

Polar coordinates: \((r, \theta)\)  
*When \(r < 0\): point is on the opposite side of the pole (origin).*

Multiple polar coordinates: \(+/-\ "r"\) and \(+/-\ "\theta"\) result in multiple representations of the same coordinates.

Convert from polar to rectangular:  \(x = r \cos(\theta)\); \(y = r \sin(\theta)\)
Convert from rectangular to polar:  \(r = \sqrt{x^2 + y^2}\); \(\theta = \tan^{-1}(y/x)\)

8-2 Polar Equations and Graphs

Convert from rectangular to polar

| Replace x with \(r \cos(\theta)\) | Try to isolate \(r \cos(\theta)\) and replace with x |
| Replace y with \(r \sin(\theta)\) | Try to isolate \(r \sin(\theta)\) and replace with y |
| Replace \(x^2 + y^2\) with \(r^2\) | Replace \(r\) with \(\sqrt{x^2 + y^2}\) |
| Solve for \(r\) is possible/practical | Replace \(\theta\) with \(\tan^{-1}(y/x)\) |

Methods of graphing

- convert to rectangular coordinates
- make a table and use symmetry
- use \(r\)-value analysis *(graph on the Cartesian coordinate plane as reference, using \(r\) in place of \(y\))*
- use a graphing calculator *(remember to set MODE to POL, and check for radians vs degrees)*

8-4 Vectors  \((A = \hat{i} + \hat{j} + \hat{k})\)

Addition (resultant): add corresponding components  
Absolute Value (magnitude): three-dimensional application of the Pythagorean theorem  
Scalar Multiplication: multiply each component by the scalar  
Subtraction: multiply second vector by \(-1\), and then add

8-5 The Dot Product (Scalar Product)

Dot product:  \(u \cdot v \cdot w = a_1a_2a_3 + b_1b_2b_3 + c_1c_2c_3\)  
Angle between vectors:  \(A \cdot B = |A| \cdot |B| \cdot \cos(\theta)\)  
Parallel vectors: angle between the vectors = 0  
Orthogonal (Perpendicular vectors): dot product = 0
8-8 Parametrics

Parametric equations: \( x = f(t); \ y = f(t); \ t \) is the independent variable

Domain and Range restrictions: 1) check \( t \), 2) domain restrictions from \( x \), 3) range restrictions from \( y \)

Graphing with table method: \([ x(t), y(t) ]\)

Graphing with calculator: Set MODE to PAR.

Parametrics to rectangular: Use substitution for \( x \) and \( y \); Use Pythagorean Identities for trig functions