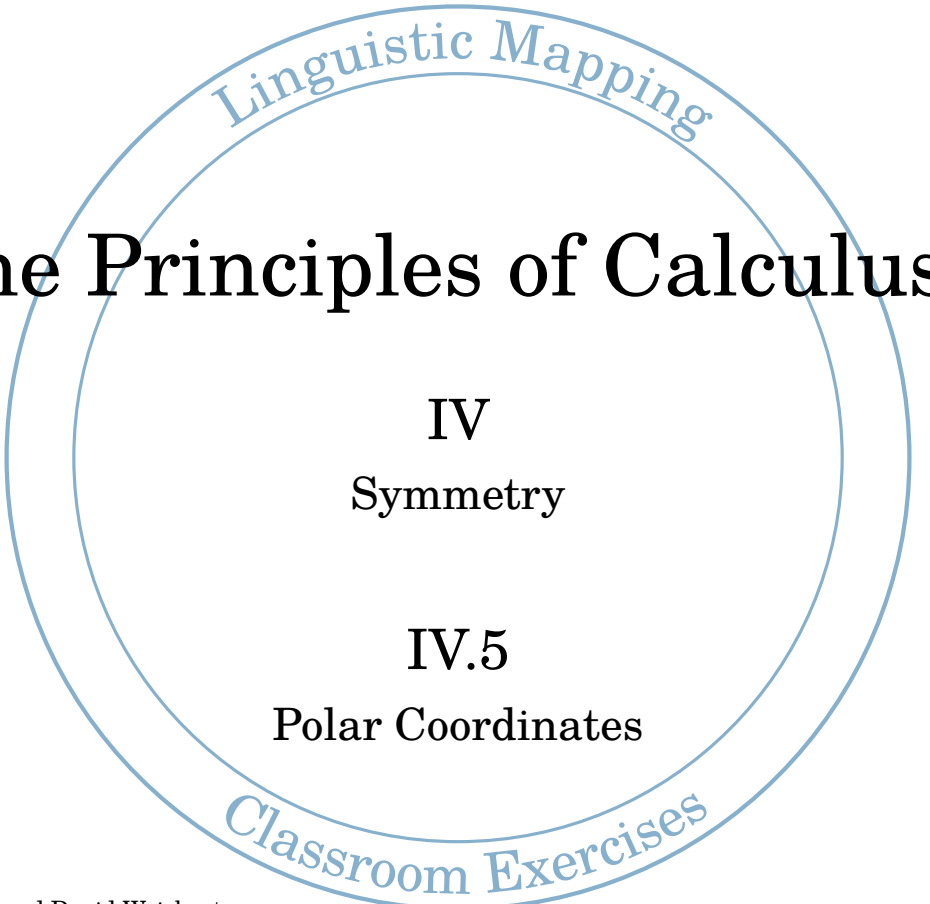


The Principles of Calculus I

IV

Symmetry

IV.5

Polar Coordinates

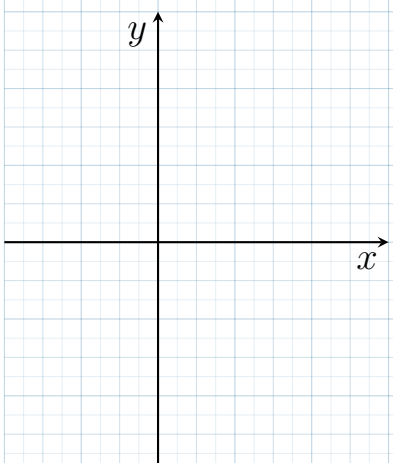
Exercise 1

There are different coordinate systems that describe position in $\mathbb{R}^2$.

(a) Explain in plain English what rectangular coordinates are.

(b) Given a point p in $\mathbb{R}^2$, explain in plain English what $\|p - (0,0)\|$ means.

(c) Given a point p in $\mathbb{R}^2$, explain in plain English what $\angle(1,0)O\hat{p}$ means.

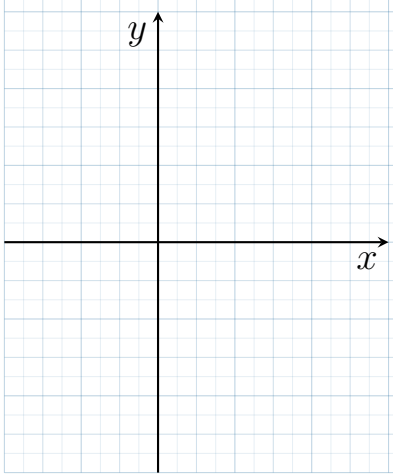


There are different coordinate systems that describe position in $\mathbb{R}^2$.

(d) Explain what is the polar coordinate representation of p.

(e) Determine if a polar coordinate representation is unique.

(f) Explain in plain English what $(r : \theta)$ means.



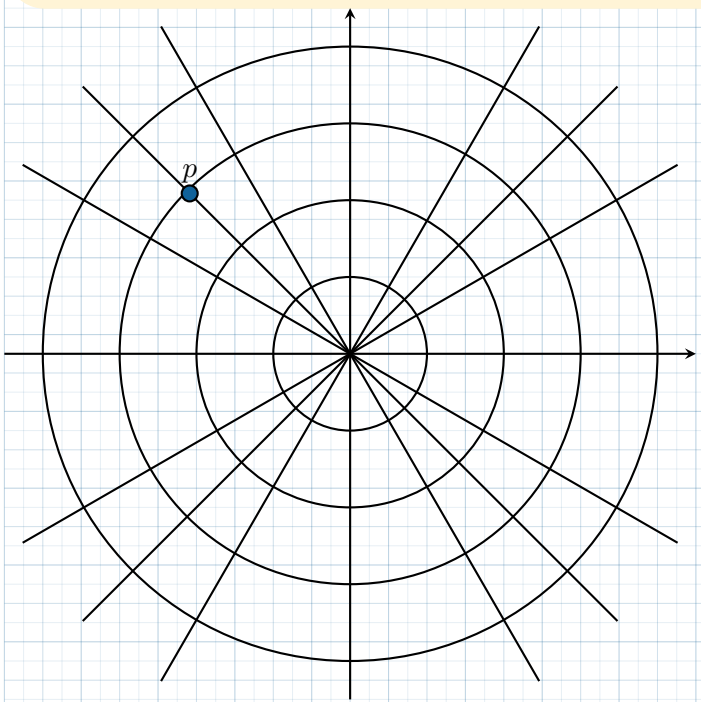
Exercise 2

A different coordinate grid is used when using polar coordinates.

(a) Explain what the rings and lines represent in the polar grid below.

(b) Determine the coordinates of the point p marked on the polar grid.

(c) Plot the point $(2: \frac{5\pi}{4})$.



Exercise 3

Translating from one form to the other is possible.

(a) Take p to be a point on the unit circle. Write out its representation in rectangular coordinates.

(b) Take q to be a point that is not on the unit circle. Write out its representation in rectangular coordinates.

(c) Use rectangular coordinates to represent the point p that is given by $p = (3 : \frac{7\pi}{4})$.

Translating from one form to the other is possible.

(d) Explain how to use the meaning of r and θ to convert a point from rectangular to polar.

(e) Convert $(4, -4)$ to polar coordinates.

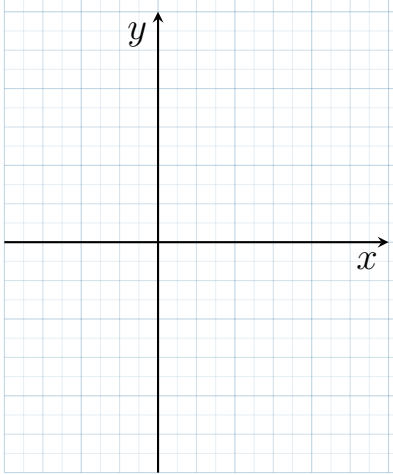
Exercise 4

Equations can be written in different coordinate systems as well. Depending on the coordinate system, producing sketches becomes easy.

(a) Explain what is a rectangular equation and a polar equation.

(b) Convert the following polar equation to a rectangular equation and sketch all points that satisfy the equation:

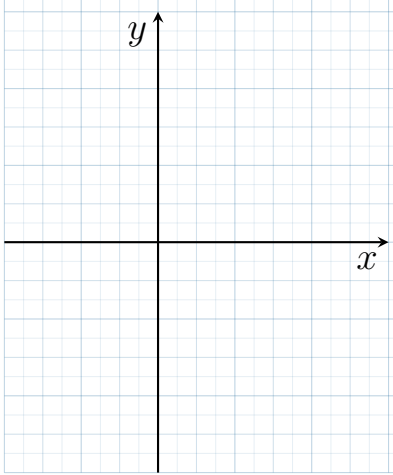
$$r = 6\sin(\theta).$$



Equations can be written in different coordinate systems as well. Depending on the coordinate system, producing sketches becomes easy.

(c) Convert the following polar equation to a rectangular equation and sketch all points that satisfy the equation:

$$r^2 - 6r\sin(\theta) = 0.$$



Equations can be written in different coordinate systems as well. Depending on the coordinate system, producing sketches becomes easy.

(d) Convert the following rectangular equation to a polar equation:

$$x^2 + y^2 = 10x.$$