

Introduction to Computer Graphics

Instructor: Sonny Chan
TA: Kamyar Allahverdi

Tutorial 03

Intro

- Kamyar Allahverdi
- CPSC 453 Tutorial 03
- Contact:
 - **kamyar.allahverdi@gmail.com**
- No foods or drinks in the lab

Intro

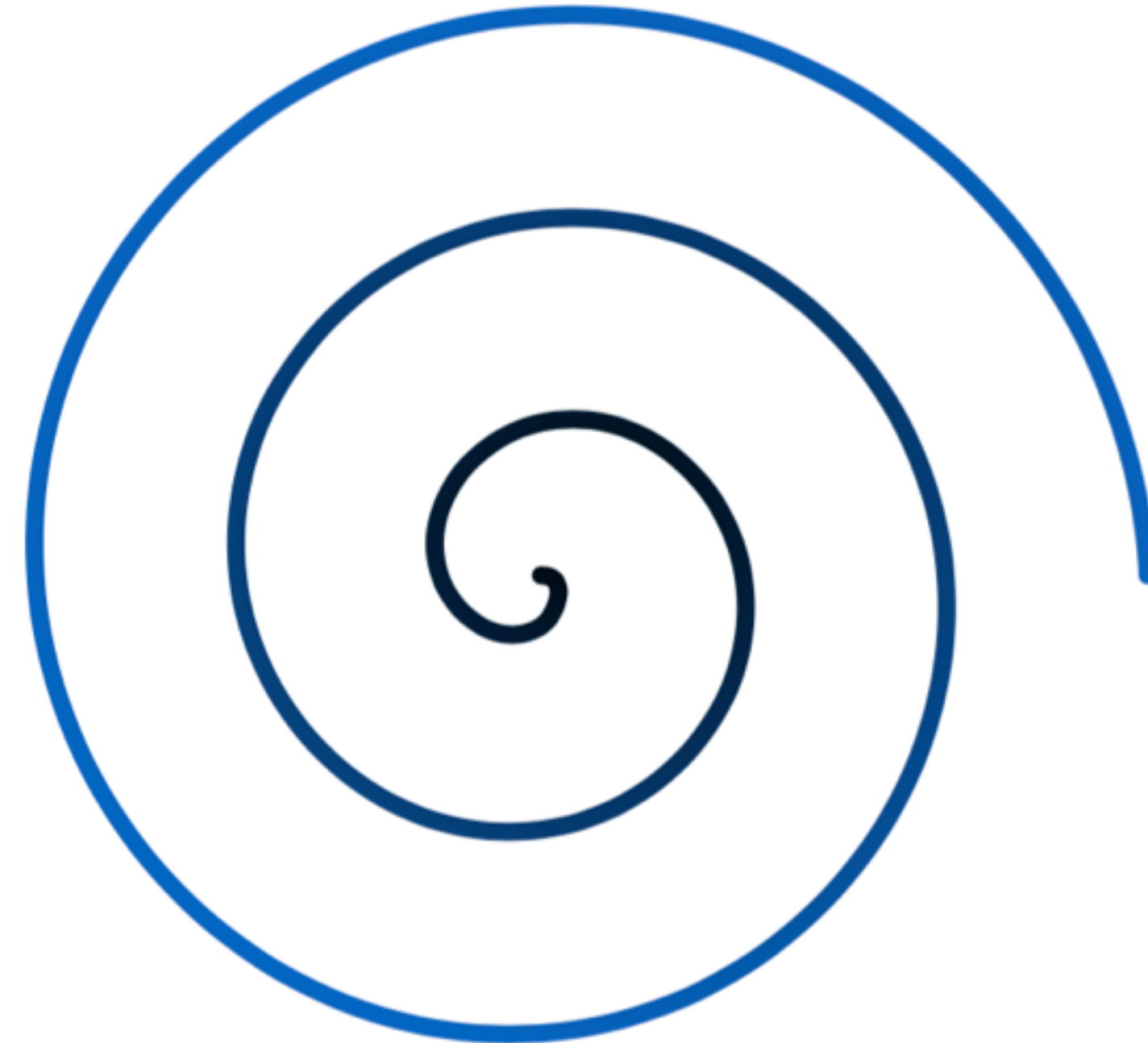
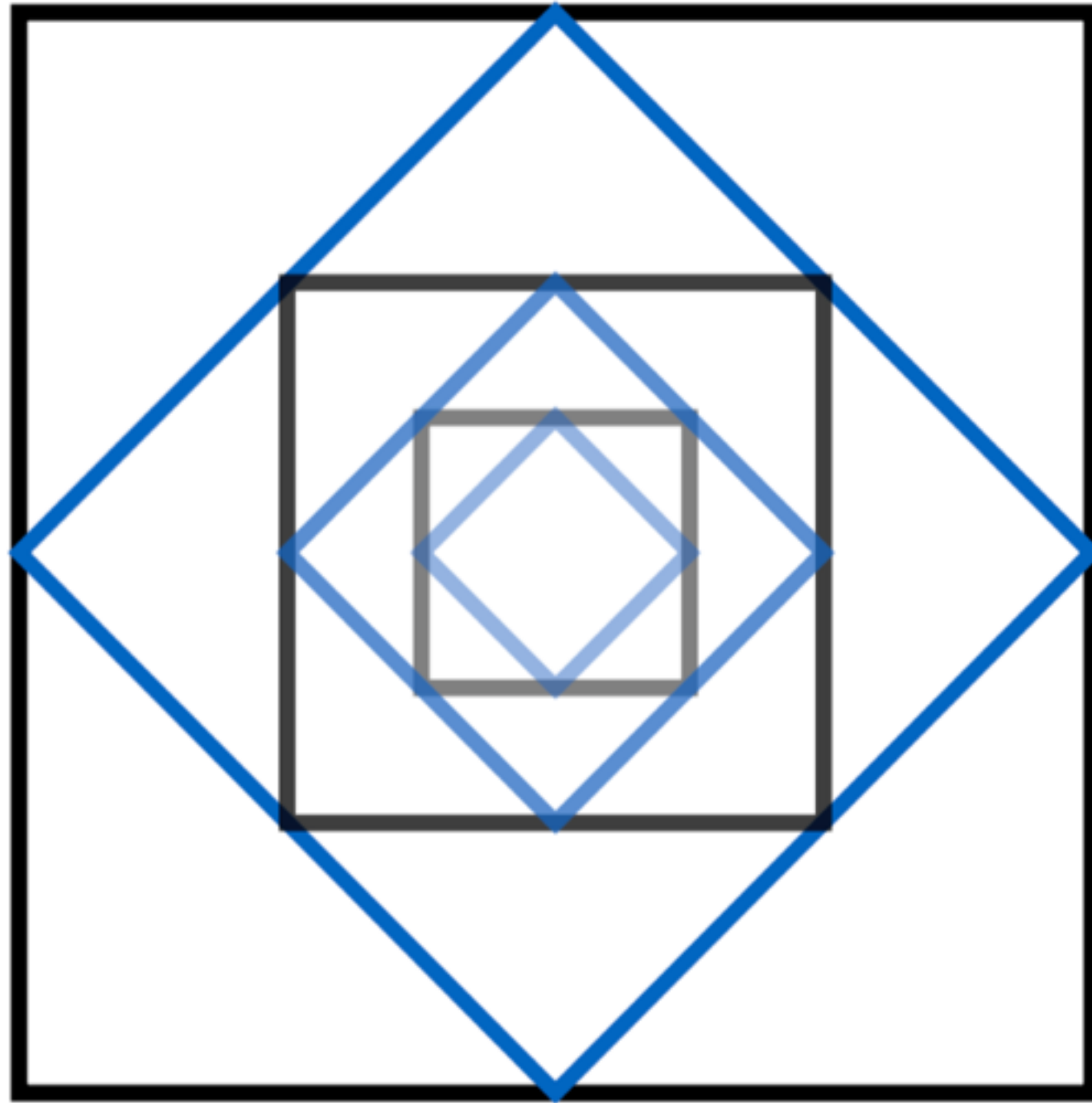
- You can code in Windows/Linux/Mac
- Labs done in Linux

Intro

- Register for Piazza:
 - <https://piazza.com/ucalgary.ca/fall2016/cspc453>
 - Ask questions here
- TA Class Materials:
 - <http://kamyarinfinity.me/courses/cpsc453/>

Assignments

- 5 Assignments (50% of your total grade)
- Written component
- Programming component
 - Can use at most 5 late days for all of programming parts.

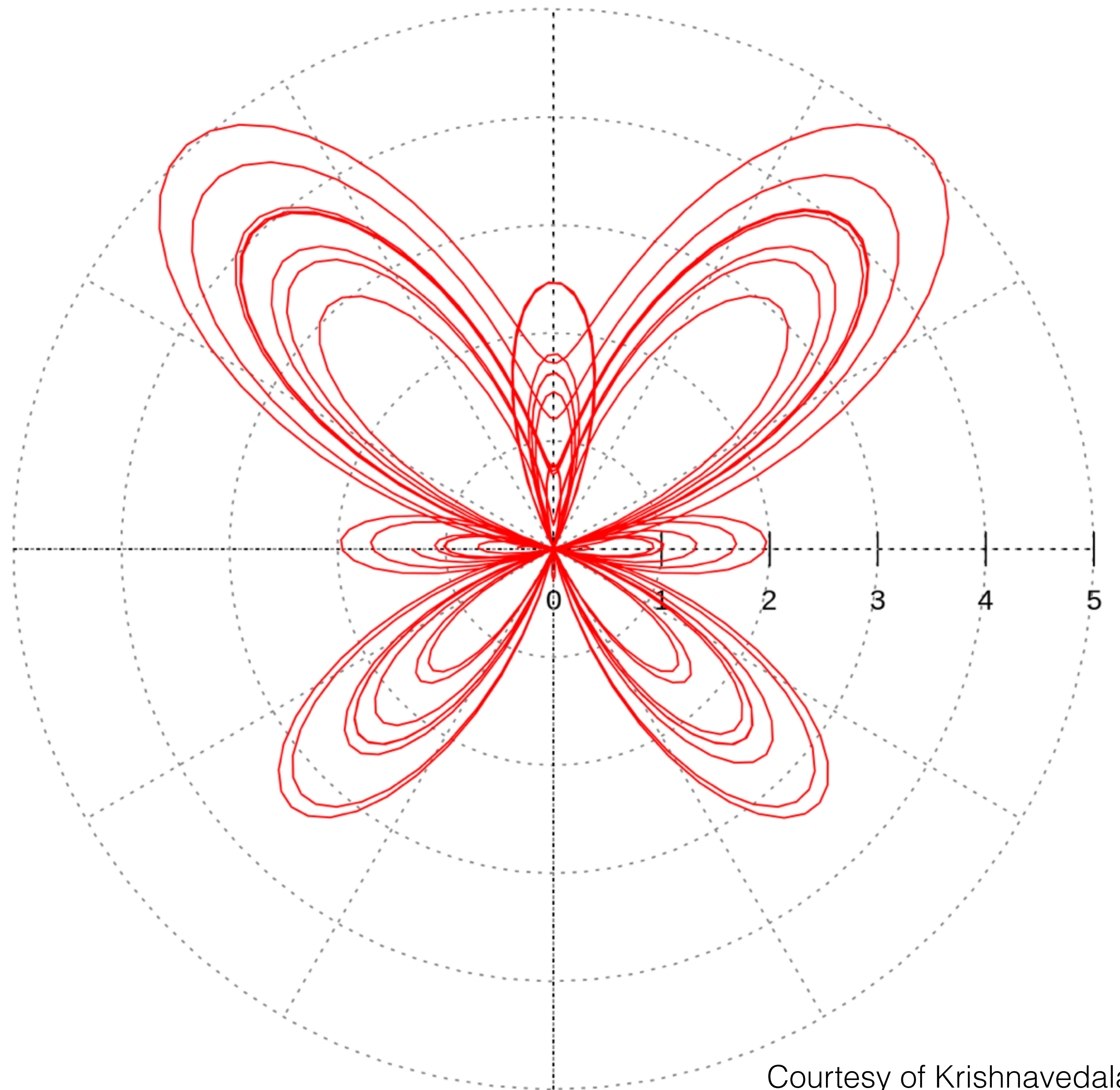


Assignment 1

Line & Polygon Geometry

Written Part

Parametric Equation

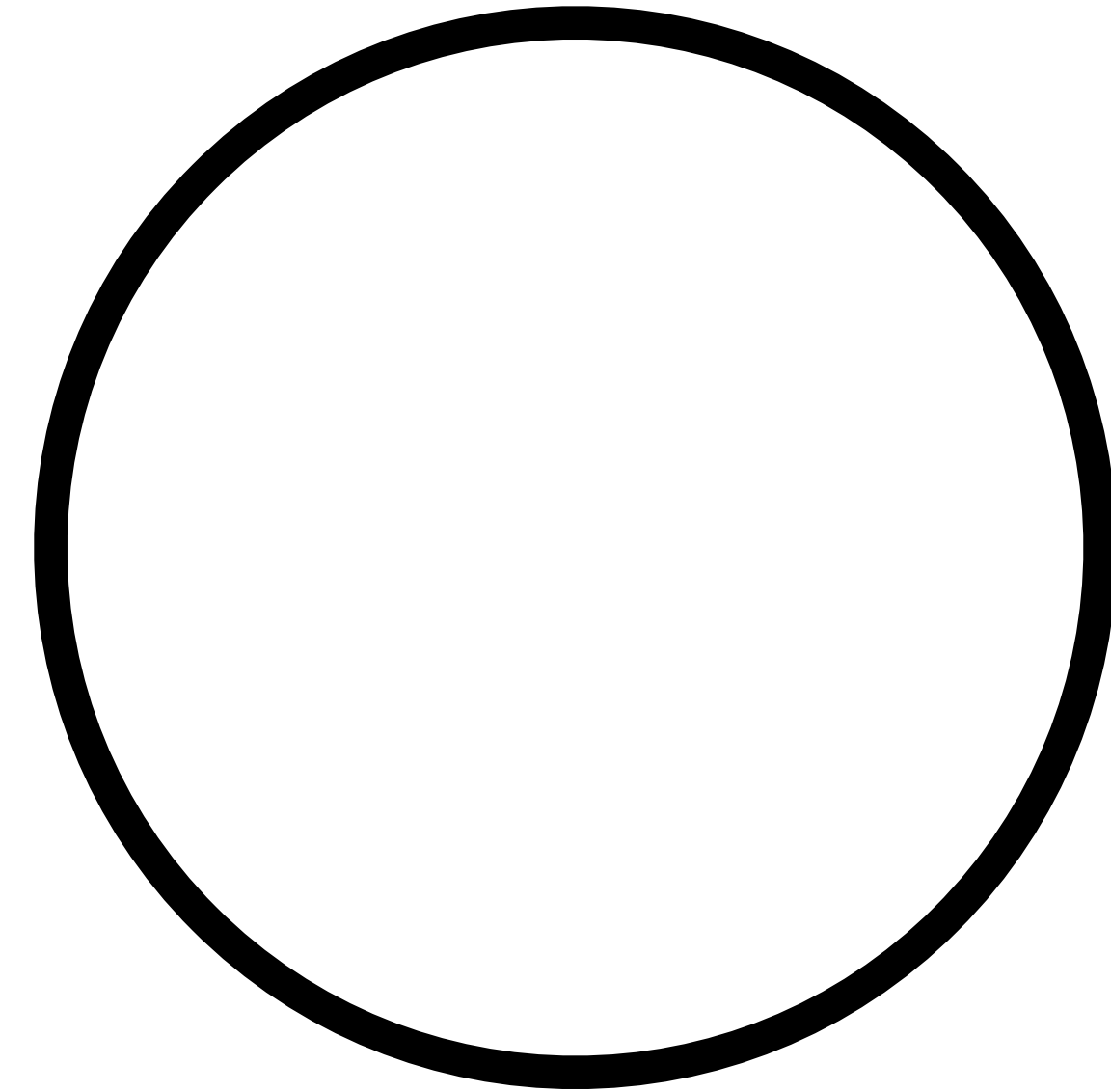


Parametric Equation

- Why?
 - Use a parameter to define a curve
- Why?
 - Move over them
 - Draw them

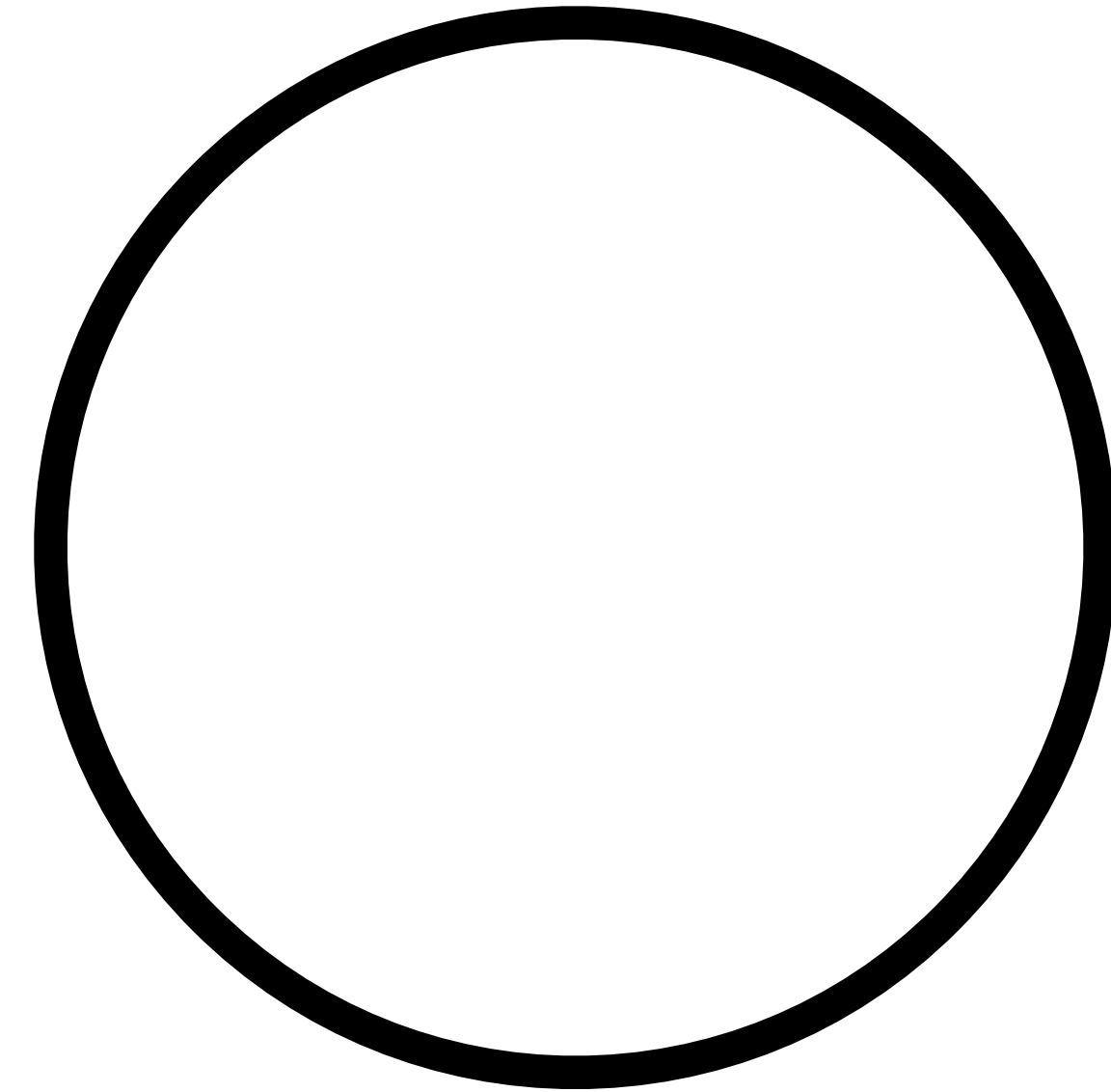
Parametric Equation

- How do you move over a circle?



Parametric Equation

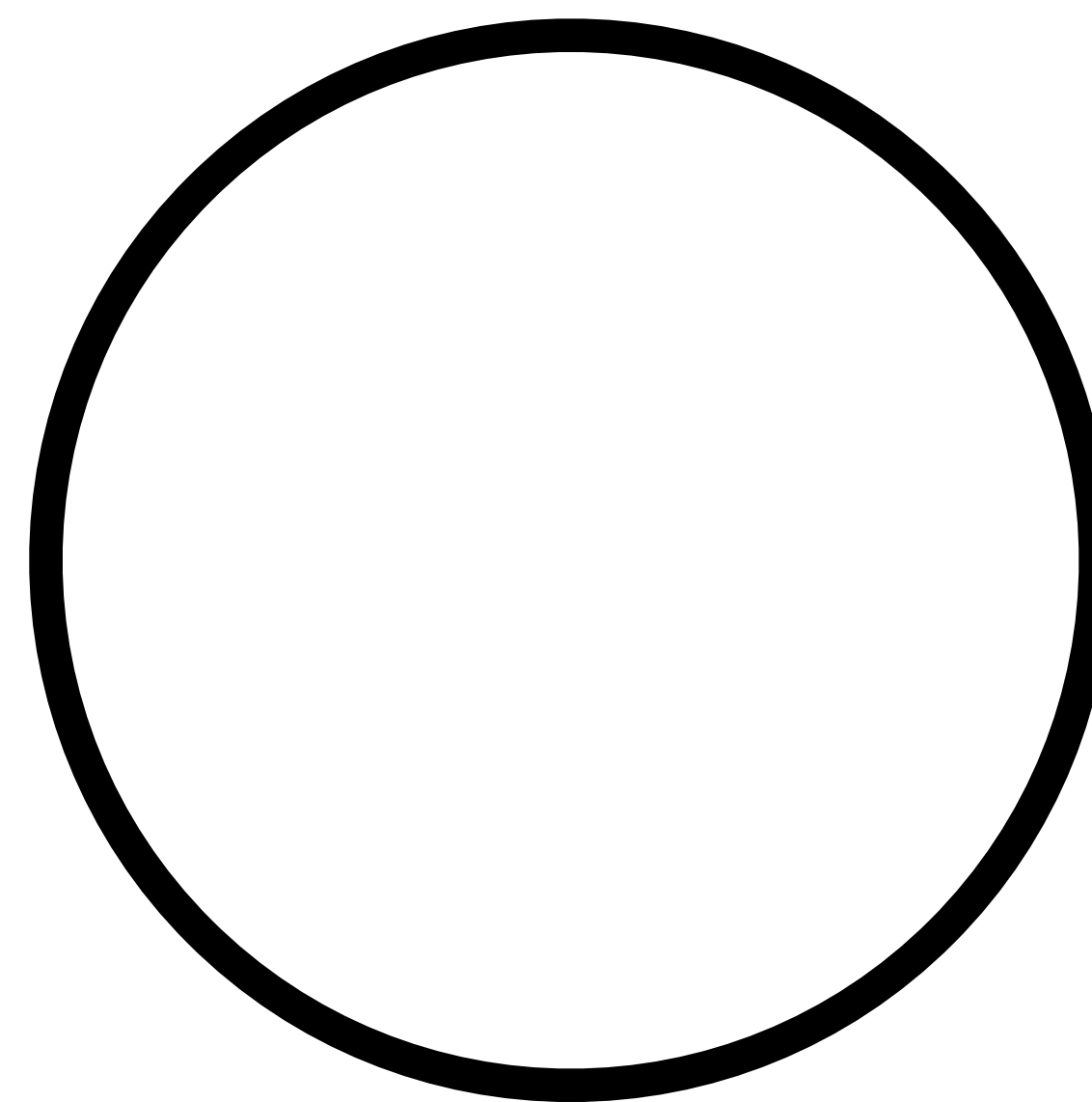
$$x^2 + y^2 = 1$$



Parametric Equation

$$x^2 + y^2 = 1$$

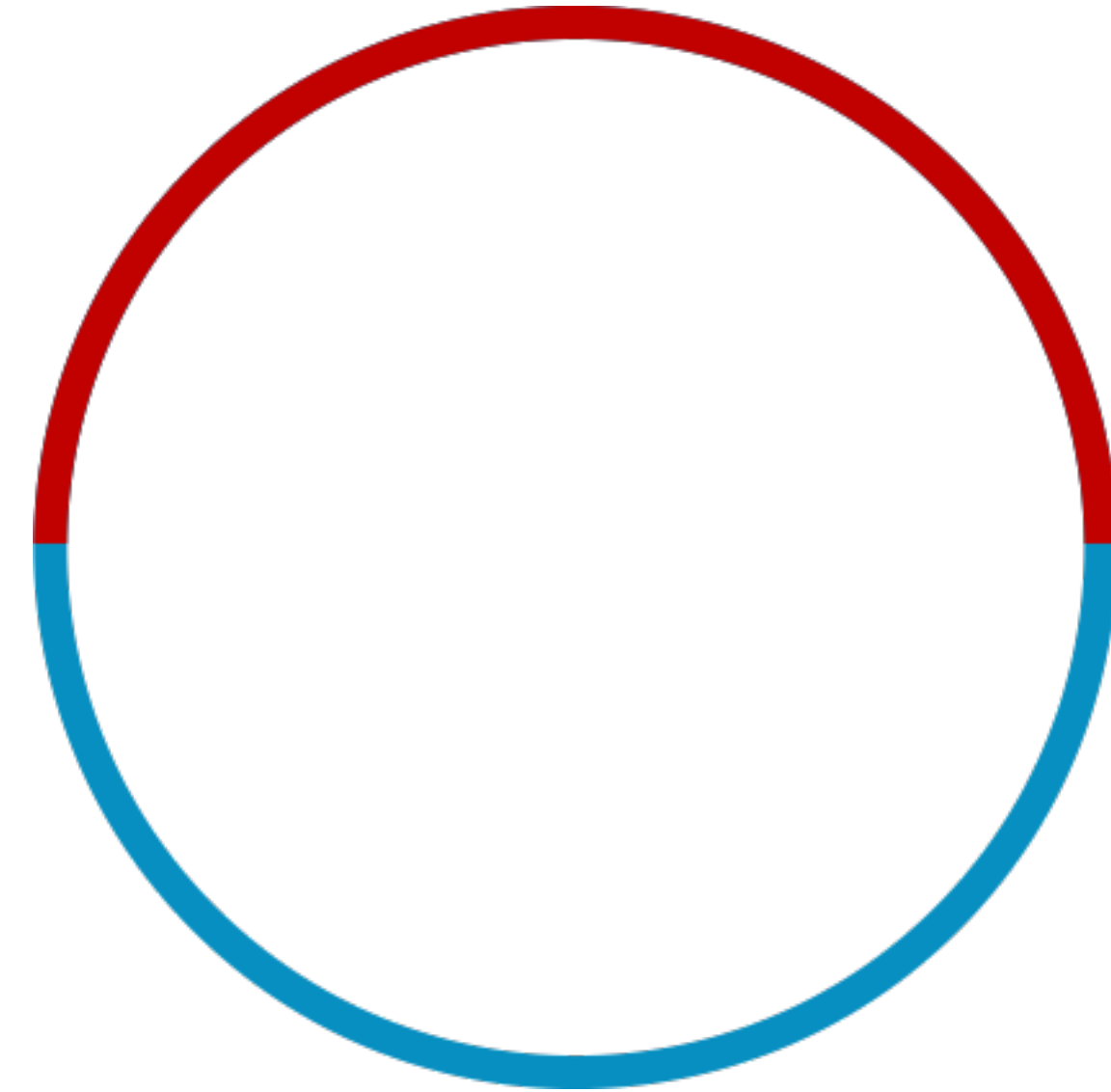
$$x = \pm \sqrt{1 - y^2}$$



Parametric Equation

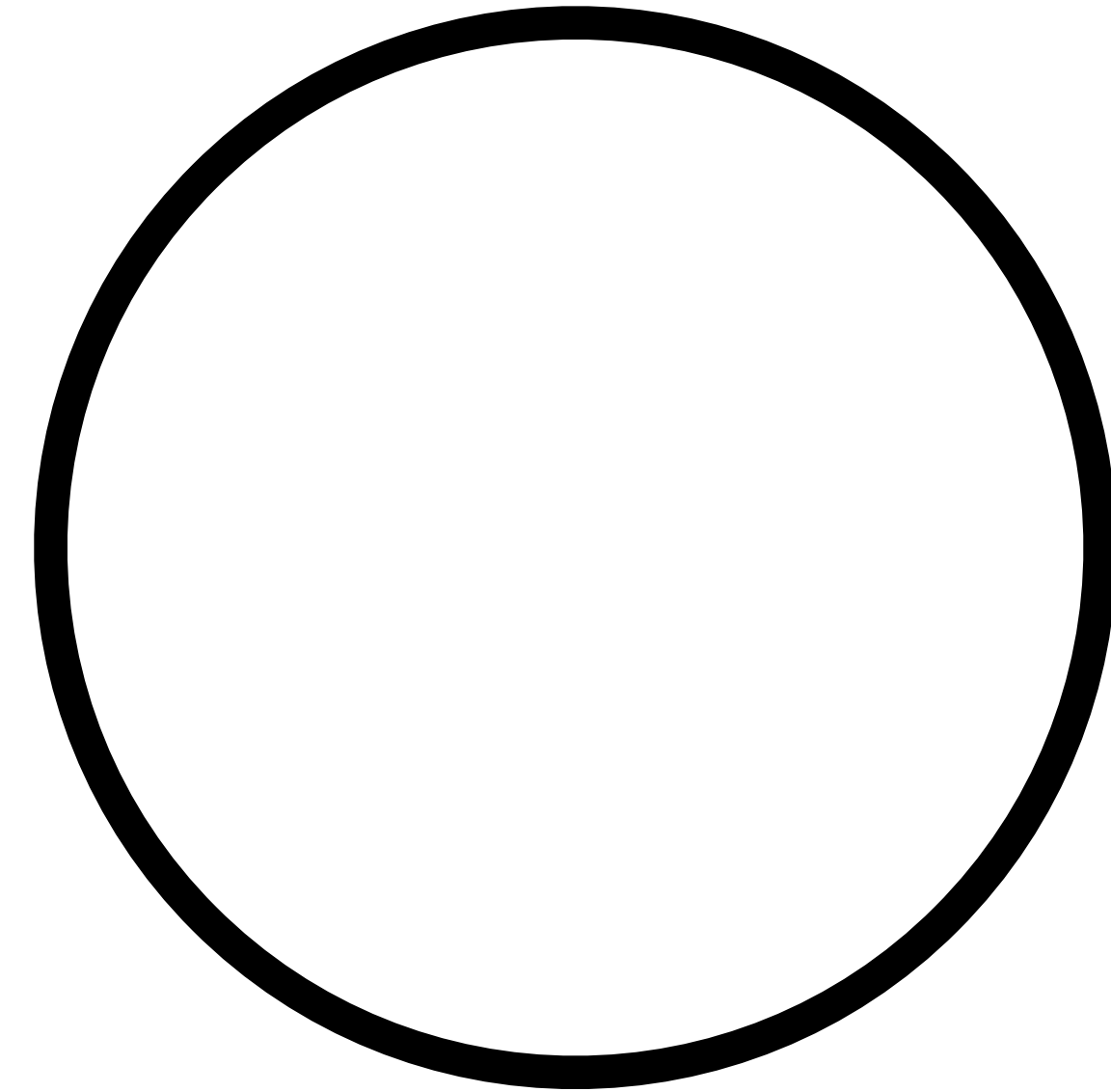
$$x^2 + y^2 = 1$$

$$x = \pm \sqrt{1 - y^2}$$



Parametric Equation

- Define circles in a different way

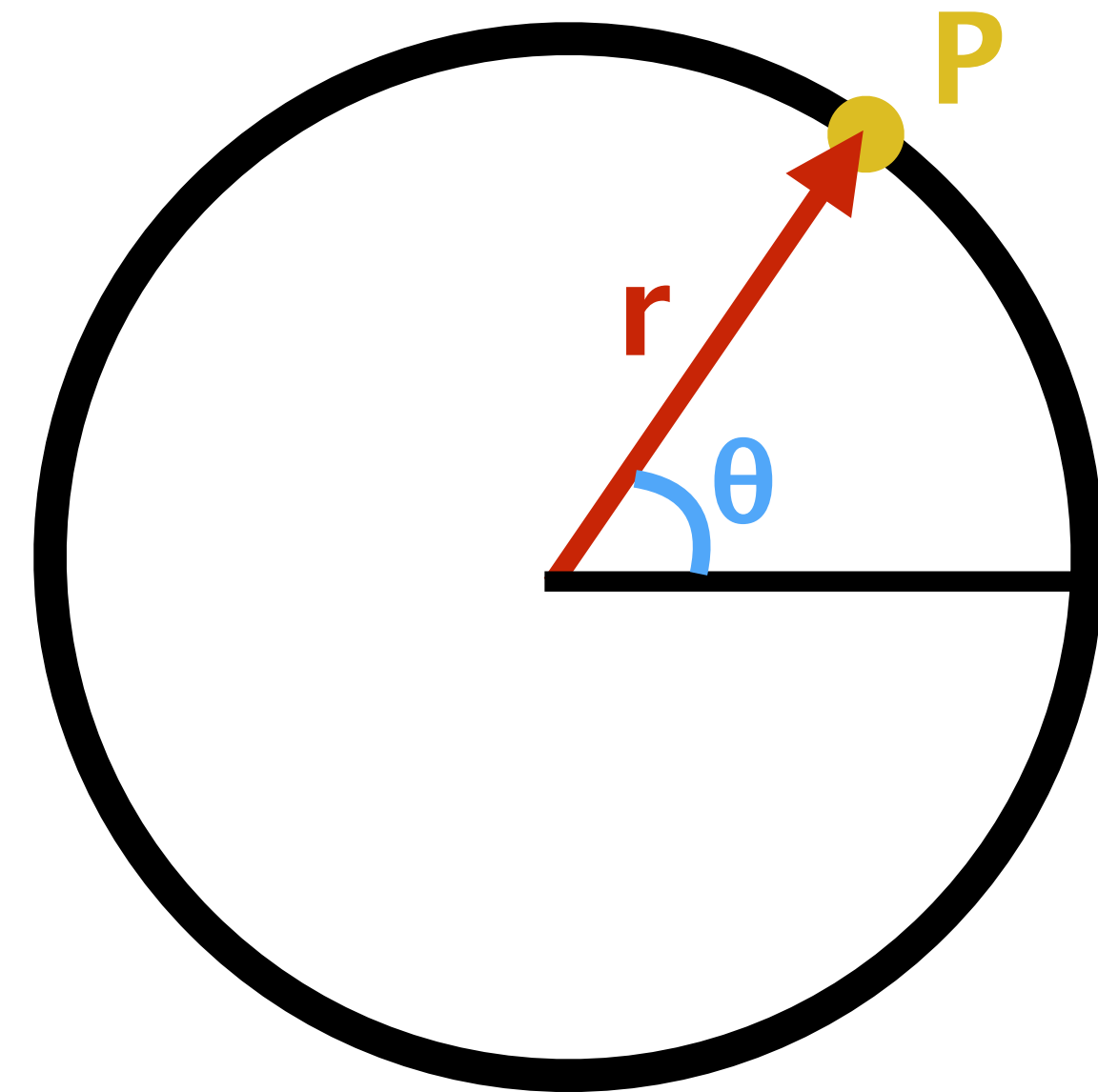


Polar Coordinates

- Define circles using Polar Coordinates

$$r = 1$$

$$0 \leq \theta \leq 2\pi$$

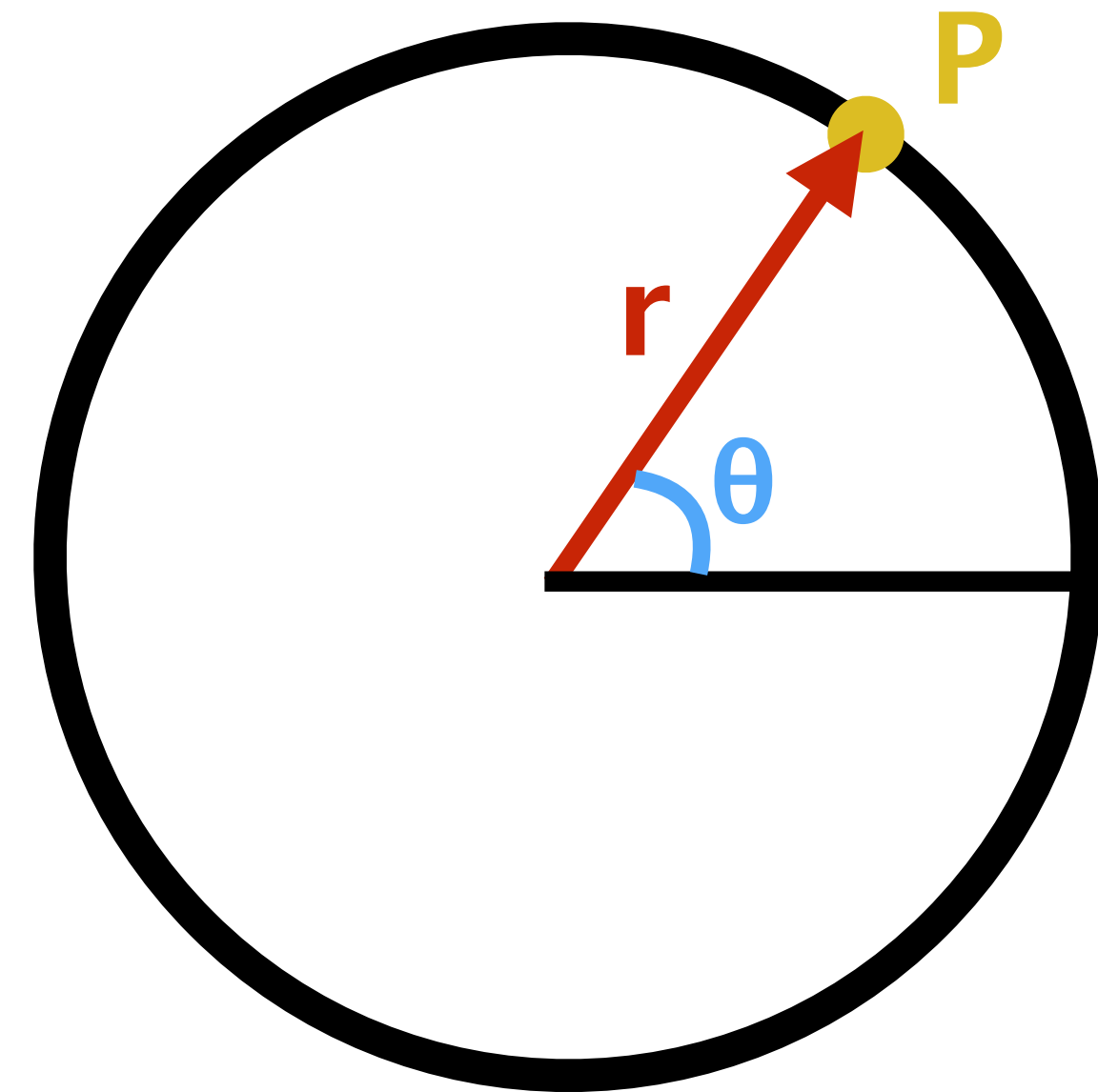


Polar Coordinates

- How to go back to Cartesian Coordinates?

$$x = r \cos \theta$$

$$y = r \sin \theta$$

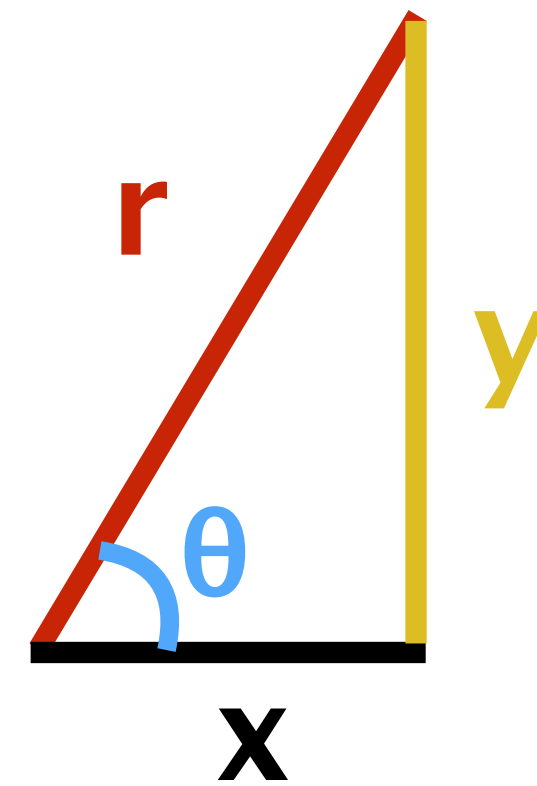


Polar Coordinates

- How to go back to Cartesian Coordinates?

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Polar Coordinates

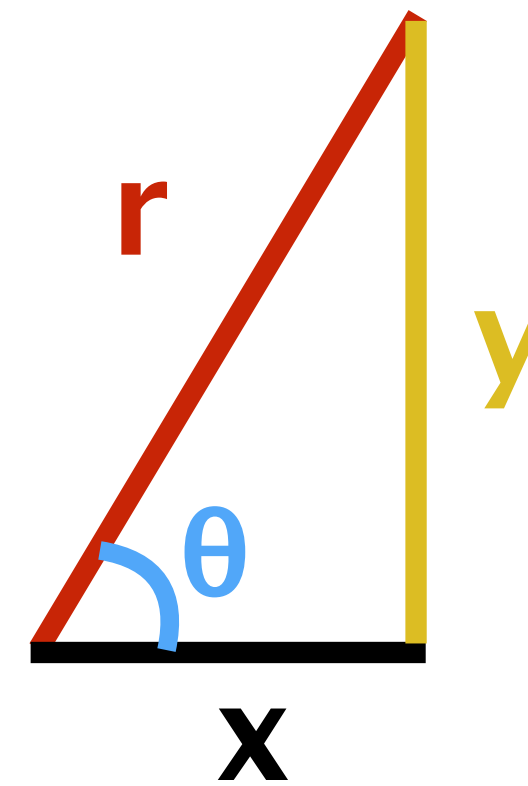
- And how about finding polar coordinates?

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$x^2 + y^2 = r^2 \cos^2 \theta + r^2 \sin^2 \theta$$

$$x^2 + y^2 = r^2$$

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

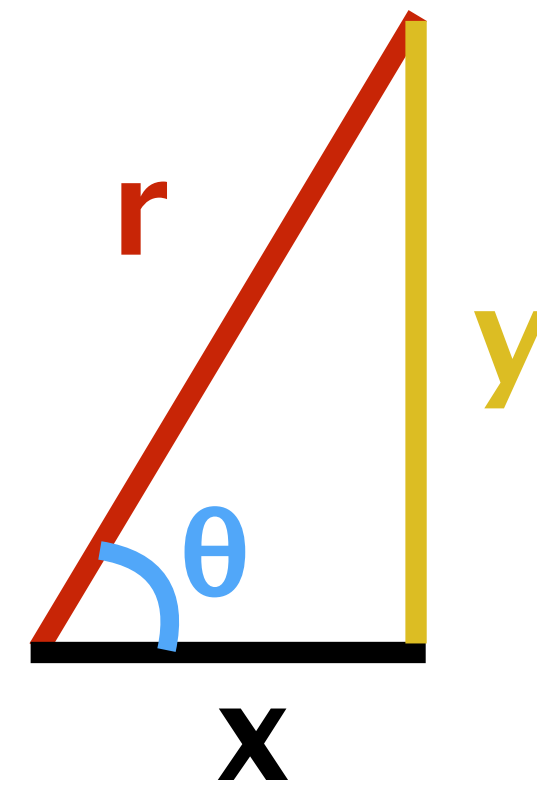


Polar Coordinates

- And how about finding polar coordinates?

$$\tan \theta = \frac{y}{x}$$

$$\theta = \arctan \frac{y}{x}$$

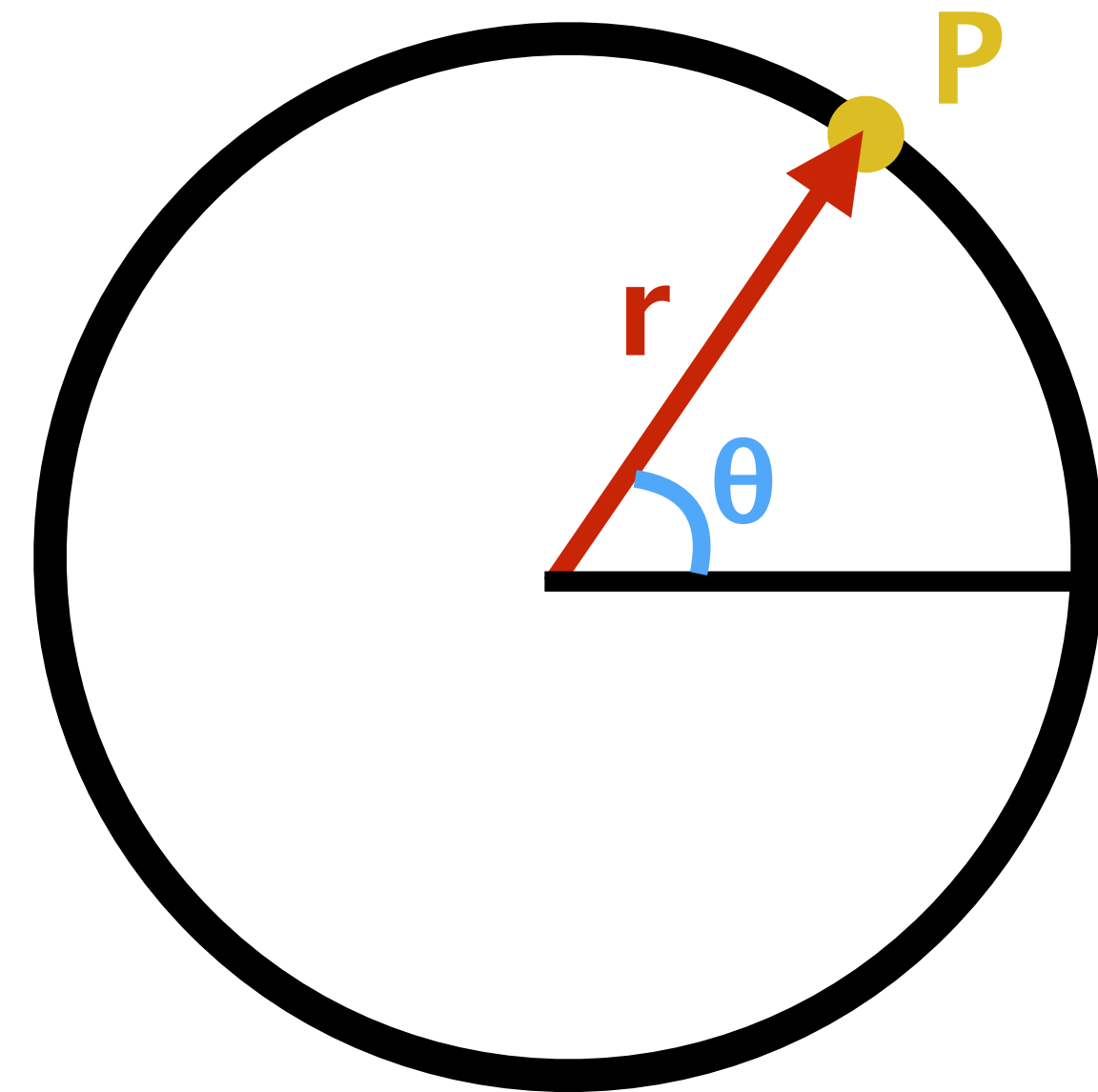


Polar Coordinates

- Define circles using Polar Coordinates

$$r = 1$$

$$0 \leq \theta \leq 2\pi$$

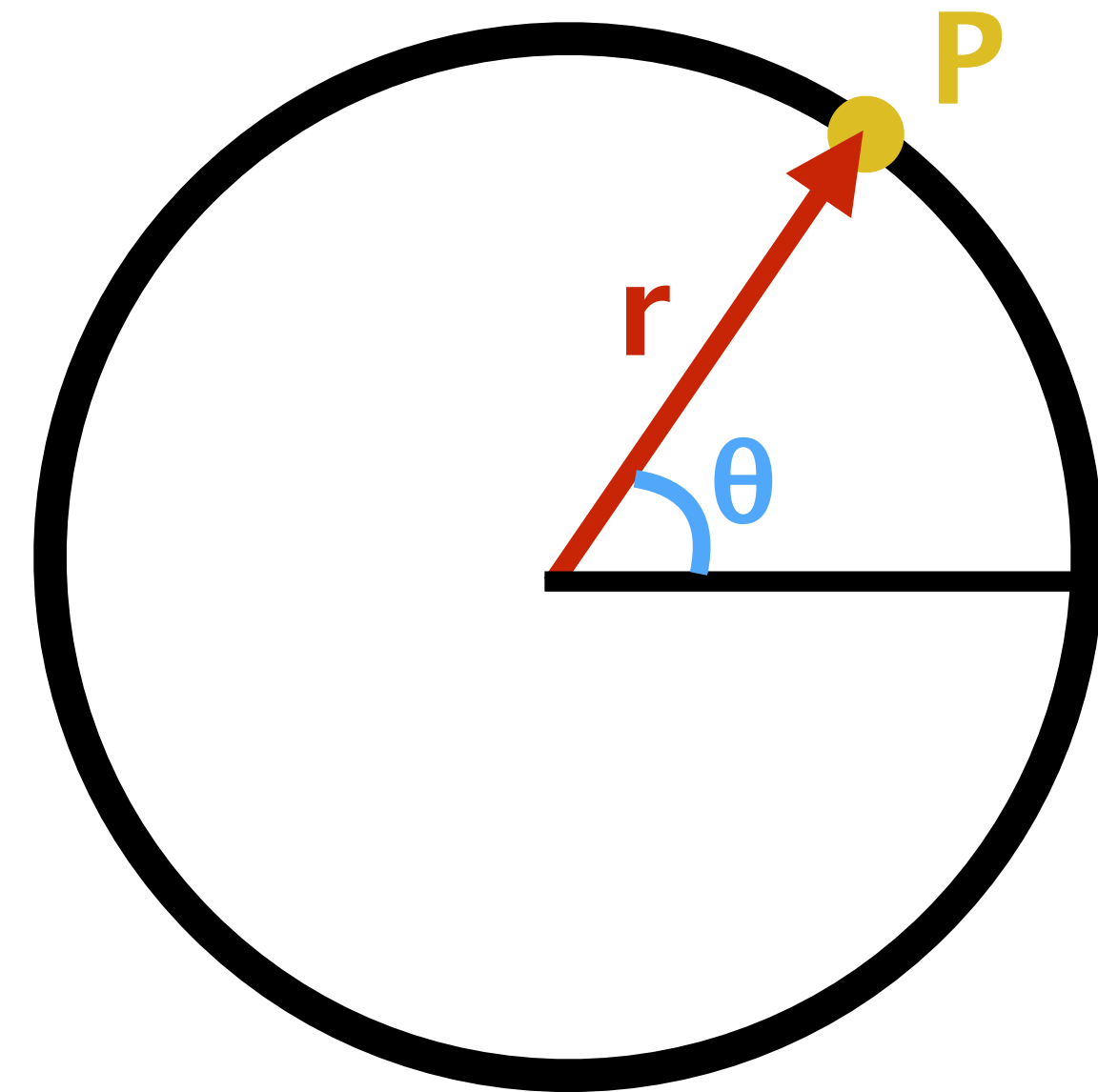


Polar Coordinates

- Define circles using Polar Coordinates

$$x = \cos \theta$$

$$y = \sin \theta$$

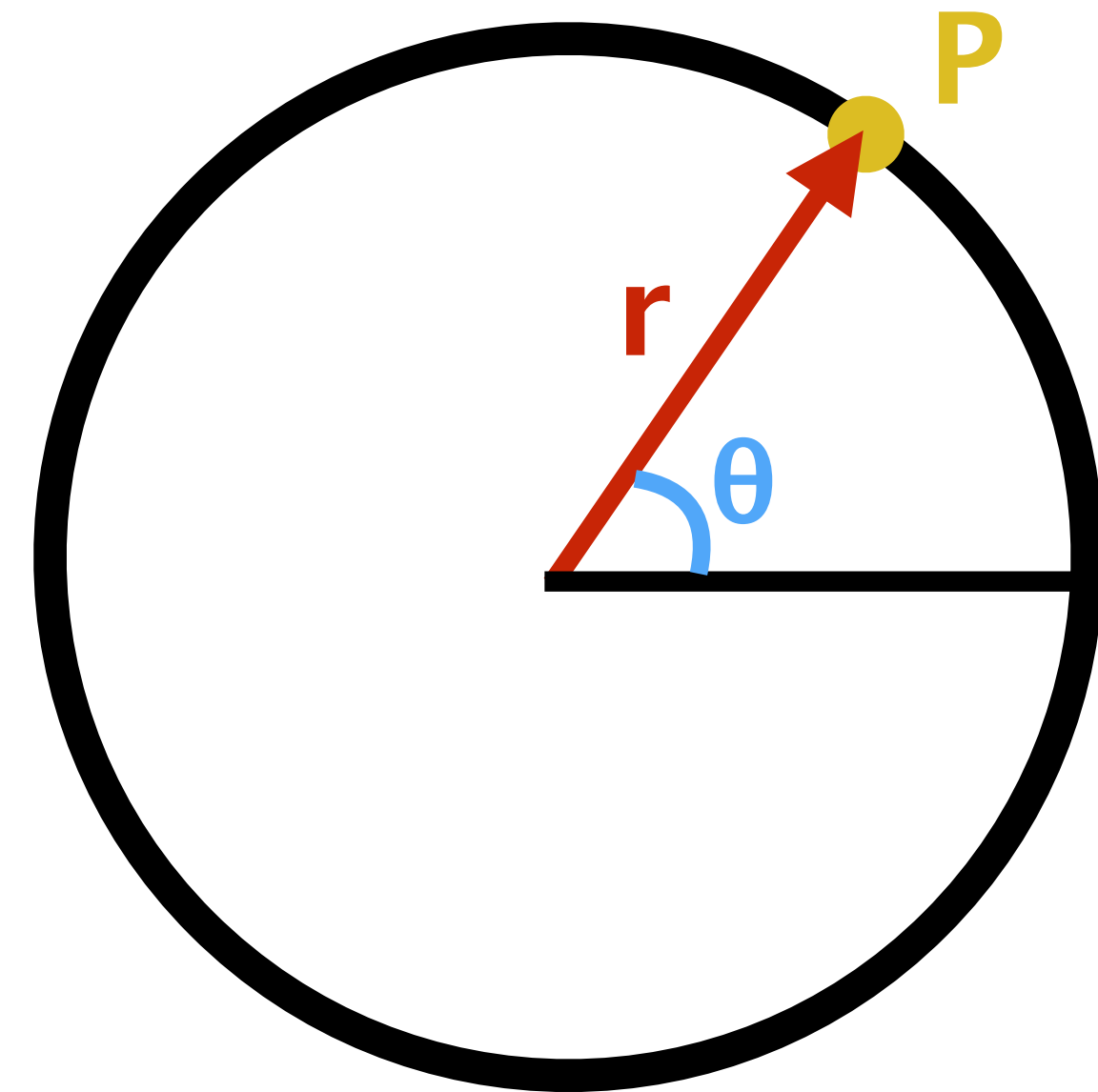


Parametric Equation

- Here, θ is a parameter

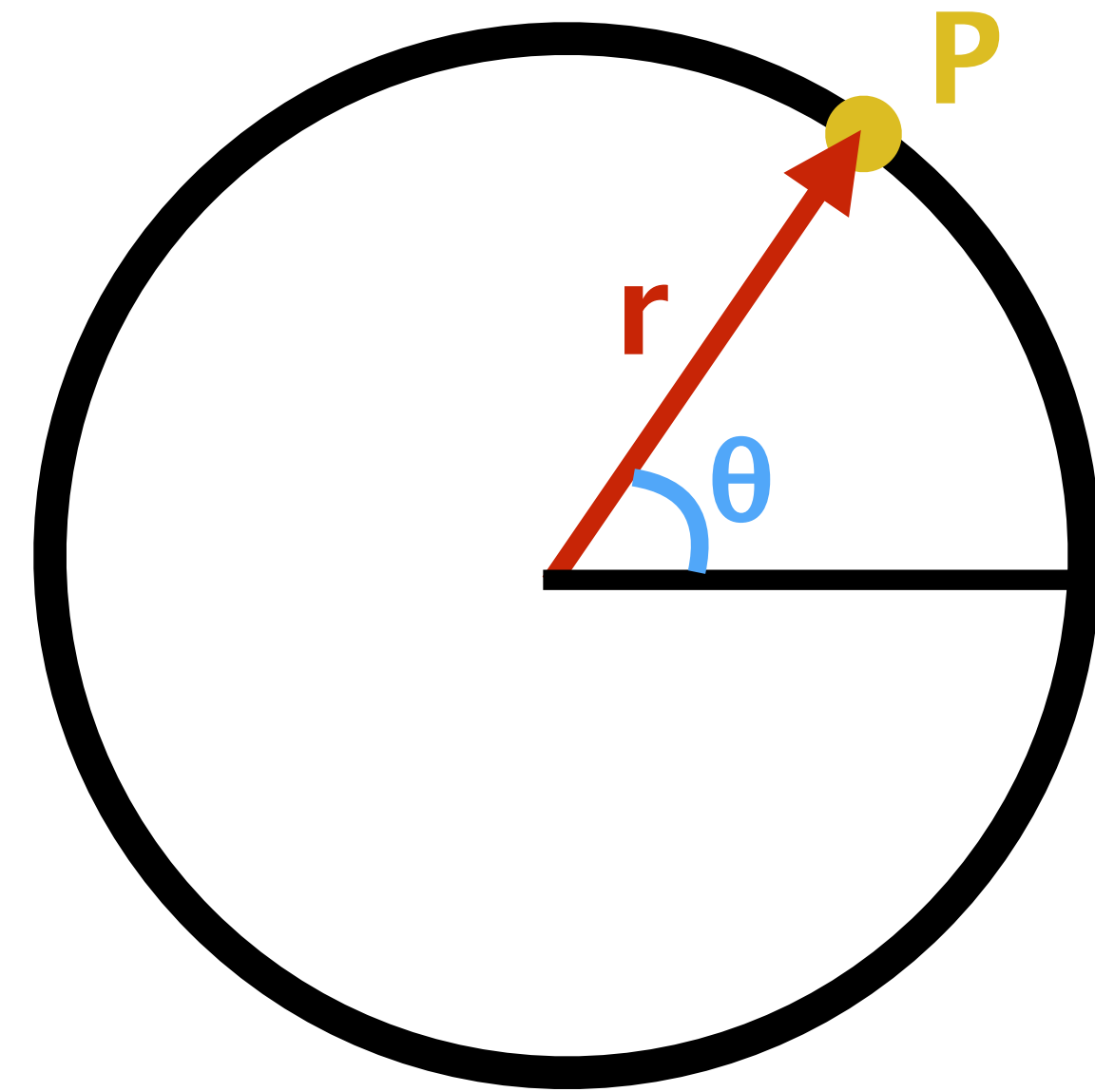
$$x = \cos \theta$$

$$y = \sin \theta$$



Parametric Equation

- Here, θ is a parameter
- We can draw/move over the circle by incrementing θ



$$x = \cos \theta$$

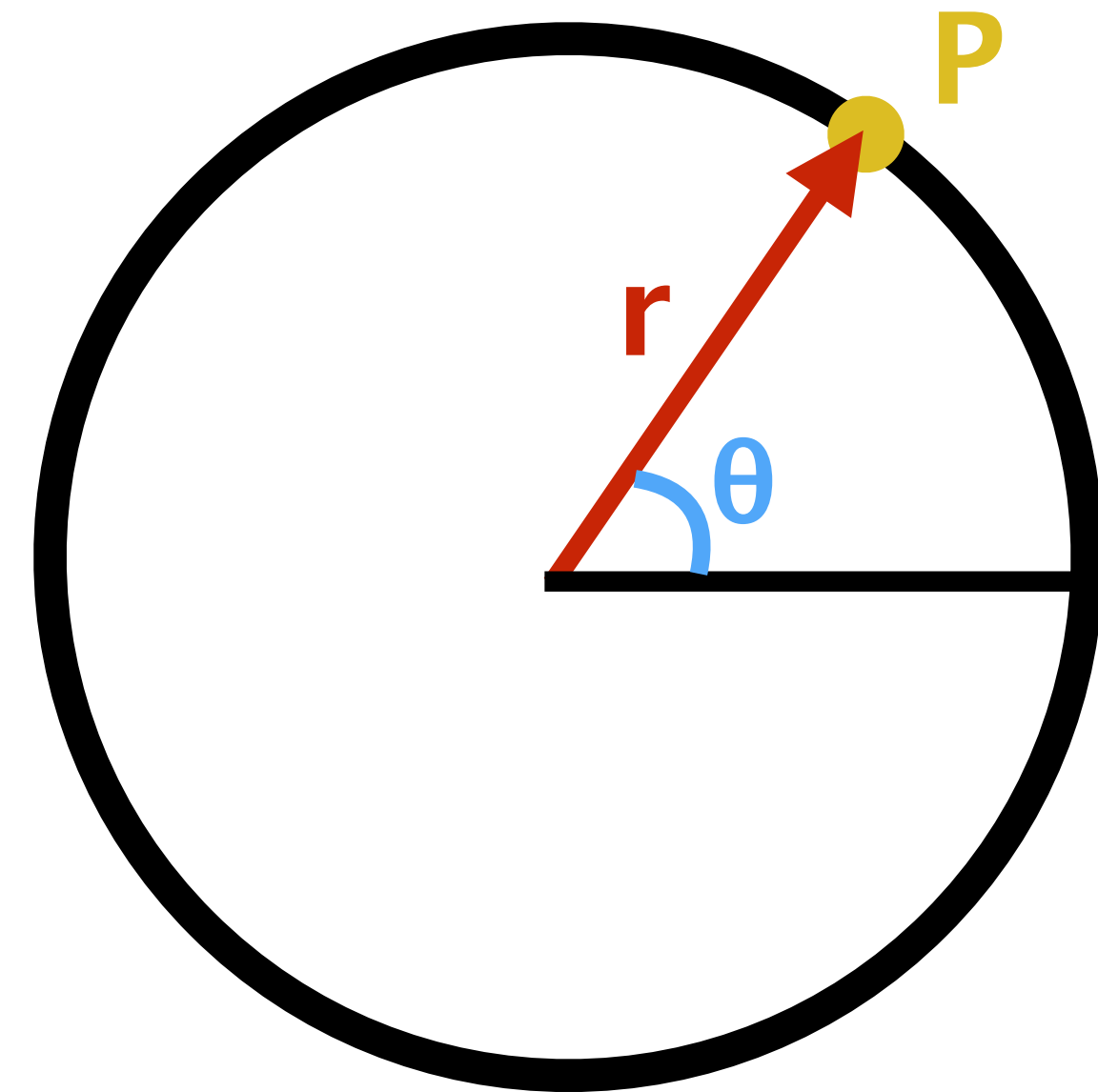
$$y = \sin \theta$$

Parametric Equation

- What about this?

$$x = \cos 2\theta$$

$$y = \sin 2\theta$$

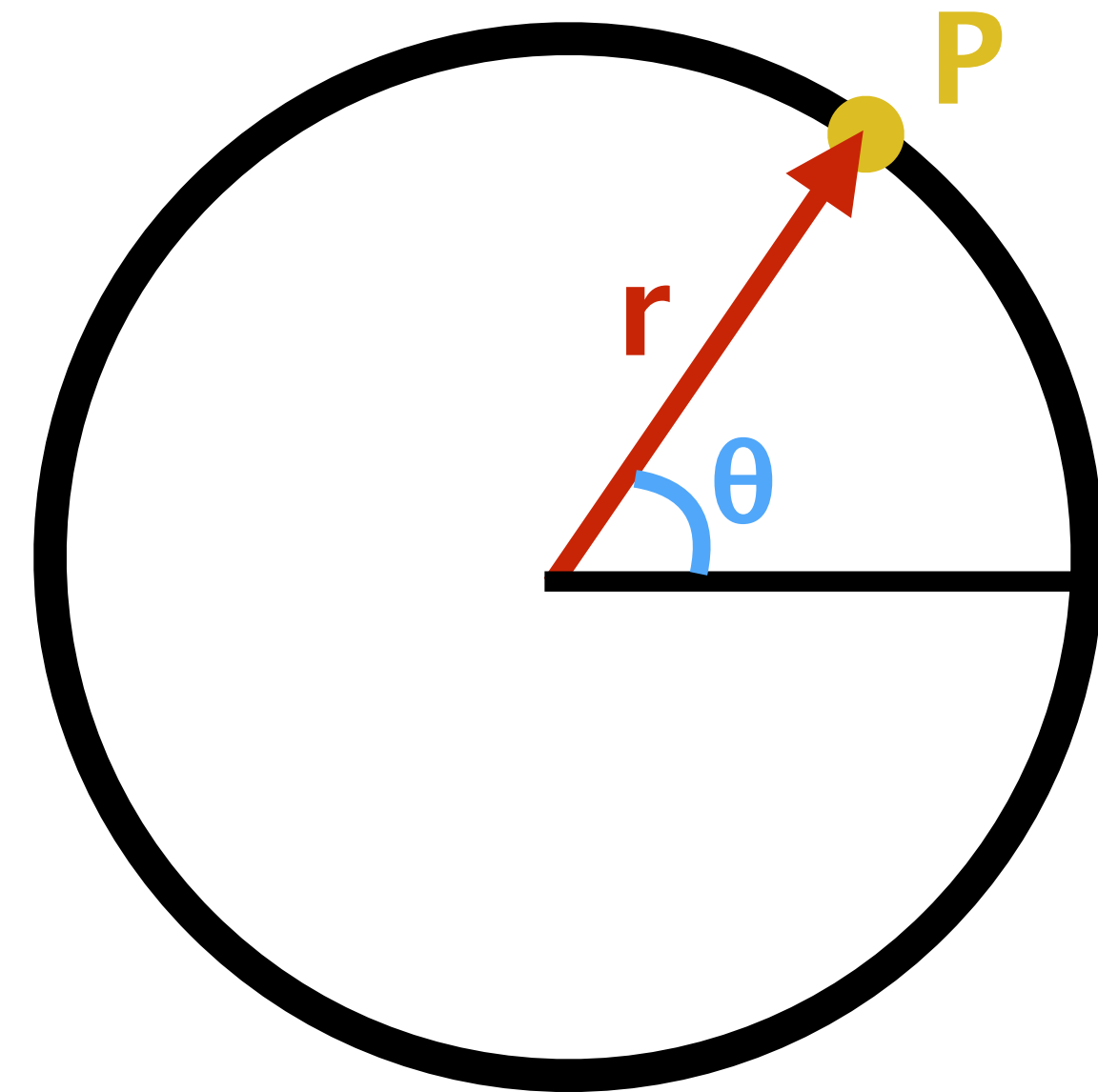


Parametric Equation

- What about this?

$$x = 2 \cos 2\theta$$

$$y = \sin 2\theta$$

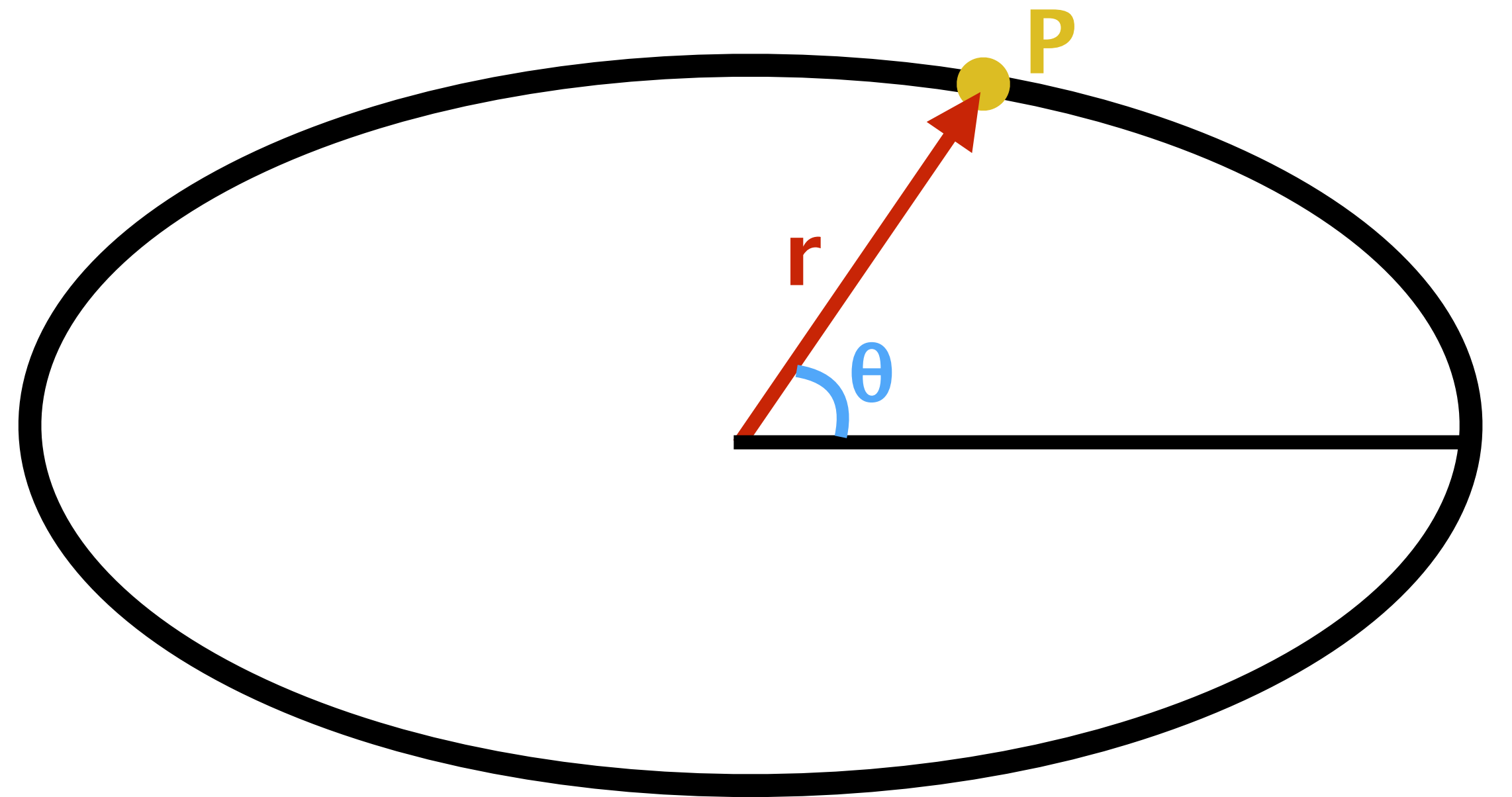


Parametric Equation

- What about this?

$$x = 2 \cos 2\theta$$

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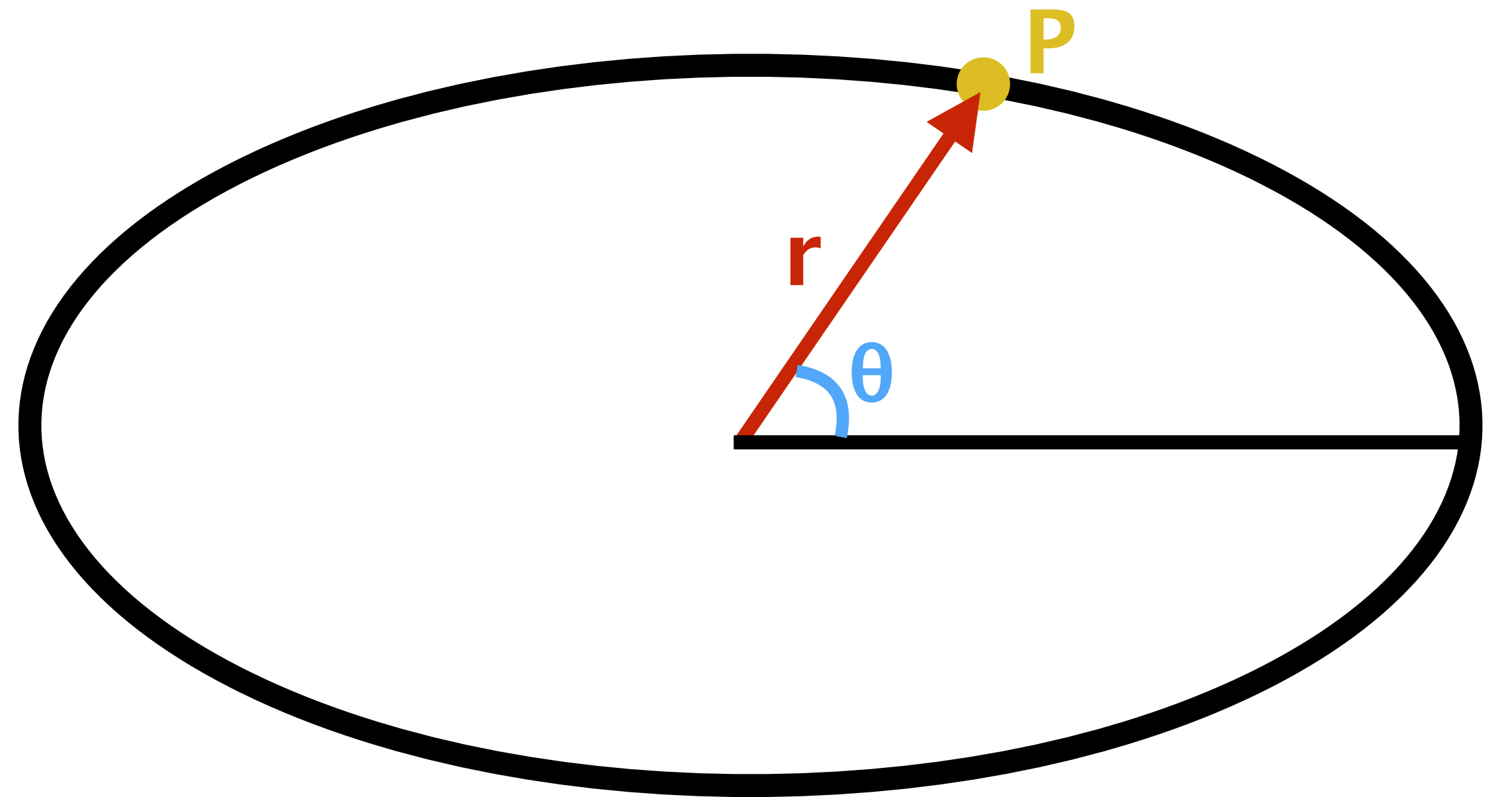


Parametric Equation

- What is radius?

$$x = 2 \cos 2\theta$$

$$y = \sin 2\theta$$

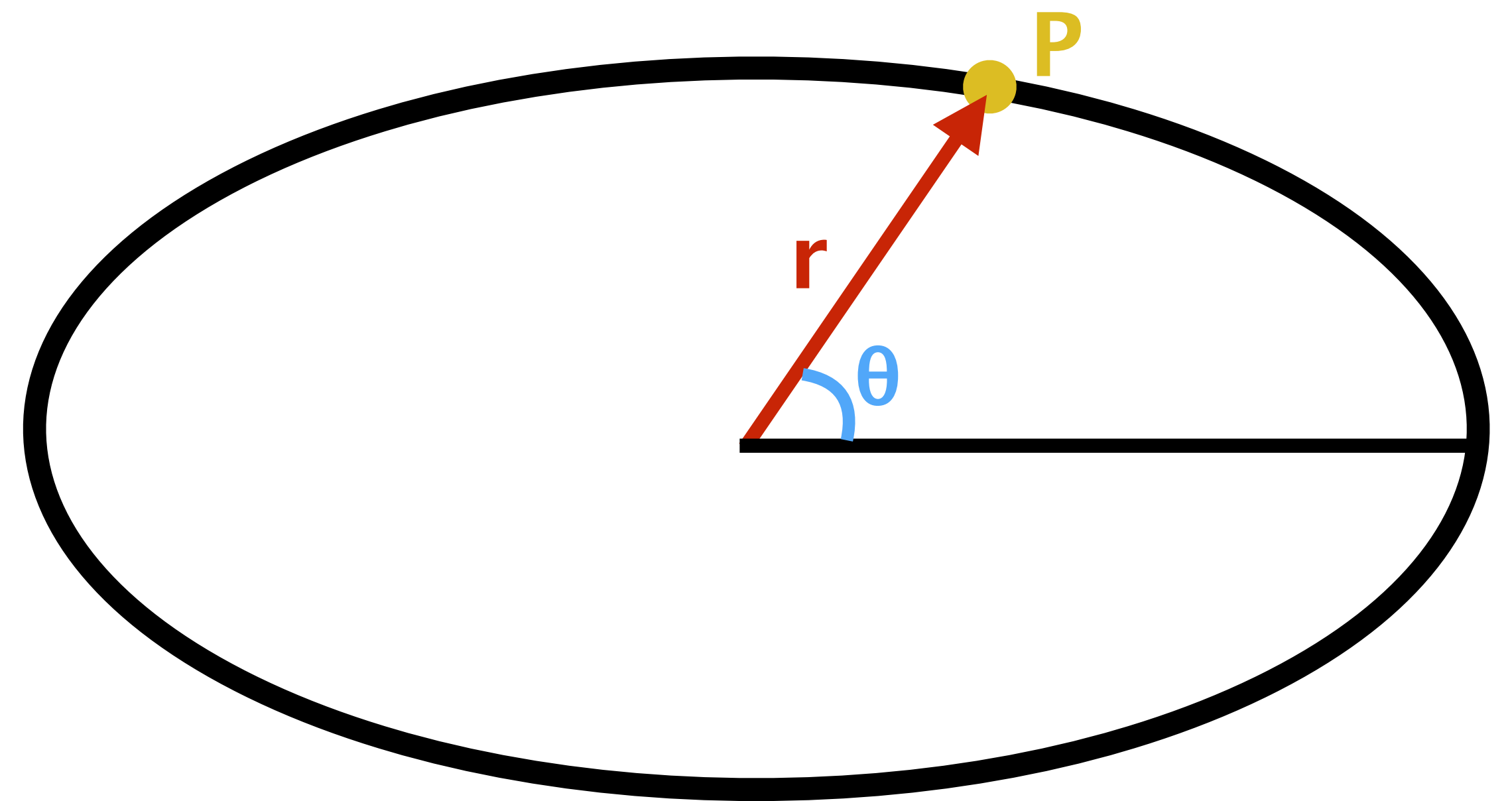


Parametric Equation

- What is radius?

$$\begin{aligned}r &= \sqrt{x^2 + y^2} \\ &= \sqrt{4\cos^2\theta + \sin^2\theta} \\ &= \sqrt{1 + 3\cos^2\theta}\end{aligned}$$

$$1 \leq r \leq \sqrt{4} = 2$$



$$x = 2 \cos 2\theta$$

$$y = \sin 2\theta$$

Parametric Equation

- Generally, not very easy to guess the shape

$$x = \cos\left(\frac{t}{2}\right)$$

$$y = \frac{1}{2} \sin(t)$$

Parametric Equation

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$$x = \cos\left(\frac{t}{2}\right)$$

$$y = \frac{1}{2} \sin(t)$$

- Let's try WolframAlpha!

Assignment 1

- Written part deadline: **Thursday, September 22, 11:59 PM**
- Programming part deadline: **Friday, September 30, 11:59 PM**
- The written part can't use your 5 late days!

Assignment 1

- Prepare for the next session:
 - Install GLFW, if working on your laptop
 - Take a look at the boilerplate code

Resources

- **GLFW quick start:**

- <http://www.glfw.org/docs/latest/quick.html>

- **Fractals Programming:**

- <http://natureofcode.com/book/chapter-8-fractals/>

- **Parametric Equations:**

- https://en.wikipedia.org/wiki/Parametric_equation