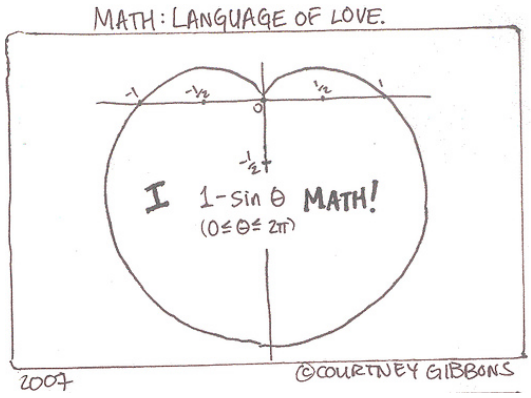
Polar Coordinates



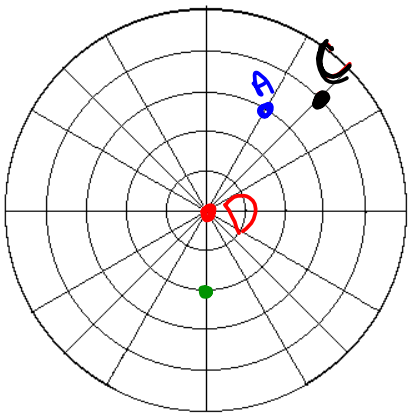
Polar:

1. Precalculus recap
2. Derivatives
3. Integrals

1. Precalculus recap

- plotting points in polar
- transforming points to other forms...rectangular $\longleftrightarrow$ polar

- plotting points in polar (r,θ)



A $\left(3,\frac{\pi}{3}\right)$ C $\left(-4,-\frac{3\pi}{4}\right)$

B $\left(-2,\frac{\pi}{2}\right)$ D $\left(0,\frac{3\pi}{2}\right)$

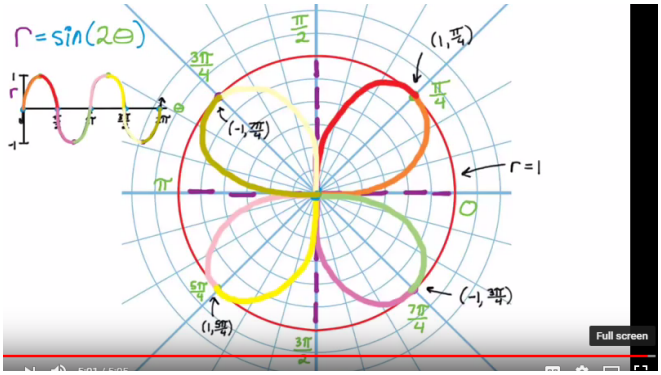
$\left(2,-\frac{\pi}{2}\right)$
$\left(2,\frac{3\pi}{2}\right)$

What are other ways to name A?

$\left(3,\frac{\pi}{3}\right)$

$\left(3,\frac{7\pi}{3}\right)$ $\left(-3,\frac{4\pi}{3}\right)$
$\left(3,-\frac{5\pi}{3}\right)$ $\left(-3,-\frac{2\pi}{3}\right)$

Graphing polar from rectangular



https://www.youtube.com/watch?v=tvPsjmcN2Yg

(5:05)

- transforming points to other forms...rectangular ⟷ polar

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

$$y = r\sin\theta \qquad \tan\theta = \frac{y}{x}$$

Polar to Rectangular: Use $x = r\cos\theta \quad y = r\sin\theta$

Convert the point $\left(3, \frac{\pi}{6}\right)$ to rectangular coordinates.

(r, θ)

$x = r\cos\theta$

$x = 3\cos\pi/6$

$x = 3\left(\frac{\sqrt{3}}{2}\right)$

$x = \frac{3\sqrt{3}}{2}$

$y = r\sin\theta$

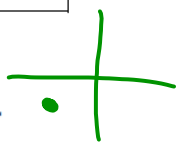
$y = 3\sin\pi/6$

$y = 3(1/2)$

$y = 3/2$

Rectangular to Polar: Use $\tan\theta = \frac{y}{x} \quad r = \sqrt{x^2 + y^2}$

Convert the point $\left(\frac{-1}{\sqrt{2}}, \frac{-1}{\sqrt{2}}\right)$ to polar coordinates.



(x, y)

$\tan\theta = \frac{\frac{-1}{\sqrt{2}}}{\frac{-1}{\sqrt{2}}} = 1$

$\tan\theta = 1$

(r, θ)

$\left(1, \frac{5\pi}{4}\right)$

$\left(-1, \pi/4\right)$

$r = \sqrt{\left(\frac{-1}{\sqrt{2}}\right)^2 + \left(\frac{-1}{\sqrt{2}}\right)^2}$

$r = \sqrt{\frac{1}{2} + \frac{1}{2}} = \sqrt{1}$

$r = 1$

Convert the rectangular equation to polar form

$$x^2 + y^2 = 9$$

$r^2 = 9$

$r = 3$

Convert the rectangular equation to polar form

$$y = 8$$

$r\sin\theta = 8$

$r = \frac{8}{\sin\theta}$

$r = 8\csc\theta$

Convert the rectangular equation to polar form

$$3x - y + 2 = 0$$

$3(r\cos\theta) - r\sin\theta + 2 = 0$

$3r\cos\theta - r\sin\theta = -2$

$r(3\cos\theta - \sin\theta) = -2$

$\frac{r(3\cos\theta - \sin\theta)}{(3\cos\theta - \sin\theta)} = \frac{-2}{3\cos\theta - \sin\theta}$

$r = \frac{-2}{3\cos\theta - \sin\theta}$

Convert the polar equation to rectangular form

$$(r)^2 = (4)^2$$

$r^2 = 16$

$x^2 + y^2 = 16$

Convert the polar equation to rectangular form

$$r = \sec\theta \tan\theta$$

$$r = \frac{1}{\cos\theta} \cdot \tan\theta$$

$$r = \frac{\tan\theta}{\cos\theta}$$

$$r\cos\theta = \tan\theta$$

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

$$x^2 = y$$