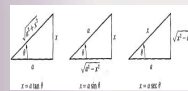


If $\lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \frac{0}{0}$
 or
 $\lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \frac{\infty}{\infty}$
 Then
 $\lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \lim_{x \rightarrow a} \frac{f'(x)}{g'(x)}$
 provided that the latter limit exists.

$$f(x) = f(a) + f'(a)(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \frac{f'''(a)}{3!}(x-a)^3 + \dots = \sum_{k=0}^{\infty} \frac{f^{(k)}(a)}{k!}(x-a)^k$$



$$\ln(x) = \int_1^x \frac{1}{t} dt \Rightarrow \ln(2) = \int_1^2 \frac{1}{t} dt \approx 0.69315$$

$$\int u dv = uv - \int v du$$

where it comes from:

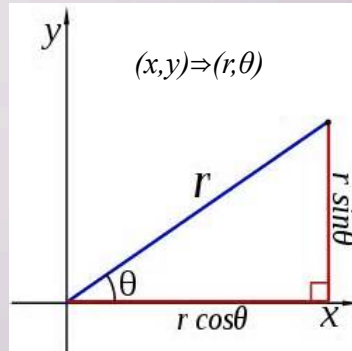
$$\frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx}$$

$$\int \frac{d}{dx}(uv) = \int u \frac{dv}{dx} + \int v \frac{du}{dx}$$

$$uv = \int u \frac{dv}{dx} + \int v \frac{du}{dx}$$

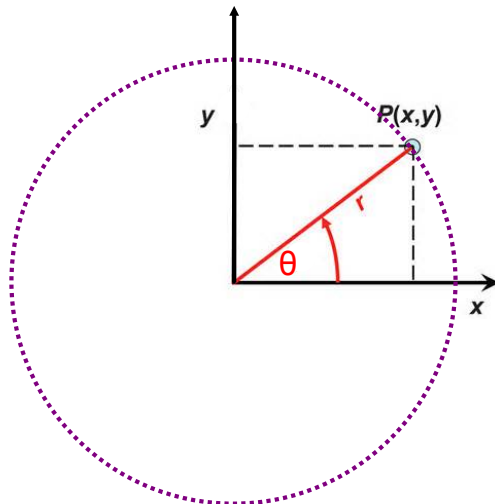
$$\int u \frac{dv}{dx} = uv - \int v \frac{du}{dx}$$

The Polar Coordinate System



The Polar Coordinate System

is a different way to express points in a plane.

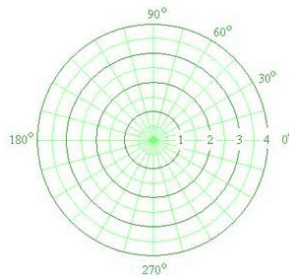


EX 1 Find the rectangular coordinates for this point. $(4, \pi/6)$

EX 2 Find the polar coordinates for this point. $(-2, 2)$

There are an infinite number of ways to write the same point in polar coordinates.

The point $(2, \pi/4)$ has other names.



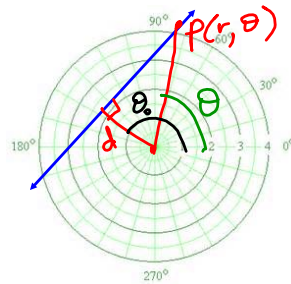
EX 3 Find three other ways to represent the
polar coordinates for this point. $(-3, 2\pi/3)$

EX 4 Plot $r = 6 \sin \theta$.

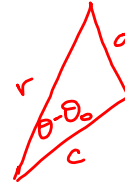
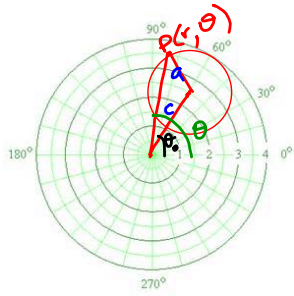
Prove that it is a circle in the Cartesian Coordinate system.

Polar Equations

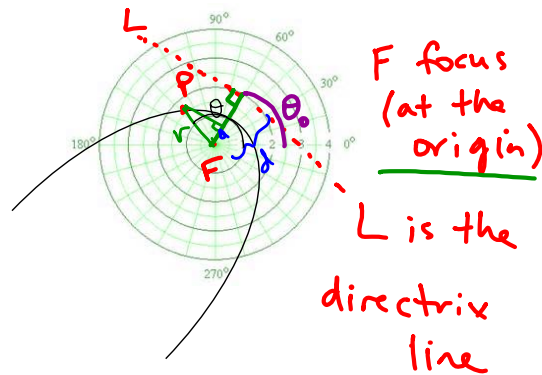
1) Lines



2) Circles



3) Conics (Parabolas, Hyperbolas, Ellipses)



EX 5 Name the curve. If it is a conic, give its eccentricity and sketch it.

a) $r = \frac{2}{2+2\cos(\theta-\pi/3)}$

b) $r = -4 \cos(\theta-\pi/4)$

c) $\theta = 2\pi/3$