

## Conversions

### Rectangular → Polar

$$x = r \cos(\theta)$$

$$y = r \sin(\theta)$$

### Polar → Rectangular

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

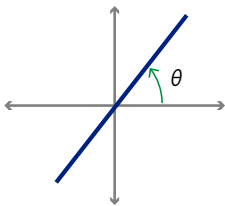
$$\tan(\theta) = \frac{y}{x}$$

## Common Curves

### Lines

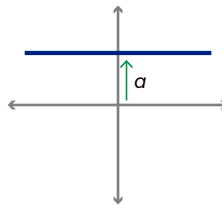
$$\theta = \text{constant}$$

Line through origin



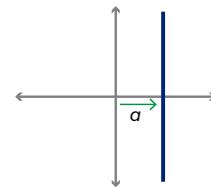
$$r = a \csc(\theta)$$

Horizontal line



$$r = a \sec(\theta)$$

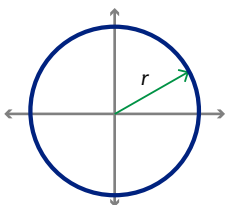
Vertical line



### Circles

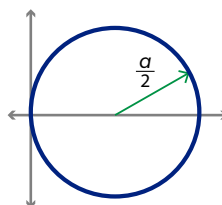
$$r = \text{constant}$$

Circle centered at origin



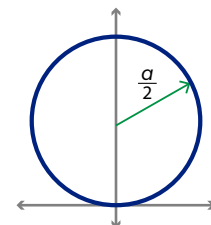
$$r = a \cos(\theta)$$

Circle centered at  $(\frac{a}{2}, 0)$

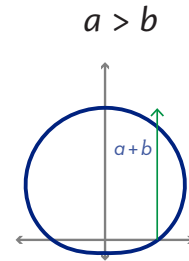
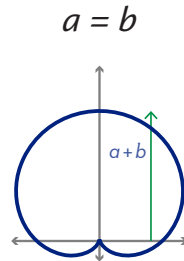
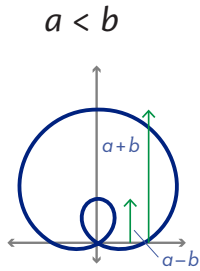


$$r = a \sin(\theta)$$

Circle centered at  $(0, \frac{a}{2})$



**Limaçon**  $r = a \pm b \sin(\theta)$

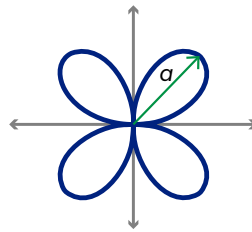


**Rose**

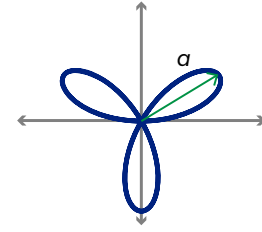
$r = a \sin(n\theta)$

- *n even*:  $2n$  petals
- *n odd*:  $n$  petals
- 1st petal starts tangent to the axis

$r = a \sin(2\theta)$



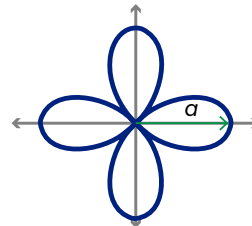
$r = a \sin(3\theta)$



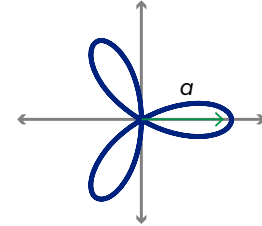
$r = a \cos(n\theta)$

- *n even*:  $2n$  petals
- *n odd*:  $n$  petals
- 1st petal starts centered on the axis

$r = a \cos(2\theta)$



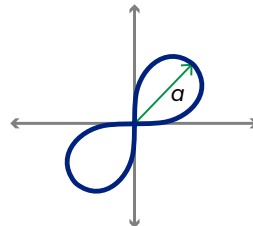
$r = a \cos(3\theta)$



**Lemniscates**

- *sine*: petals aligned  $45^\circ$
- *cosine*: petals on x-axis

$r^2 = a^2 \sin(2\theta)$



$r^2 = a^2 \cos(2\theta)$

