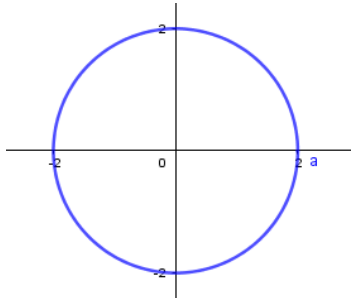


# GRÁFICAS EN COORDENADAS POLARES

## CIRCUNFERENCIAS

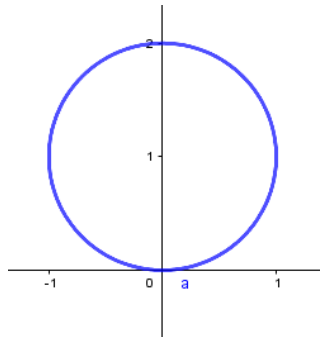
Radio  $a$

$$r = a$$



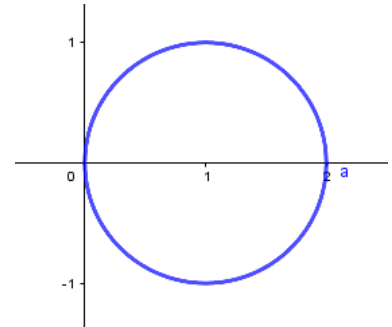
Centro en el polo

$$r = 2a \operatorname{sen}(\theta)$$



Centro en  $\frac{\pi}{2}$

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



Centro en el eje polar

## CARDIOIDES O LIMACONES

$$r = a \pm b \operatorname{sen}(\theta) \text{ simetrías con el eje } \frac{\pi}{2}$$

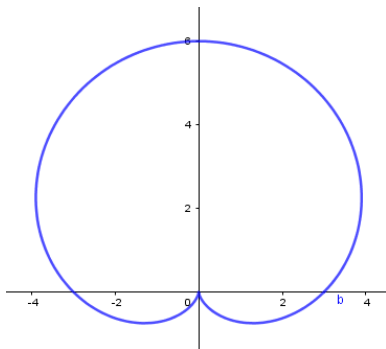
$$r = a \pm b \cos(\theta) \text{ Simetrías con el eje polar}$$

### CARDIOIDES

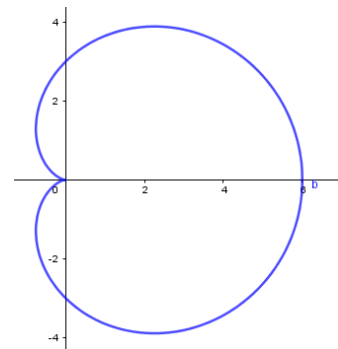
Gráficas “en forma de corazón” que pasan por el origen, simétricas con los ejes, para  $\frac{a}{b} = 1$

$$|a| = |b|$$

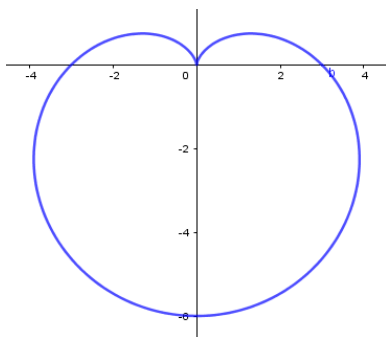
$$r = a + a \operatorname{sen}(\theta)$$



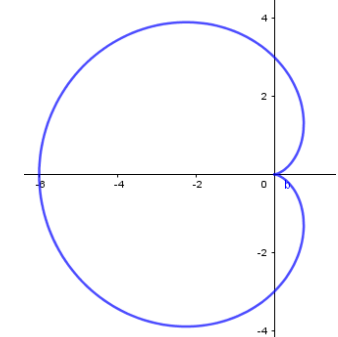
$$r = a + a \cos(\theta)$$



$$r = a - a \operatorname{sen}(\theta)$$



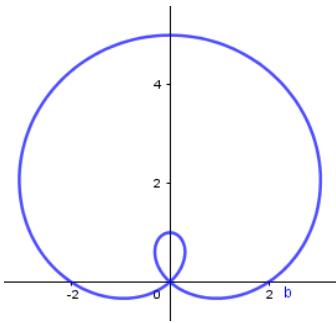
$$r = a - a \cos(\theta)$$



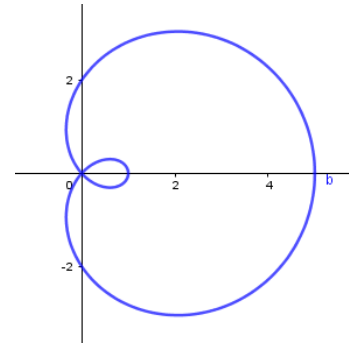
### LIMACÓN CON LAZO INTERIOR

La forma de una limacón depende de las magnitudes de  $a$  y  $b$ , para  $0 < \frac{a}{b} < 1$   
 $|a| < |b|$

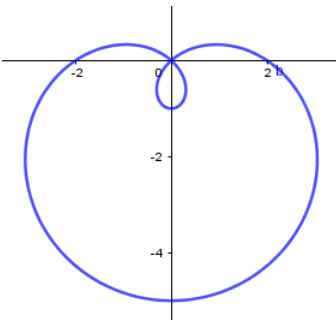
$$r = a + b \operatorname{sen}(\theta)$$



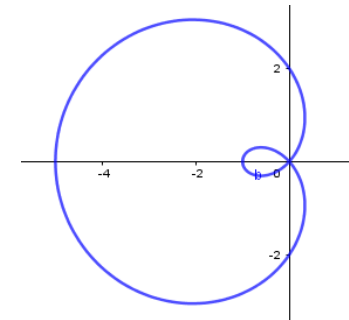
$$r = a + b \operatorname{cos}(\theta)$$



$$r = a - b \operatorname{sen}(\theta)$$



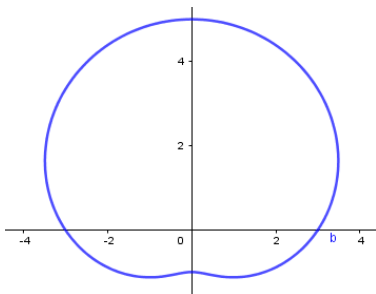
$$r = a - b \operatorname{cos}(\theta)$$



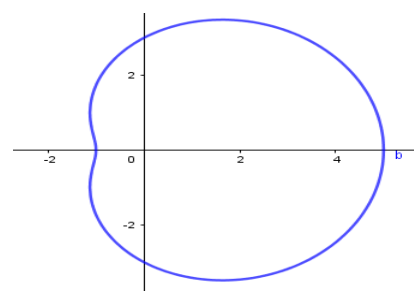
### LIMACÓN CON ENDIDURA O ORIFÍCIO

La forma de una limacón depende de las magnitudes de  $a$  y  $b$ , para  $1 < \frac{a}{b} < 2$   
 $|a| > |b|$

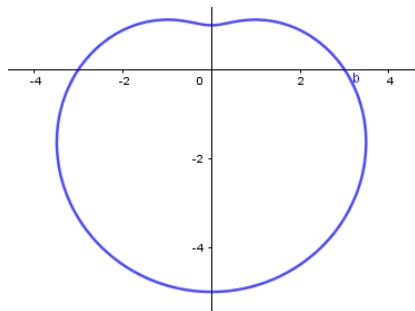
$$r = a + b \operatorname{sen}(\theta)$$



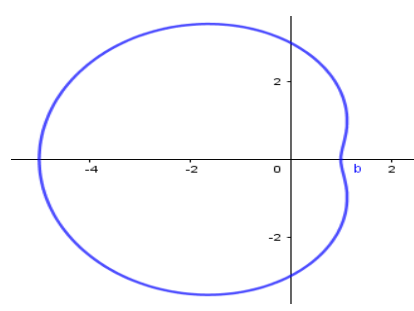
$$r = a + b \operatorname{cos}(\theta)$$



$$r = a - b \operatorname{sen}(\theta)$$



$$r = a - b \operatorname{cos}(\theta)$$

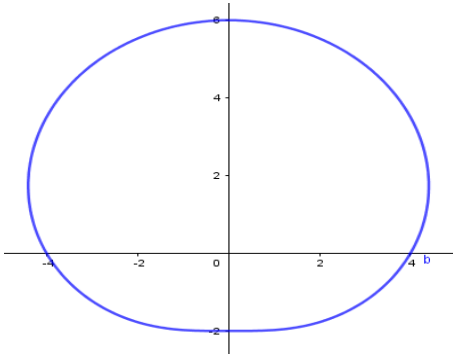


## LIMACÓN CONVEXA

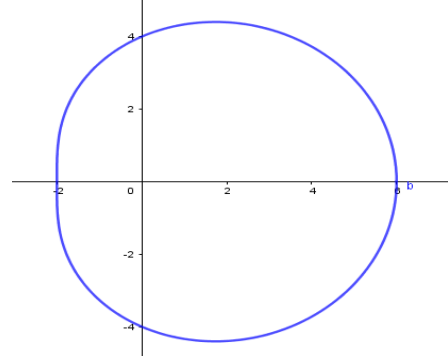
La forma de una limacón depende de las magnitudes de  $a$  y  $b$ .

$$\frac{|a|}{|b|} \geq 2$$

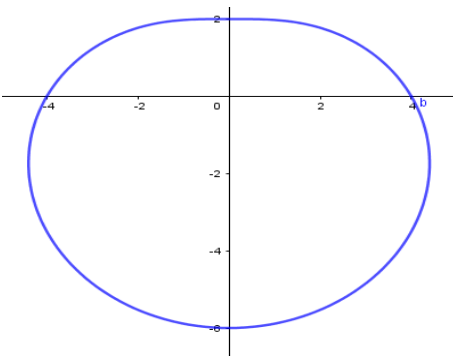
$$r = a + b \operatorname{sen}(\theta)$$



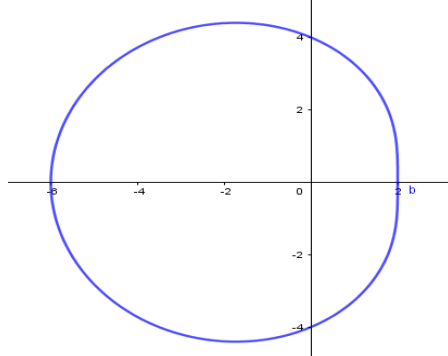
$$r = a + b \operatorname{cos}(\theta)$$



$$r = a - b \operatorname{sen}(\theta)$$



$$r = a - b \operatorname{cos}(\theta)$$

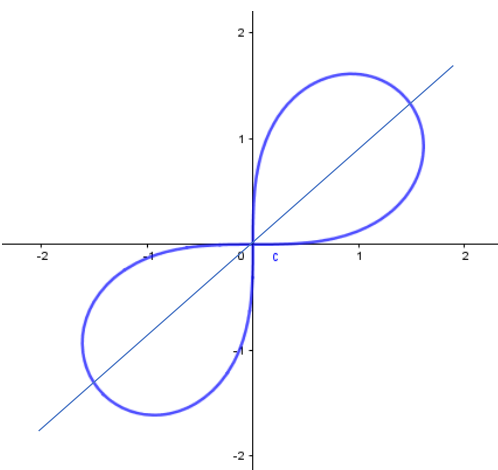


## LEMNISCATAS

Las gráficas de ambas ecuaciones son simétricas respecto al origen.

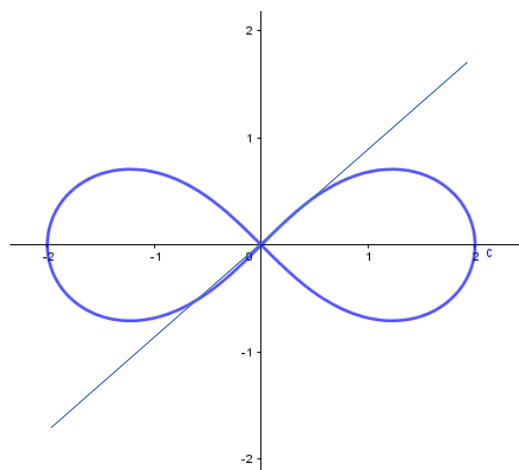
Además, la gráfica es simétrica respecto al eje  $x$

$$r^2 = a \operatorname{sen}(2\theta)$$



Simetría en  $\frac{\pi}{4}$

$$r^2 = a \operatorname{cos}(2\theta)$$



Simetría en  $\frac{\pi}{4}$

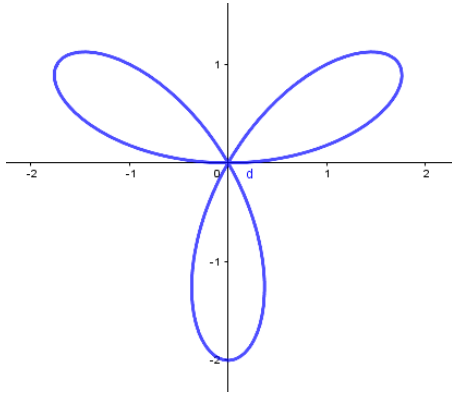
## ROSAS

*Si  $n$  es impar, tiene  $n$  pétalos*

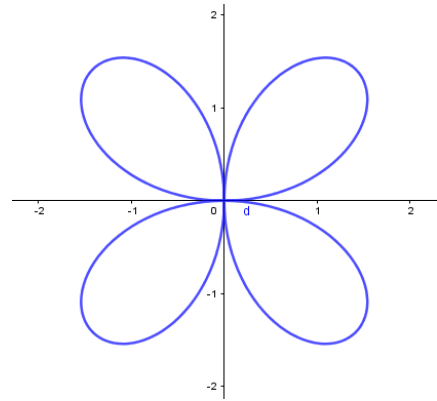
*Si  $n$  es par, tiene  $2n$  pétalos*

Según el número de pétalos o lazos

$$r = a \operatorname{sen}(n \theta)$$

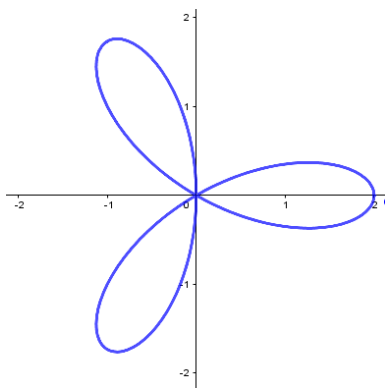


$$n = 3$$

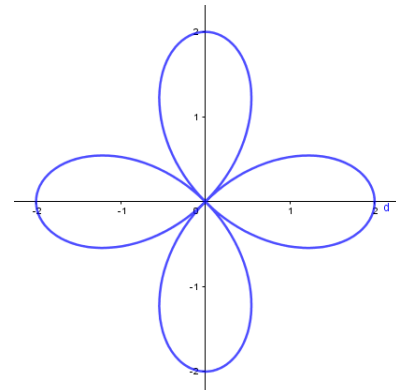


$$n = 2$$

$$r = a \operatorname{cos}(n \theta)$$



$$n = 3$$



$$n = 2$$

## ESPIRAL

$$r = a(\theta)$$
$$r = a + b(\theta)$$

