

Polar Graphs Day 1

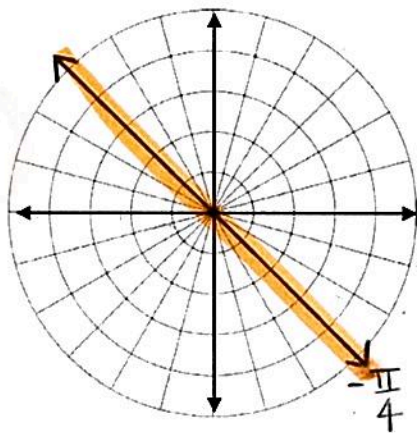
{Lines, Circles, Roses, and Lemniscates}

Name Key

- We will be using a calculator to investigate these polar graphs, but you must be prepared to graph them without a calculator.

Lines $\theta = a$

1) $\theta = -\frac{\pi}{4}$

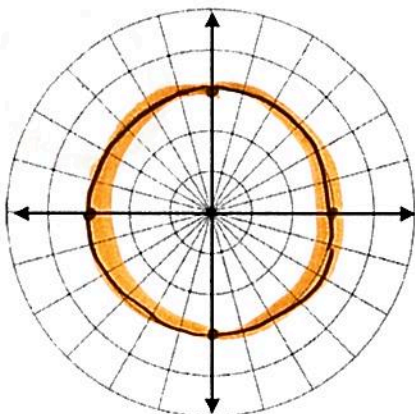


Window

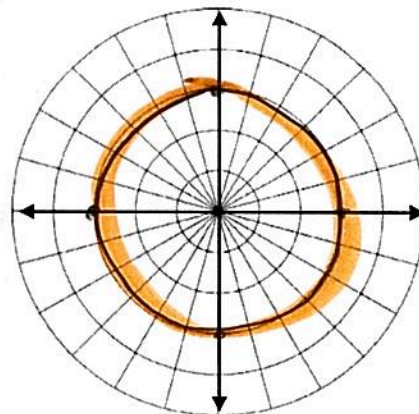
$$\begin{aligned}\theta_{\min} &= 0 \\ \theta_{\max} &= 360 \\ \theta_{\text{step}} &= 15 \\ x_{\min} &= -5 \\ x_{\max} &= 5 \\ y_{\min} &= -5 \\ y_{\max} &= 5\end{aligned}$$

Circles centered at (0,0) $r = a$ or $r = -a$

1) $r = 3$



2) $r = -3$



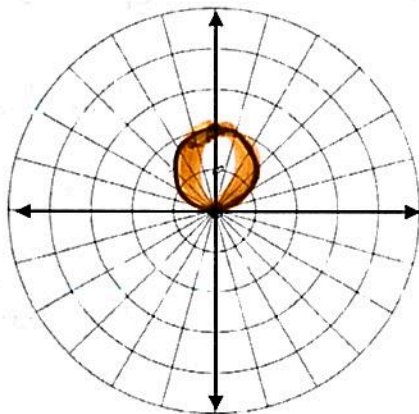
Things to remember:

$\theta = a$ constant is ALWAYS a line through the origin.
(angle)

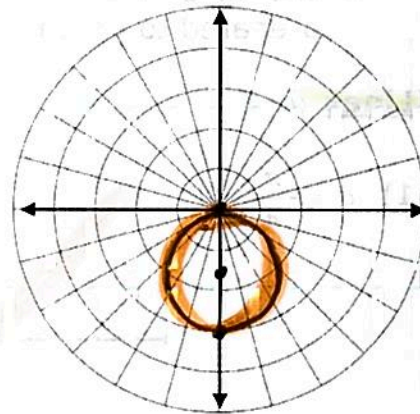
$r = a$ constant is always a circle centered at the origin. If a is $(-)$, the final graph is the same as $(+)$.

Circles not centered at (0,0) $r = a \cos \theta$ or $r = a \sin \theta$

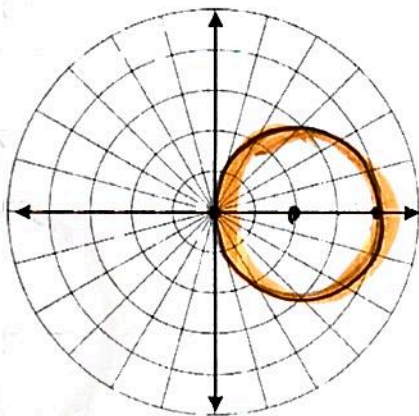
1) $r = 2 \sin \theta$



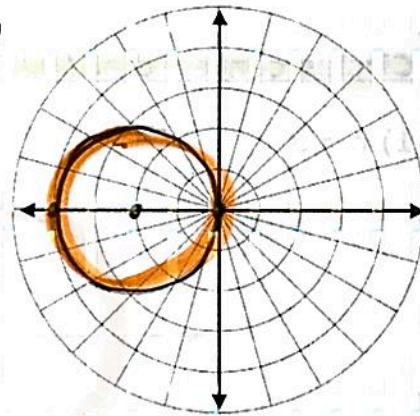
2) $r = -3 \sin \theta$



3) $r = 4 \cos \theta$



4) $r = -4 \cos \theta$



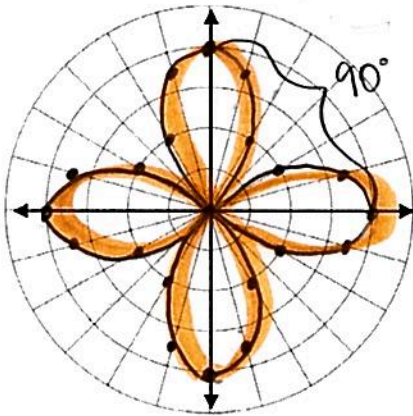
Things to remember:

- \cos graphs are on the x-axis
- \sin graphs are on the y-axis
- "a" is the diameter
- If (+a), the circle will be up or right
- If (-a), the circle will be down or left

"a" is length of each petal

Rose Curves $r = a \cos n\theta$ or $r = a \sin n\theta$

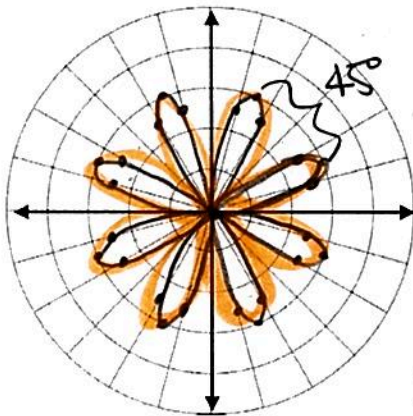
1) $r = 4 \cos 2\theta$



How many degrees between each petal?

$$\frac{360}{4} = 90^\circ$$

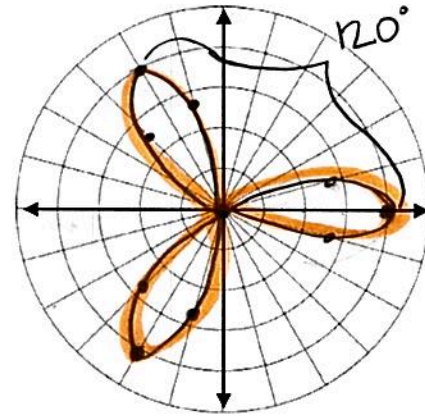
3) $r = 3 \sin 4\theta$



How many degrees between each petal?

$$\frac{360}{8} = 45^\circ$$

2) $r = 4 \cos 3\theta$

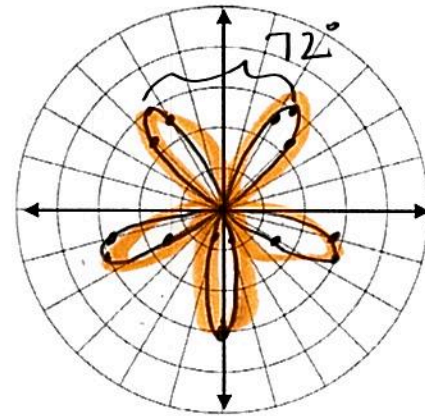


How many degrees between each petal?

$$\frac{360}{3} = 120^\circ$$

$$\frac{2\pi}{5} \text{ or } \frac{360}{5} = 72^\circ$$

4) $r = -3 \sin 5\theta$



Where are the petals?

length

$$\frac{3}{-3} = -\sin 5\theta$$

$$-1 = \sin 5\theta$$

$$\frac{5\theta}{5} = \frac{270^\circ}{5}$$

$$\theta = 54, 126, 198, 270, 342^\circ$$

How many degrees between each petal?

$$\frac{360}{5} = 72^\circ$$

Things to remember:

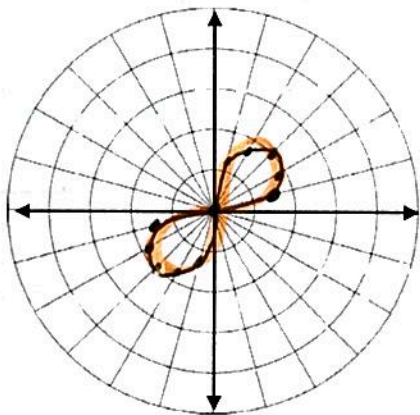
- when "n" is even, there are "2n" petals
- when "n" is odd, there are "n" petals
- "a" is the length of each petal
- cos graphs are symmetric to the x-axis
- sin graphs are symmetric to the y-axis

"a" is the length of each petal

Lemniscates $r^2 = a^2 \sin 2\theta$ or $r^2 = a^2 \cos 2\theta$

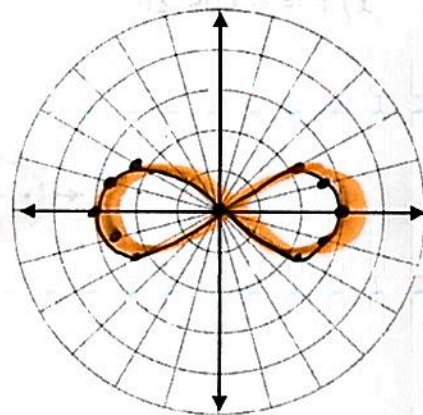
1) $r^2 = 4 \sin 2\theta$

$$r = \sqrt{4 \sin 2\theta}$$



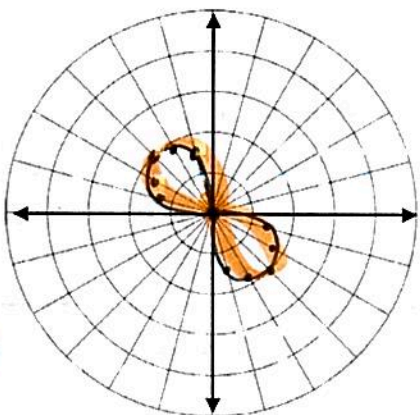
2) $r^2 = 9 \cos 2\theta$

$$r = \sqrt{9 \cos 2\theta}$$



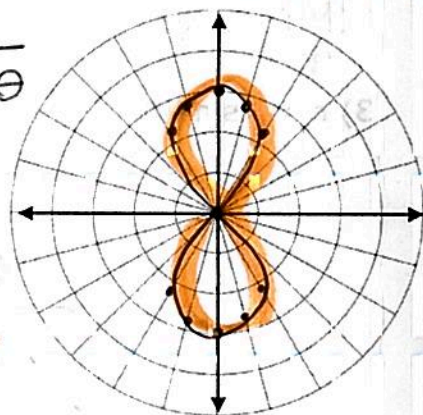
3) $r^2 = -4 \sin 2\theta$

$$r = \sqrt{-4 \sin 2\theta}$$



4) $r^2 = -9 \cos 2\theta$

$$r = \sqrt{-9 \cos 2\theta}$$



Things to remember:

- sin graphs are in either Q1 & Q3 (+) or Q2 & Q4 (-)
- cos graphs are on the x-axis (+) or the y-axis (-)
- "a" is the length of each petal