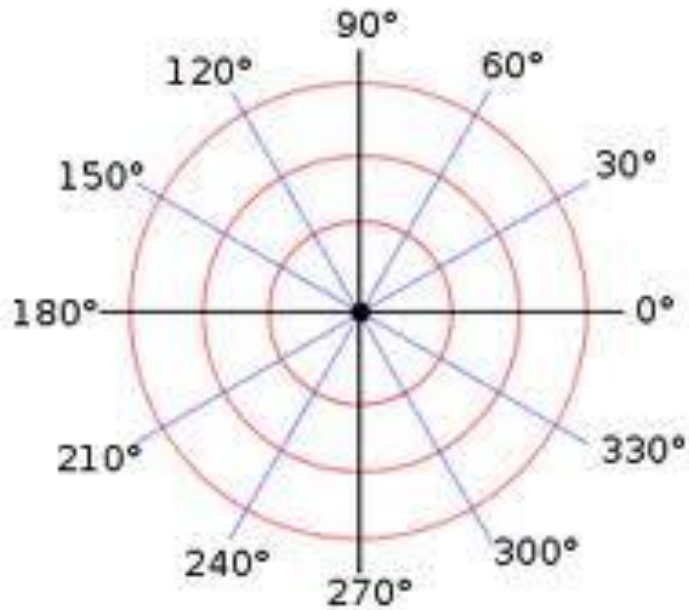# Pre-Calculus
Sec. 6.4
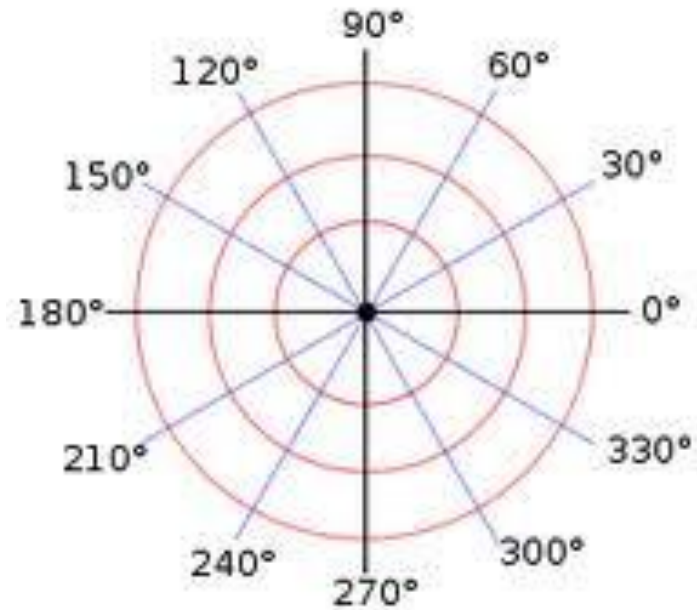## Graphs of Polar Equations

1) CIRCLES:

A) $r = n \cos \theta$

"center on the x-axis with radius = n/2 or diameter = n"
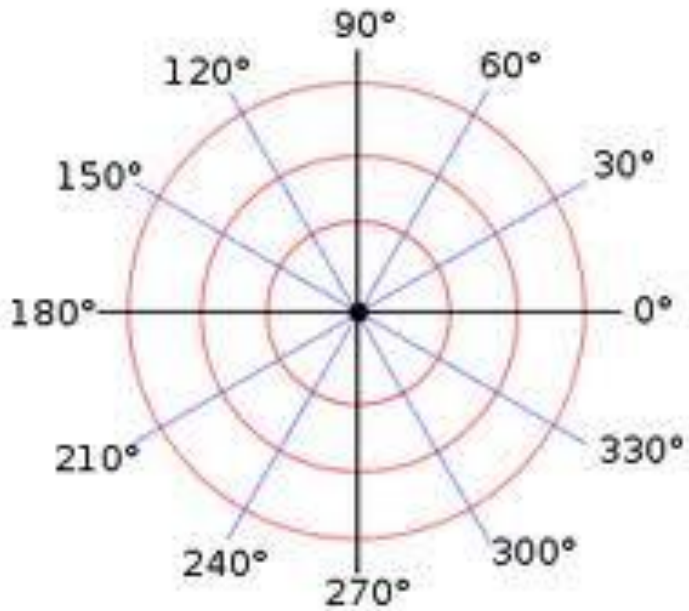
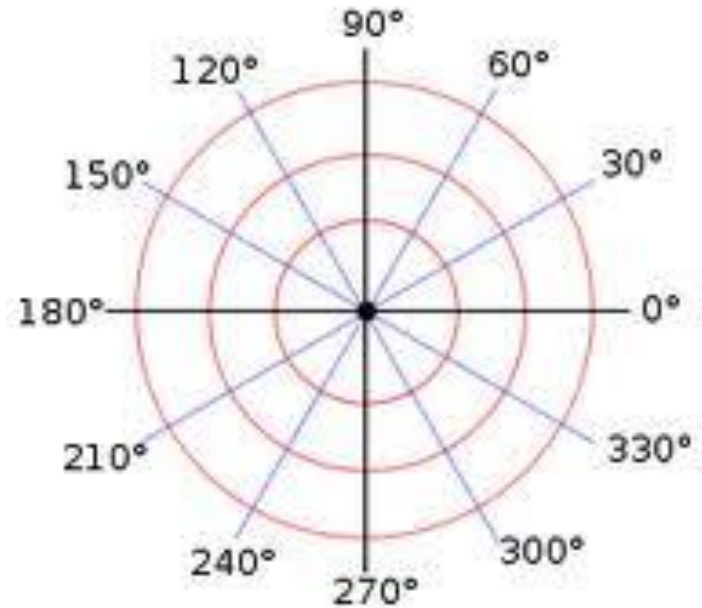Ex. $r = 4 \cos \theta$ Ex. $r = -4 \cos \theta$

B) r = n sin θ

"center on y-axis with radius = n/2 or diameter = n"

Ex. r = 4 sin θ   Ex. r = - 4 sin θ

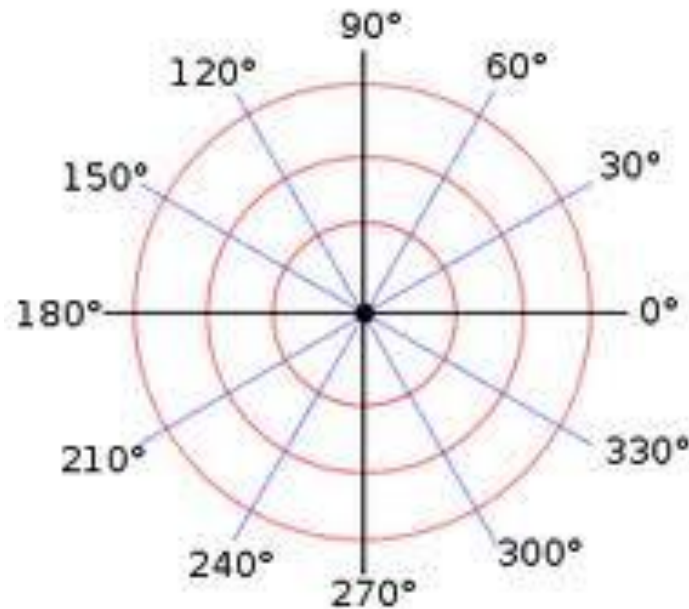# 2) Limacons "Limasons"

r = a $\pm$ b sin θ   or   r = a $\pm$ b cos θ

A) If |a| = |b| : "Heart Shape" called a Cardioid

Ex. r = 2 + 2 sin θ

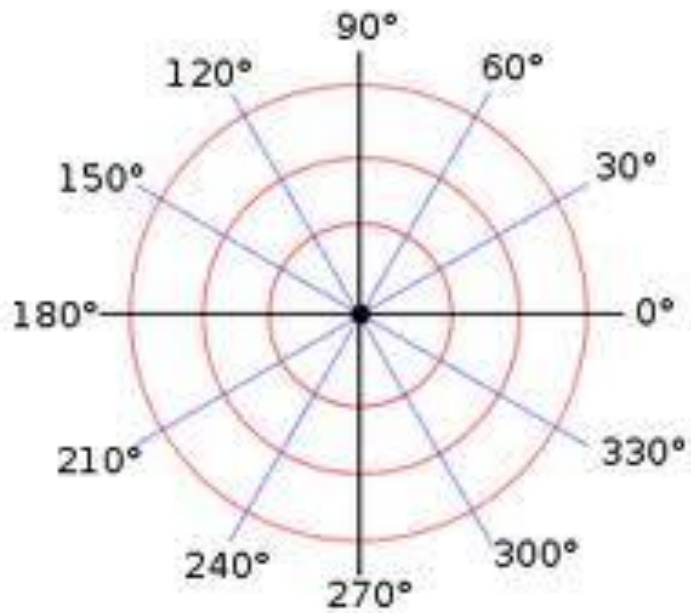r = 2 − 2 cos θ **Limacon**: Cardioid
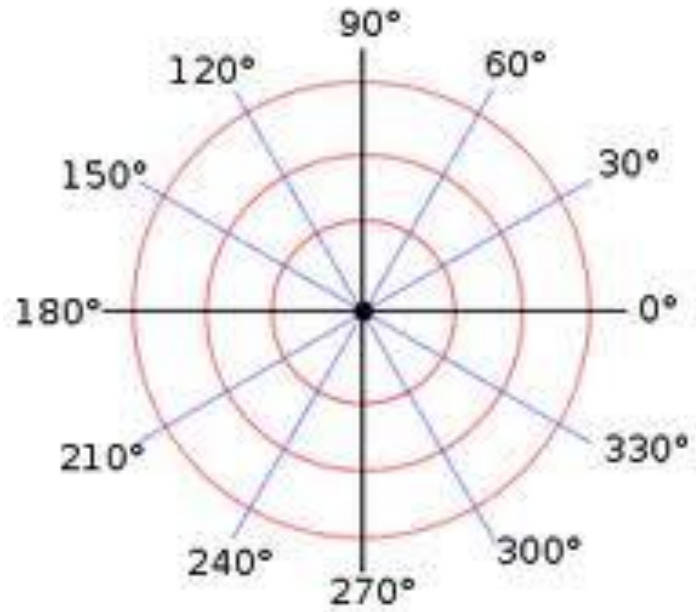
B) If |a| < |b| **Limacon:**

"Inner Loop - crosses or loops at the pole"

Ex. r = 2 + 4 sin θ

C) If |a| > |b| **Limacon:**"Curve surrounding the pole"
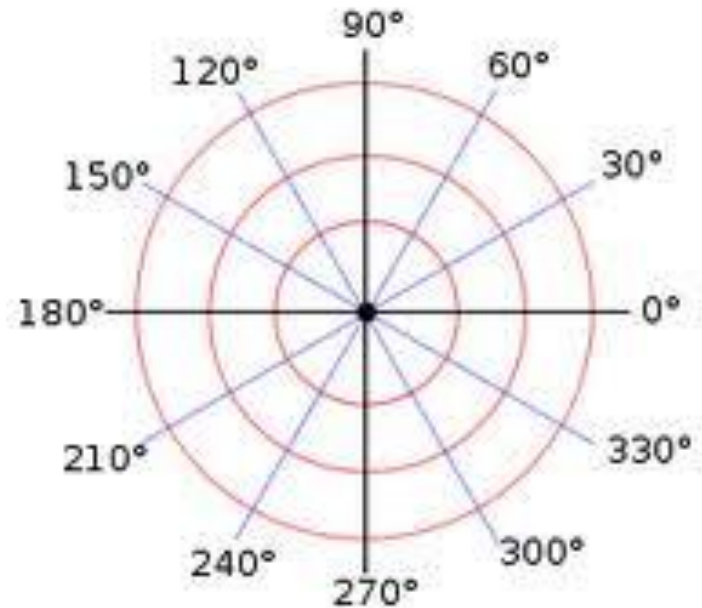
$$1 < \frac{|a|}{|b|} < 2$$
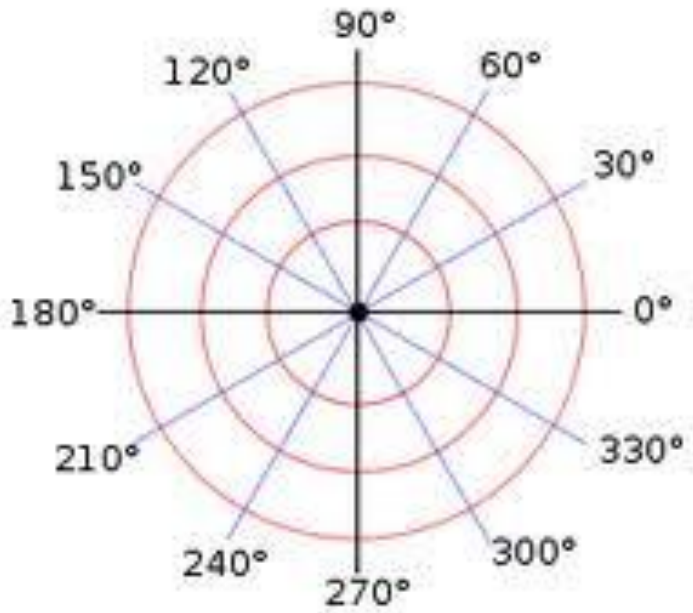
$$\frac{|a|}{|b|} \geq 2$$

(NO pole, NO loop, With DIMPLE)   (NO pole, NO loop, NO dimple)

Ex. r = 3 + 2 cos θ

(NO pole, NO loop, With DIMPLE)

Ex. r = 2 - cos θ **Limacon:** Curve surrounding the pole

(NO pole, NO loop, NO dimple)

3) Roses:

r = a sin nθ   or   r = a cos nθ

length of each

petal

# of petals

If n is even: # of petals = 2n **(double)**
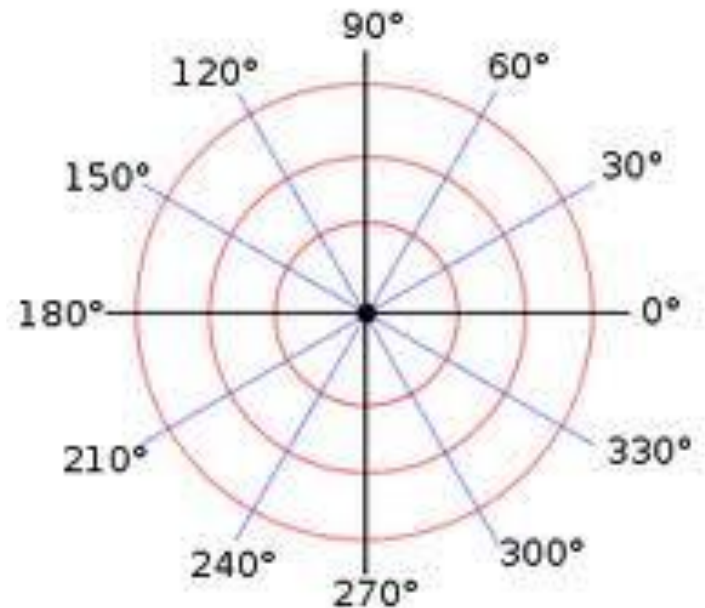
If n is odd: # of petals = n

Ex. Steps for graphing roses: $r = 3 \sin 2\theta$

Step 1: Find the 1ˢᵗ tip of the petals:

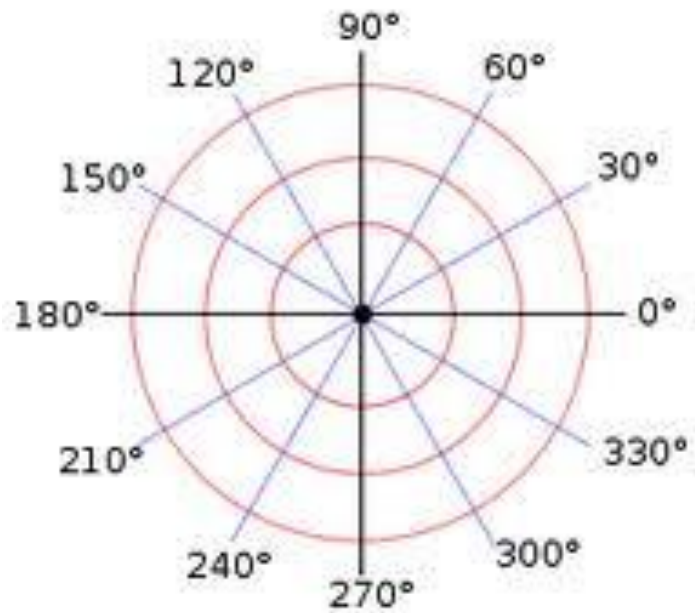   Set $\sin n\theta = 1$ or $\cos n\theta = 1$ (leave off "a")

Step 2: Find the rest of the tips:

   360 ÷ # of petals, add to

   step 1
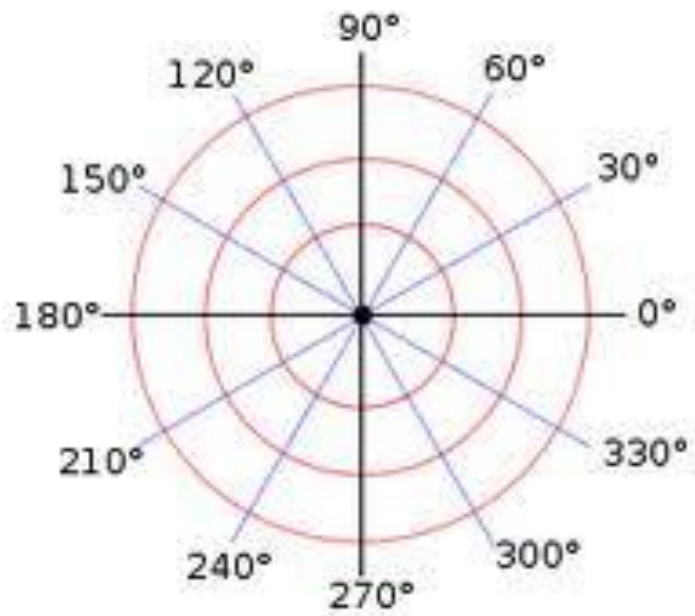
Ex. r = 2 sin 3θ

Find 1st tip:

Ex. r = 2 cos 3θ

Find 1st tip:

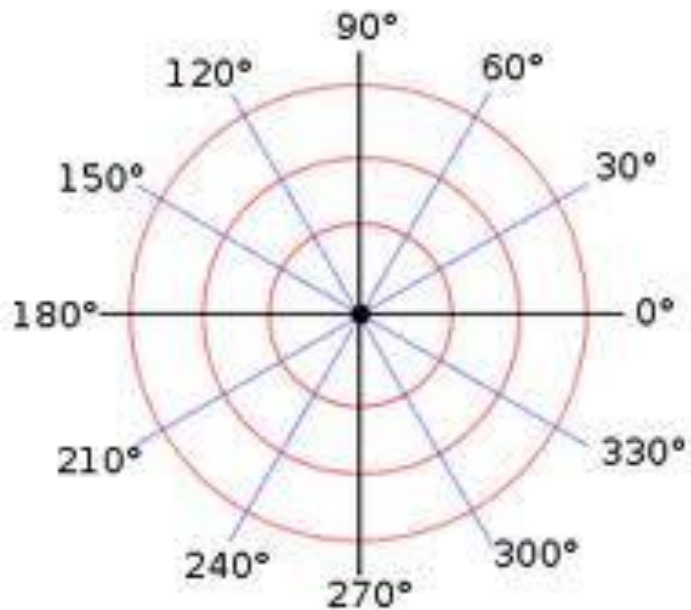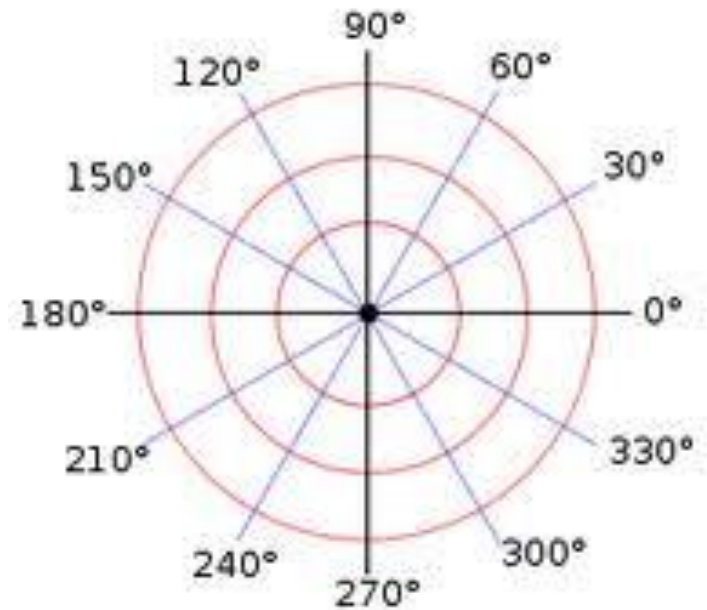# 4) Lemniscates:

The equation looks like a rose, but with r^2 & a^2.

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

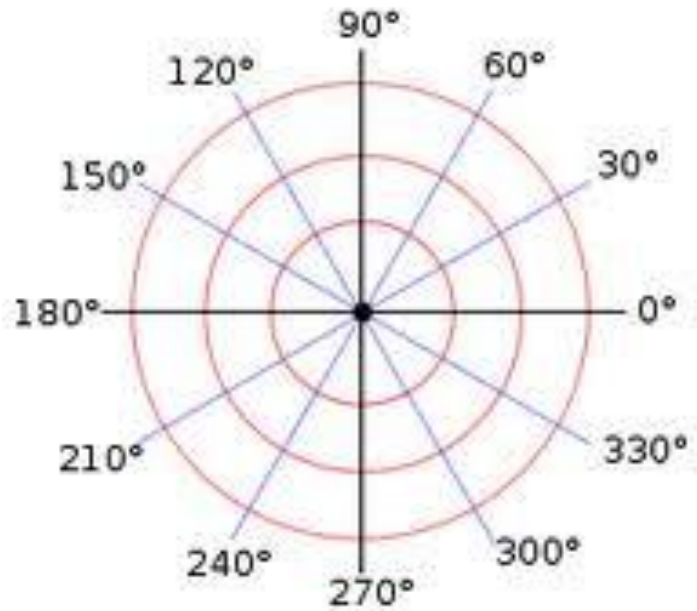Ex. $r^2 = 4 \sin 2\theta$ Ex. $r^2 = -4 \sin 2\theta$

Lemniscates:

Ex. $r^2 = 9\cos 2\theta$ Ex. $r^2 = -9\cos 2\theta$