Lemniscates

```
r^{2} = a^{2}cos(2\theta)
r^{2} = a^{2}sin(2\theta)
```



Symmetry Properties

1. If the polar equation is unchanged by replacing θ with $-\theta$ the graph is symmetric about the polar axis (x-axis rectangular coordinates).



2. If the polar equation is unchanged by replacing r with -r the graph is symmetric about the pole (origin in rectangular coordinates).



3. If the polar equation is unchanged by replacing θ with $\pi - \theta$ the graph is symmetric about the vertical line $\theta = \frac{\pi}{2}$ (y-axis in rectangular coordinates).



1.
$$r^2 = 4cos(2\theta)$$







3. $r^2 = 4cos(2\theta)$



4.
$$r^2 = 8sin(2\theta)$$

