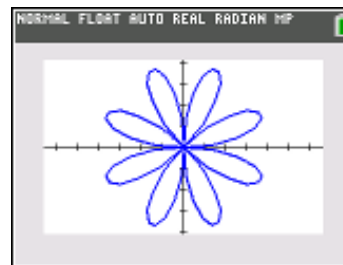# Rose Curve
Student Activity

Name _____

Class _____

In this activity, you will investigate the effect of changing the values of *a* and *n* in the equation $r = asin(n\theta)$. You will also explore the relationship between the polar rose curve $r = asin(n\theta)$ and the sinusoidal function $f(x) = asin(nx)$.

To set your calculator to Polar mode, press mode and select **POLAR** as shown to the right. At this time, also set your graphing calculator to Radian mode by selecting **RADIAN** on this screen as well.
To graph a polar equation on your graphing calculator, press y=
and enter your equation. . The x,τ,θ,n key produces θ in your equation when you are in Polar mode.

1. Graph $r1 = 2sin(3\theta)$. Press zoom and select 4: ZDecimal. A polar curve with an equation in the form of $r = asin(n\theta)$ is called a polar rose. Why do you think this is so?

2. Graph the following by editing $r1$ to observe each graph, then complete the table below.

   i) $r1 = 2sin(\theta)$ ii) $r1 = 2sin(2\theta)$

   iii) $r1 = 2sin(3\theta)$ iv) $r1 = 2sin(4\theta)$

   v) $r1 = 2sin(5\theta)$ vi) $r1 = 2sin(6\theta)$

Graph	n	Number of petals
i) $r1 = 2sin(\theta)$	1	
i) $r1 = 2sin(\theta)$	2	
iii) $r1 = 2sin(3\theta)$	3	
iv) $r1 = 2sin(4\theta)$	4	
v) $r1 = 2sin(5\theta)$	5	
vi) $r1 = 2sin(6\theta)$	6	

3. What effect does the value of n have on the graph of the curve?

4. How many petals does the curve have when n = 3? When n = 4? Predict the number of petals when n = 9 and when n = 10.

5. Write a rule to determine the number of petals of a rose curve.

6. Graph the following.

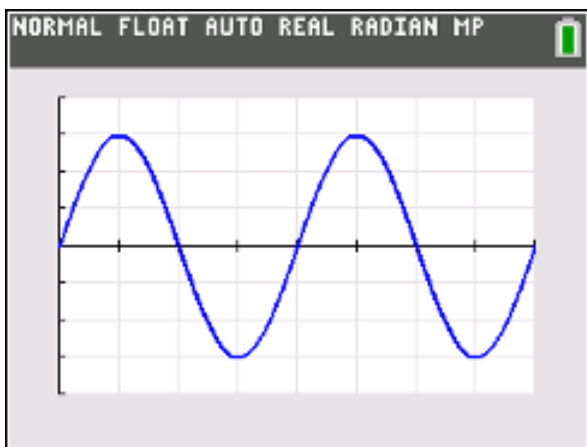 $i)\ r1 = 2sin(3\theta)$ $ii)\ r2 = 3sin(3\theta)$

   $iii)\ r3 = 4sin(3\theta)$ $iv)\ r4 = 5sin(3\theta)$

   Explain the effect that the value of a in the equation $r = asin(n\theta)$ has on the graph.

7. The graph of the sinusoidal function $f(x) = 3sin(2x)$ is shown below. The x-scale for the gridlines is π/4.

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   Graph the polar rose given by $r1 = 3sin(2\theta)$. Press [2nd][zoom] to access format. In the first row, use the right arrow to highlight **PolarGC** and press [enter]. Press [trace] and then the right arrow to move your cursor. Observe the change in the r and θ values.

   a) When the r value is 3, your cursor will be at the tip of the first petal. Notice that the θ value is π/4 ≈ 0.7853982. On the interval from x = 0 to x = π/2, which point on the graph of the sinusoidal function would correspond to $\left(\frac{\pi}{4}, 3\right)$? How is the value of a in a sinusoidal function related to the graph of the polar rose?

   b) What part of the sinusoidal function graph corresponds to the first petal of the rose graph?

   c) From x = π/2 to x = π, the graph of the sinusoidal function has an arch that is below the x-axis. Continue to trace around the polar rose. In what quadrant is the second petal of the polar rose located? Why?
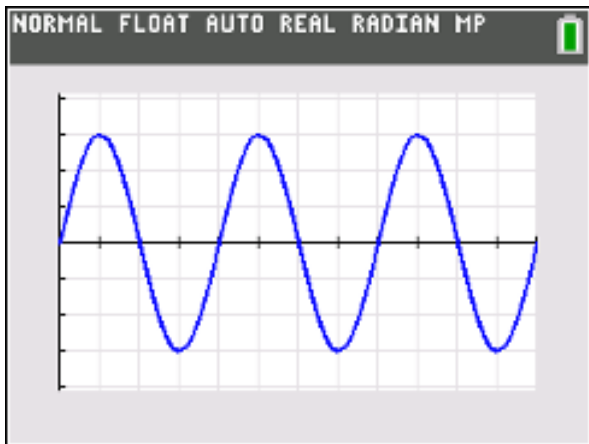
d) The graph of the sinusoidal function has two intervals where the graph is above the *x*-axis and two intervals where the graph is below the x-axis. How does this correspond to the graph of the polar rose?

8. The graph of the sinusoidal function $f(x) = 3sin(3x)$ is shown below. The *x*-scale for the gridlines is $\pi/6$.

Graph the polar rose given by $r1 = 3sin(3\theta)$. Press [trace] and then the right arrow to move your cursor. Observe the change in the *r* and θ values. Explain why the polar curve $r = 3sin(3\theta)$ has only three petals, while the function $f(x) = 3sin(3x)$ has six arches in the interval $0 \leq \theta \leq 2\pi$.

9. What is the equation of a rose curve in the form of $r = asin(n\theta)$ that has 12 petals, each of length 10? Check your answer by graphing your polar equation.

10. What is the equation of a rose curve in the form of $r = asin(n\theta)$ that has 5 petals, each of length 4? Check your answer by graphing your polar equation.

11. Explain the similarities and differences you would expect if we replaced the sine graphs with cosine graphs. How does this affect the polar rose graph?