



## What's Going On in This Graph?

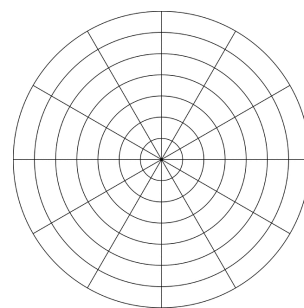


In this course we've studied all kinds of functions and analyzed their key characteristics, their graph behavior, and their rate of change. Today we'll do the same thing for a polar function!

1. Consider the function  $r = f(\theta) = 5 \sin(3\theta)$  on the interval  $0 \leq \theta \leq \pi$ .
  - a. What is the independent variable of this function? What is the dependent variable?
  - b. What shape is made by the graph of  $f$ ?
2. What is the maximum value of  $r$ ? How do you know? At which value(s) of  $\theta$  does the maximum value occur?
3. What is the minimum value of  $r$ ? How do you know? At which value(s) of  $\theta$  does the minimum value occur?

4. For which values of  $\theta$  is  $f(\theta) = 0$ ?

5. Graph  $r = f(\theta)$  on the given polar plane.



6. Complete the table to indicate whether the radius is positive or negative on each interval and whether the radius is increasing or decreasing on each interval.

$\theta$	$0 < \theta < \frac{\pi}{6}$	$\frac{\pi}{6} < \theta < \frac{\pi}{3}$	$\frac{\pi}{3} < \theta < \frac{\pi}{2}$	$\frac{\pi}{2} < \theta < \frac{2\pi}{3}$	$\frac{2\pi}{3} < \theta < \frac{5\pi}{6}$	$\frac{5\pi}{6} < \theta < \pi$
Is $r$ positive or negative?						
Is $r$ increasing or decreasing?						

7. Explain how you could use the table to identify the angles at which the maximum and minimum values of  $r$  occur.
8. Jared says that whenever the radius is increasing, the distance between  $f(\theta)$  and the origin is increasing. Do you agree? Why or why not?
9. Find the average rate of change of  $f$  between  $\theta = 0$  and  $\theta = \frac{\pi}{6}$ . Write a sentence interpreting your answer.

## Lesson 8.5 – Rates of Change in Polar Functions

QuickNotes

### Check Your Understanding

1. Consider the polar function  $r = f(\theta) = -2 + 4 \cos \theta$ .

a. Complete the table of values.

$\theta$	0	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\pi$	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$	$2\pi$
$r$									

b. On which interval(s) of  $\theta$  is  $f$  increasing?

c. On which interval(s) of  $\theta$  is  $f$  decreasing?

d. Identify the maximum and minimum values of  $f$ .

e. Is  $f$  changing faster between  $\theta = 0$  and  $\theta = \pi$  or between  $\theta = \frac{\pi}{3}$  and  $\theta = \frac{2\pi}{3}$ ? Justify your answer.

f. On the interval  $\left[\frac{\pi}{2}, \frac{2\pi}{3}\right]$  is the distance between  $f(\theta)$  and the origin increasing or decreasing? Explain.