

3.15 Rates of Change in Polar Functions

AP Precalculus

Name: _____

CA #2

Use the table of selected values for the polar function $r = f(\theta)$ to answer the following.

1.

θ	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	π	$\frac{5\pi}{4}$	$\frac{3\pi}{2}$	$\frac{7\pi}{4}$	2π
r	-9	-3.44	6.36	8.31	0	-8.31	-6.36	3.44	9

- Determine the interval(s) where f is increasing.
- Determine the interval(s) where f is decreasing.
- Are there any extrema on the interval $0 \leq \theta \leq 2\pi$? Explain how you know.
- Determine the interval(s) where distance between $f(\theta)$ and the pole is increasing on $0 \leq \theta \leq 2\pi$? Justify your work.
- Determine the interval(s) where distance between $f(\theta)$ and the pole is decreasing on $0 \leq \theta \leq 2\pi$? Justify your work.
- Find the average rate of change of f between $\theta = \pi$ and $\theta = \frac{5\pi}{4}$.
- Estimate the value of $f\left(\frac{\pi}{3}\right)$ using an average rate of change.

Use the polar function $r = f(\theta)$ to fill in the table and answer the questions. Calculator Active.

2. $r = f(\theta) = 3 + 5 \cos(\theta)$

- a. Is f increasing or decreasing on the interval $0 \leq \theta \leq \frac{\pi}{4}$?
- b. Is the distance between $f(\theta)$ and the pole is increasing or decreasing on the interval $0 \leq \theta \leq \frac{\pi}{4}$?

θ	r
0	
$\frac{\pi}{6}$	
$\frac{\pi}{4}$	

- c. Find the average rate of change of f between $\theta = \frac{\pi}{6}$ and $\theta = \frac{\pi}{4}$.

- d. Estimate the value of $f\left(\frac{\pi}{6}\right)$ using an average rate of change.

Answers to 3.15 CA #2

1. a. $\left(0, \frac{3\pi}{4}\right)$ and $\left(\frac{5\pi}{4}, 2\pi\right)$
- b. $\left(\frac{3\pi}{4}, \frac{5\pi}{4}\right)$
- c. at least 2 extrema: changes from increasing to decreasing to increasing
- d. $\left(\frac{\pi}{2}, \frac{3\pi}{4}\right)$ r is positive and increasing
 $\left(\pi, \frac{5\pi}{4}\right)$ r is negative and decreasing
 $\left(\frac{7\pi}{4}, 2\pi\right)$ r is positive and increasing
- e. $\left(0, \frac{\pi}{4}\right)$ r is negative and increasing
 $\left(\frac{3\pi}{4}, \pi\right)$ r is positive and decreasing
 $\left(\frac{5\pi}{4}, \frac{3\pi}{2}\right)$ r is negative and increasing
- f. $\frac{33.24}{-\pi} \approx -10.58$ units per radian
- g. $y - 6.36 = 12.477\left(x - \frac{\pi}{2}\right)$
 $f\left(\frac{\pi}{3}\right) \approx -0.172$

2.

θ	r
0	8
$\frac{\pi}{6}$	7.33
$\frac{\pi}{4}$	6.535

- a. decreasing
- b. decreasing: r is positive and decreasing
- c. $\frac{9.54}{-\pi} \approx -3.036$ units per radian
- d. $y - 8 = -1.865(x - 0)$
 $f\left(\frac{\pi}{6}\right) \approx 7.023$