

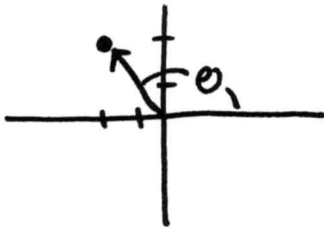
Name: \_\_\_\_\_

Section: \_\_\_\_\_

You have 15 minutes to complete the quiz. Calculators are **not** permitted.

Please show all work, and then circle your answer.

1. (2 points). Convert the cartesian coordinate  $(-2, 2)$  to polar coordinates.



$$r = \sqrt{(-2)^2 + 2^2} = \sqrt{4+4} = \sqrt{8}$$

$$\tan \theta = \frac{y}{x} = \frac{2}{-2} = -1$$

$$\text{Know } \tan\left(\frac{3\pi}{4}\right) = 1$$

$$\text{Pick } \theta = \frac{3\pi}{4}$$

$$\Rightarrow \text{one polar coordinate is } \left(\sqrt{8}, \frac{3\pi}{4}\right)$$

1 pt

1 pt

2. (2 points). Rewrite the polar equation  $r = \frac{1}{3} \sec(\theta)$  as a cartesian equation.

$$r = \frac{1}{3} \cdot \frac{1}{\cos \theta}$$

$$r \cdot \cos \theta = \frac{1}{3}$$

$$x = \frac{1}{3}$$

1 pt

2 pt

know

$$r^2 = x^2 + y^2$$

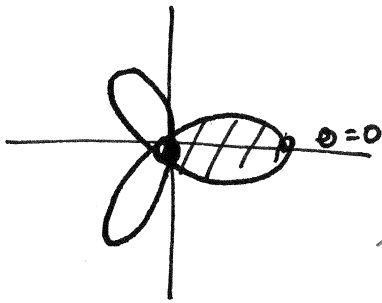
$$x = r \cdot \cos \theta$$

$$y = r \cdot \sin \theta$$

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3. (6 points). Find the area of one leaf of the curve  $r = 2 \cos(3\theta)$ .



1 pt

Start & end when  $r=0$

when  $2 \cdot \cos(3\theta) = 0$

when  $3\theta = \frac{\pi}{2}, -\frac{\pi}{2}, \text{etc}$

when  $\theta = \frac{\pi}{6}, -\frac{\pi}{6}$



area of leaf =  $\int_{-\pi/6}^{\pi/6} \frac{1}{2} r^2 d\theta$

1 pt  $= \int_{-\pi/6}^{\pi/6} \frac{1}{2} (2 \cdot \cos(3\theta))^2 d\theta$

$= \int_{-\pi/6}^{\pi/6} \frac{1}{2} \cdot 4 \cdot \cos^2(3\theta) d\theta$

2 pt  $= \int_{-\pi/6}^{\pi/6} 2 \cdot \frac{1 + \cos(6\theta)}{2} d\theta$

2 pt  $= \left[ \theta + \frac{\sin(6\theta)}{6} \right]_{-\pi/6}^{\pi/6}$

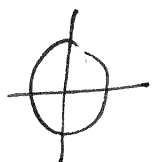
$= \left( \frac{\pi}{6} - \left( -\frac{\pi}{6} \right) \right) + \left( \frac{\sin(\pi)}{6} - \frac{\sin(-\pi)}{6} \right)$

$= \frac{\pi}{3} + 0$

$\cos^2 \theta = \frac{1 + \cos(2\theta)}{2}$

$\cos^2(3\theta) = \frac{1 + \cos(6\theta)}{2}$

Think:  $\frac{d}{d\theta} \left[ \frac{\sin(6\theta)}{6} \right] = \frac{\cos(6\theta) \cdot 6}{6}$



(1 pt totally correct answer)