

10.5.33

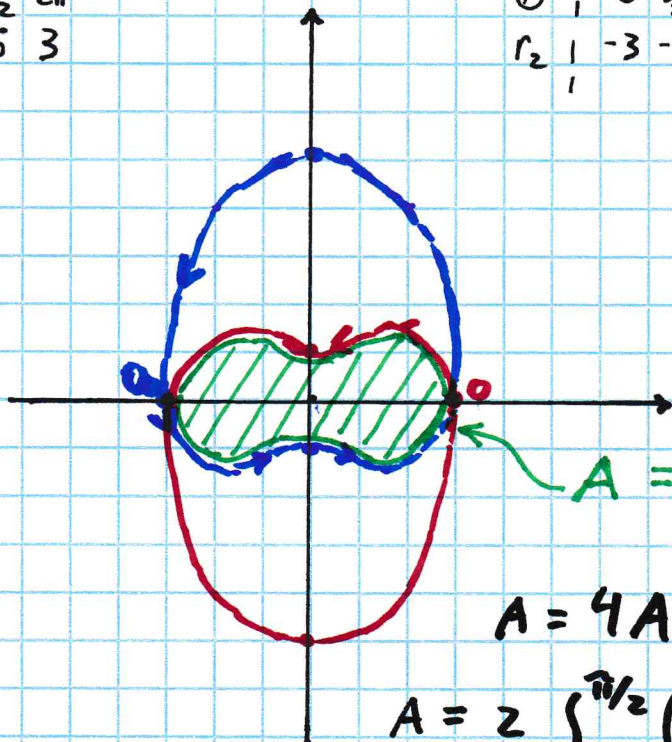
Find area of common interior of r_1 & r_2

$$\underline{r_1} = 3 - 2 \sin \theta$$

θ	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
r_1	3	1	3	5	3

$$\underline{r_2} = -3 + 2 \sin \theta$$

θ	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
r_2	-3	-1	-3	-5	-3



$$A = 4 \cdot A_1$$

$$A = 4A_1 = 4 \int_0^{\pi/2} \frac{1}{2} r_1^2 d\theta$$

$$A = 2 \int_0^{\pi/2} (3 - 2 \sin \theta)^2 d\theta \quad \text{10.56}$$

$$A = \int_0^{\pi/2} 18 d\theta - \int_0^{\pi/2} +24 \sin \theta d\theta + \int_0^{\pi/2} 8 \sin^2 \theta d\theta$$

$$= 9\pi + \underbrace{24 \cos \theta}_- \Big|_0^{\pi/2} + 4 \int_0^{\pi/2} 1 - \cos 2\theta d\theta$$

$$= 9\pi - \frac{24}{24} + 4 \left[\theta - \frac{1}{2} \sin 2\theta \right]_0^{\pi/2}$$

$$= 9\pi - \frac{24}{24} + 4 \left[\frac{\pi}{2} \right] = \cancel{11\pi - 24} = 11\pi - 24$$

$$\boxed{A = 11\pi - 24}$$

Pol. FRQ1

$$r_1 = 3 \quad r_2 = 3 - 2 \sin 2\theta$$

a.) $R = A_1 + A_2 =$ 

$$R = \frac{1}{4} \pi 3^2 + \int_0^{\pi/2} \frac{1}{2} (3 - 2 \sin 2\theta)^2 d\theta$$

$$R = \frac{9}{4} \pi +$$

b.) $x(\theta) = (3 - 2 \sin(2\theta)) \cos \theta$

$$= 3 \cos \theta - 2 \sin 2\theta \cos \theta$$

$$\frac{dx}{d\theta} = -3 \sin \theta - 4 \cos 2\theta \cos \theta + 2 \sin 2\theta \sin \theta$$

$$\frac{dx}{d\theta}(\pi/6) = -3 \cdot \frac{1}{2} - 4 \cdot \frac{1}{2} \cdot \frac{\sqrt{3}}{2} + 2 \cdot \frac{\sqrt{3}}{2} \cdot \frac{1}{2}$$

c.) $D = |r_1 - r_2| = 2 \sin 2\theta$

$$\frac{dD}{d\theta} = +4 \cos 2\theta, \quad \frac{dD}{d\theta}(\pi/3) = -2$$

d.) $\frac{dr}{dt} = \frac{dr}{d\theta} \cdot \frac{d\theta}{dt} = [3 - 2 \sin 2\theta]' \cdot 3$

$$= -4 \sin 2\theta \cdot 3$$

$$\frac{dr}{dt}(\pi/6) = -6$$

