

$$1. \quad \begin{aligned} x &= r \cos \theta & x &= (2 - 3 \sin \theta) \cos \theta \\ y &= r \sin \theta & y &= (2 - 3 \sin \theta) \sin \theta \\ & & & \quad 2 \sin \theta - 3 \sin^2 \theta \end{aligned}$$

$$\frac{dy}{dx} = \frac{2 \cos \theta - \cancel{6 \sin \theta} \cdot \cancel{\cos \theta}}{\cancel{-2 \sin \theta} + \cancel{(-3 \sin \theta)(-\sin \theta)} + \cos \theta (-3 \cos \theta)}$$

$$\frac{-2}{-3} = \frac{2}{3}$$

$$2. \quad \begin{aligned} x &= 3 \sin(2\theta) \cos \theta \Big|_{\theta = \frac{\pi}{3}} \\ y &= 3 \sin(2\theta) \sin \theta \Big|_{\theta = \frac{\pi}{3}} \\ \left(\frac{3\sqrt{3}}{2} \cdot \frac{1}{2}, \frac{3\sqrt{3}}{2} \cdot \frac{\sqrt{3}}{2} \right) & \quad \text{at: } \left(\frac{3\sqrt{3}}{4}, \frac{9}{4} \right) \end{aligned}$$

$$\frac{dy}{d\theta} = \frac{3 \sin 2\theta \cos \theta + \sin \theta (6 \cos 2\theta)}{3 \sin 2\theta (-\sin \theta) + \cos \theta (6 \cos 2\theta)}$$

$$\frac{dx}{d\theta} = \frac{3 \sqrt{\frac{3}{2}} \cdot \frac{1}{2} + \frac{\sqrt{3}}{2} \left(\frac{3}{2} \cdot \frac{1}{2} \right)}{3 \sqrt{\frac{3}{2}} \left(-\frac{\sqrt{3}}{2} \right) + \frac{1}{2} \left(\frac{3}{2} \cdot \frac{1}{2} \right)}$$

$$\frac{\frac{3\sqrt{3}}{4} \cdot \frac{1}{2} + \frac{\sqrt{3}}{2} \left(\frac{3}{2} \cdot \frac{1}{2} \right)}{3 \sqrt{\frac{3}{2}} \left(-\frac{\sqrt{3}}{2} \right) + \frac{1}{2} \left(\frac{3}{2} \cdot \frac{1}{2} \right)}$$

$$\frac{\frac{3\sqrt{3}}{4} - \frac{2 \cdot 3\sqrt{3}}{2 \cdot 2}}{\frac{-9}{4} - \frac{3 \cdot 2}{2 \cdot 2}} = \frac{\frac{-3\sqrt{3}}{4}}{\frac{-15}{4}} = \frac{\sqrt{3}}{5}$$

$$y = \frac{\sqrt{3}}{5} \left(x - \frac{3\sqrt{3}}{4} \right) + \frac{9}{4}$$



$\frac{1}{2} \int_{\pi/3}^{2\pi/3} 2^2 - \left(\frac{1}{\cos \theta}\right)^2 d\theta$
 $\frac{1}{2} \int_{\pi/3}^{2\pi/3} 4 - \sec^2 \theta d\theta$
 $\frac{1}{2} \left(4\theta - \tan \theta \Big|_{\pi/3}^{2\pi/3} \right)$
 $\frac{1}{2} \left(\left(\frac{4\pi}{3} - \sqrt{3} \right) - \left(-\frac{4\pi}{3} - (-\sqrt{3}) \right) \right)$
 $\frac{1}{2} \left(\frac{8\pi}{3} - 2\sqrt{3} \right) = \frac{4\pi}{3} - \frac{3\sqrt{3}}{3}$

$r \cos \theta = 1$ $r = 2$
 $2 \cos \theta = 1$
 $\cos \theta = \frac{1}{2}$

$$r^2 = 4 \cos 2\theta \quad r = \sqrt{2}$$

$$1. \quad r = 2 - 3 \sin \theta \quad (2, \pi)$$

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

$$y = (2 - 3 \sin \theta) \sin \theta$$

$$\frac{dy}{dx} = \frac{(2 - 3 \sin \theta)(\cos \theta) + \sin \theta(-3 \cos \theta)}{(2 - 3 \sin \theta)(-\sin \theta) + \cos \theta(-3 \cos \theta)} \Big|_{\theta = \pi}$$

$$= \frac{-2}{-3} = \frac{2}{3}$$

$$2. \quad r = 3 \sin(2\theta) \quad \theta = \frac{\pi}{3}$$

$$x = (3 \sin 2\theta) \cos \theta$$

$$y = (3 \sin 2\theta) \sin \theta$$

$$\left(3 \frac{\sqrt{3}}{2} \cdot \frac{1}{2}, 3 \frac{\sqrt{3}}{2} \cdot \frac{\sqrt{3}}{2}\right)$$

$$Pt: \left(\frac{3\sqrt{3}}{4}, \frac{9}{4}\right)$$

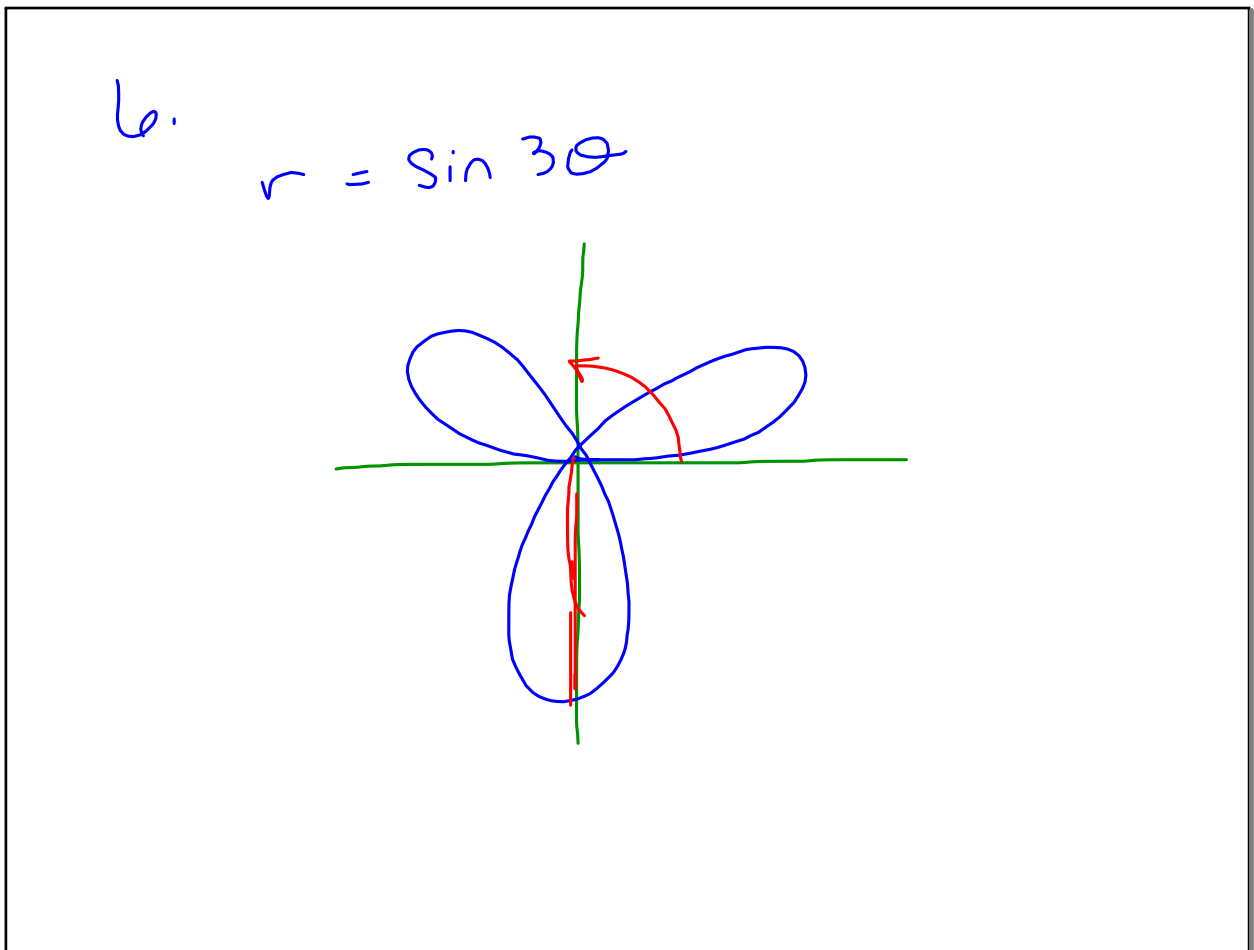
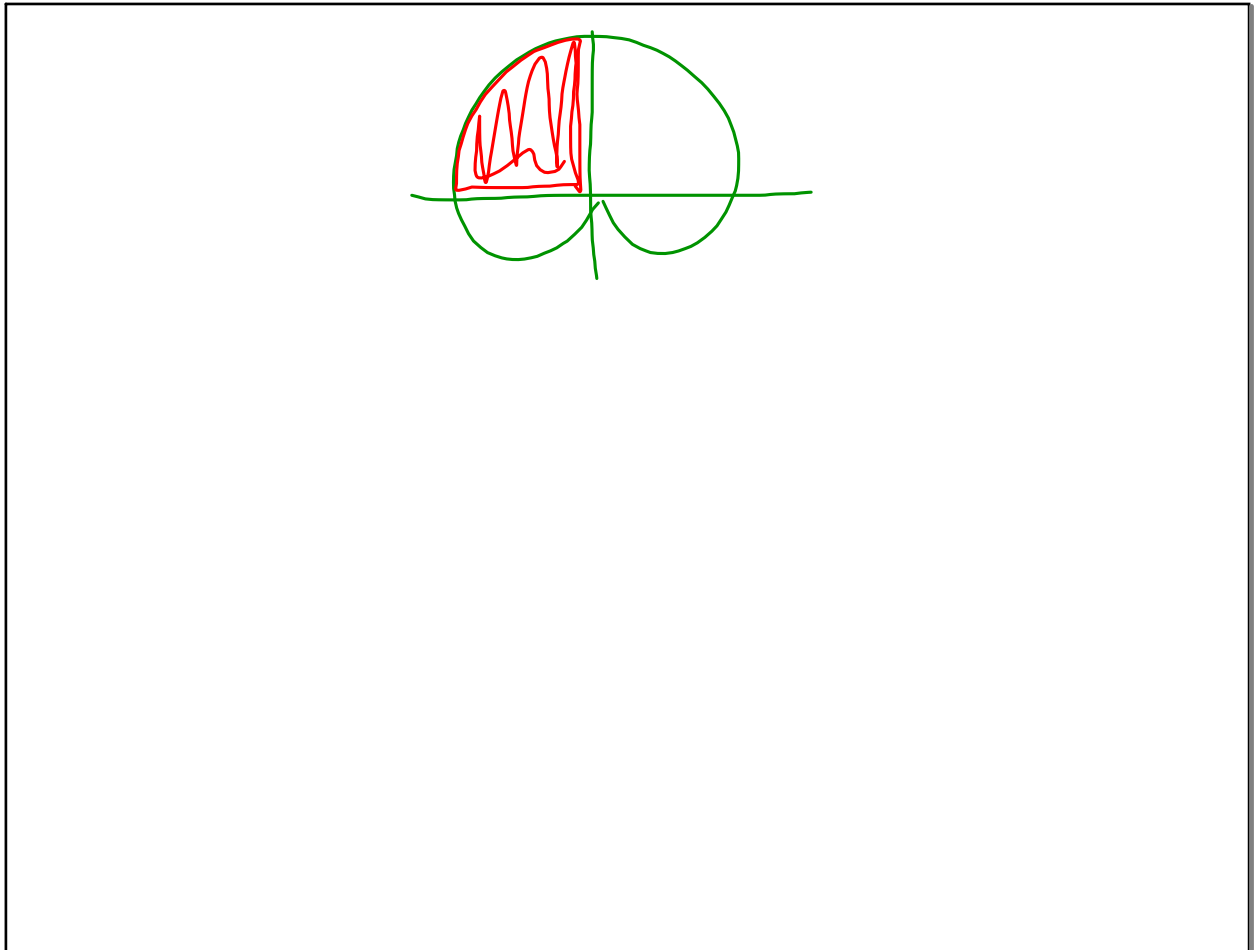
$$\frac{dy}{dx} = \frac{(3 \sin 2\theta) \cos \theta + \sin \theta(6 \cos 2\theta)}{(3 \sin 2\theta)(-\sin \theta) + \cos \theta(6 \cos 2\theta)} \Big|_{\theta = \frac{\pi}{3}}$$

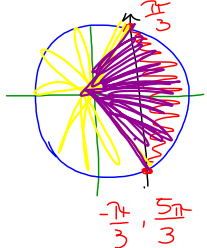
$$\frac{\left(3 \frac{\sqrt{3}}{2}\right) \frac{1}{2} + \frac{\sqrt{3}}{2} \cdot 6 \cdot \frac{-1}{2}}{3 \frac{\sqrt{3}}{2} \left(-\frac{\sqrt{3}}{2}\right) + \frac{1}{2} \cdot 6 \cdot \frac{-1}{2}}$$

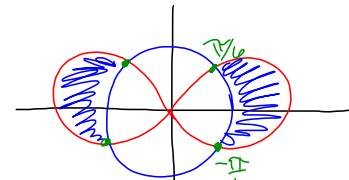
$$\frac{\frac{3\sqrt{3}}{4} - \frac{6\sqrt{3}}{4}}{\frac{-9}{4} - \frac{6}{4}} = \frac{\frac{3\sqrt{3}}{4}}{\frac{-15}{4}}$$

$$= \frac{\sqrt{3}}{5}$$

$$y = \frac{\sqrt{3}}{5} \left(x - \frac{3\sqrt{3}}{4}\right) + \frac{9}{4}$$



7. $x=1$
 $\frac{r \cos \theta = 1}{\cos \theta \cdot \cos \theta}$
 $r = \sec \theta$
 $r = 2$
 $2 = \frac{1}{\cos \theta}$
 $\frac{1}{2} = \cos \theta$
 $\frac{1}{2} \int_{-\frac{\pi}{3}}^{\frac{\pi}{3}} 2^2 - \sec^2 \theta \, d\theta$

 $\frac{1}{2} \left(4\theta - \tan \theta \Big|_{-\frac{\pi}{3}}^{\frac{\pi}{3}} \right)$
 $\frac{1}{2} \left(\left(4\frac{\pi}{3} - \sqrt{3} \right) - \left(-4\frac{\pi}{3} - (-\sqrt{3}) \right) \right)$
 $\frac{1}{2} \left(\frac{8\pi}{3} - 2\sqrt{3} \right)$
 $\frac{4\pi}{3} - \sqrt{3}$

8.

 $r^2 = 4 \cos 2\theta$
 $r = \sqrt{2}$
 $r^2 = 2$
 $2 = 4 \cos 2\theta$
 $\cos 2\theta = \frac{1}{2}$
 $2\theta = -\frac{\pi}{3}, \frac{\pi}{3}, \frac{5\pi}{3}$
 $\theta = -\frac{\pi}{6}, \frac{\pi}{6}, \frac{5\pi}{6}$
 $\frac{1}{2} \int_{-\frac{\pi}{6}}^{\frac{\pi}{6}} 4 \cos 2\theta - 2 \, d\theta$
 $2 \sin 2\theta - 2\theta \Big|_{-\frac{\pi}{6}}^{\frac{\pi}{6}}$
 $\frac{2\sqrt{3}}{2} - 2\frac{\pi}{6} - \left(2\left(-\frac{\sqrt{3}}{2}\right) - 2\left(-\frac{\pi}{6}\right) \right)$
 $\sqrt{3} - \frac{\pi}{3} + \sqrt{3} - \frac{\pi}{3}$
 $2\sqrt{3} - \frac{2\pi}{3}$