1. Let $r = 2 + \sin(3\theta)$. Find $\frac{dy}{dx}$.

\[ \frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{3\cos(3\theta)\sin\theta + (2 + \sin(3\theta))\cos\theta}{3\cos(3\theta)\cos\theta - (2 + \sin(3\theta))\sin\theta} \]

2. Find the points on the curve $r = 3\cos\theta$, $0 \leq \theta \leq \pi$ where the tangent line is horizontal or vertical.

Horizontal: $\left(\frac{3}{\sqrt{2}}, \frac{\pi}{4}\right), \left(-\frac{3}{\sqrt{2}}, \frac{3\pi}{4}\right)$

Vertical: $(3, 0), (0, \frac{\pi}{2}), (-3, \pi)$

Remember that $A = \int_a^b \frac{1}{2}r^2 \, d\theta$

3. Find the area of the region bounded by $r = \cos\theta$, $0 \leq \theta \leq \pi/6$

\[ \frac{\pi}{24} + \frac{\sqrt{3}}{16} \]

4. Find the area of one loop of $r = \sin(4\theta)$.

\[ \frac{\pi}{16} \]

5. The curve below is $r = 2 + \cos\theta$. Find the area of the shaded region.

\[ \frac{9\pi}{8} - 2 \]

6. The curve below is $r = 1 - \sin\theta$. Find the area enclosed by the curve.

\[ \frac{3\pi}{2} \]

Remember that $L = \int_a^b \sqrt{\left(\frac{dx}{d\theta}\right)^2 + \left(\frac{dy}{d\theta}\right)^2} \, d\theta$

7. Find the length of the polar curve $r = 4\cos\theta$, $0 \leq \theta \leq \pi$.

\[ \frac{4\pi}{3} \]

8. Find the length of the polar curve $r = 2\theta^2$, $0 \leq \theta \leq \sqrt{5}$.

\[ \frac{28\sqrt{5}}{3} \]