Problem 1: Convert the following points from Cartesian to polar coordinates. Plot the point in both coordinate systems.

(a) $(4, 4)$

(b) $(-3, 4)$

(c) $(1, -\sqrt{3})$

(d) $(4, -2)$

Problem 2: Convert the following points from polar to Cartesian coordinates. Plot the point in both coordinate systems.

(a) $(2, \frac{\pi}{3})$

(b) $(4, \frac{\pi}{2})$

(c) $(0, \pi)$

(d) $(5, \frac{5\pi}{4})$

Problem 3: Graph the following functions:

(a) $r = 5$ & $r = 0$

(b) $r = 6\cos\theta$

(c) $r = 5\sec\theta$

(d) $r = 2\cos 4\theta$

(e) $\theta = \frac{2\pi}{3}$

(f) $r^2 = 2\cos 2\theta$

(g) $r = \frac{3}{\sin\theta}$

(h) $r = 1 + \cos\theta$

(i) $r = 2(1 + \cos\theta)$

Problem 4: Convert the following equations to polar form:

(a) $y = 4$

(b) $x = 2$

(c) $x^2 + y^2 = 4$

(d) $3x + 4x - 2 = 0$

(e) $y = x$

(f) $x^2 + (y-2)^2 = 1$

Problem 5: Complete the following:

1. Find the area enclosed by $r = \sqrt{\sin\theta}$, $0 \le \theta \le \pi$.
2. Find the area enclosed by $r = 2 + \cos\theta$.
3. Find the area of the inner loop of $r = 2 + 4\cos\theta$.
4. Find the area inside of one loop of $r = \cos 3\theta$.
5. Find the area between $r = 2\cos\theta$ and $r = 1$.
6. Find the area inside of one loop of $r = \sin^2\theta$.
7. Find the area inside of one loop of $r^2 = \cos 2\theta$.
8. Find area outside $r = 2\sin\theta$ and inside $r = 2\sin 2\theta$.
9. Find the area inside $r = 3 + 2\sin\theta$ and outside $r = 2$.
10. Find the area between $r = \sqrt{3}\cos\theta$ and $r = \sin\theta$.

Problem 6: Complete the following:

(a) Find the length of $r = \theta$ for $0 \le \theta \le 1$.

(b) Find the length of $r = 1 - \cos\theta$.

(c) Find the length of $r = \sqrt{1 + \sin 2\theta}$ for $0 \le \theta \le \pi\sqrt{2}$.

Problem 7: Complete the following:

(a) Find $\frac{dy}{dx}$ given $r = 6\sin 3\theta$.

(b) Find $\frac{dy}{dx}$ given $r = 4 + 3\cos\theta$.

(c) Find the tangent line to $r = 4\cos 3\theta$ at $\theta = \frac{\pi}{6}$.

(d) Find $\frac{dy}{dx}$ given $r = 5 - 3\sin 2\theta$.

(e) Find the tangent line to $r = \theta$ at $\theta = \frac{\pi}{2}$.