1.) Find the area of the region bounded by the graphs of $\theta = \pi / 6$, $\theta = \pi / 4$, and $r = \sec \theta$.

2.) Find the area of the region lying inside the graph of $r = 2 + \sin \theta$ and outside the graph of $r = \cos \theta$.

3.) Find the area of the region lying inside the graph of $r = 4 \sin \theta$ and above the graph of $r = \csc \theta$.

4.) Find the area of one leaf of the graph of
   a.) $r = \sin 2 \theta$
   b.) $r = \sin 3 \theta$

5.) Find all points of intersection (in polar coordinates) of the following pairs of polar equations. Begin by sketching the graph of each equation. In part f.) a good estimate of the point(s) of intersection will do.
   a.) $\theta = \pi / 3$, $r = 1 + 1/2 \cos \theta$
   b.) $r = 1/2$, $r = \cos \theta$
   c.) $r = \sin \theta$, $r = \sqrt{3} \cos \theta$
   d.) $r = 1 - \sin \theta$, $r = \sin \theta$
   e.) $r = 1 + \sin \theta$, $r = \csc \theta$
   f.) $r = \theta$, $r = 3 \sin \theta$

6.) Sketch the graph of $r = \frac{1}{\cos \theta + 1}$. What is it?

7.) Sketch the graph of $r = 1/\theta$ for $0 < \theta \leq 2 \pi$.

8.) Consider a flat, spinning circular disc of mass $M$ and radius $a$ and constant density. It rotates about an axis perpendicular to its face and passing through its center $f$ times per second.
   a.) Calculate the total kinetic energy of the spinning disc.
   b.) Assume that the disc (while spinning) starts to deteriorate and
"spin off" thin slices until the disc is gone? Find the total kinetic energy of these slices if each slice is "dr" thick and "2πr" long. What happens to the total kinetic energy?

9.) Determine whether the following improper integrals are convergent or divergent.

a.) \[ \int_{3}^{\infty} \frac{1}{\sqrt{x-3}} \, dx \]

b.) \[ \int_{0}^{2} \frac{2x}{x^2-1} \, dx \]

c.) \[ \int_{0}^{\pi} \tan x \, dx \]

d.) \[ \int_{0}^{1} \frac{1}{\sqrt{1-x^2}} \, dx \]

e.) \[ \int_{0}^{\infty} \frac{x^2}{(x^3+1)^3} \, dx \]