Remember force is $F = \rho gdA$, where $\rho$ is the density, $g$ is acceleration, $d$ distance and $A$ area.

Also pressure is $P = \rho gd$

1. The Hoover Dam near Las Vegas has “penstock gates” to control the flow of water. They are circular, approximately 5 meters in radius, and are centered 90 meters under water.

   a) Make a clear diagram of this problem. Include a “ruler” to the right which clearly indicates the meaning of your coordinates.

   b) Compute the hydrostatic force on one of these gates to two significant figures. Use 9.8 m/s$^2$ for the gravitational constant and 1000 kg/m$^3$ for the density of water.

   c) The mass of a loaded 747 airplane is approximately 400,000 kg. Find the weight of a 747 in Newtons. How many 747s would it take to provide the force you computed in part (b)?
Make sure you know the formula for moments and the centroid (page 557 and 558).

2. A lamina with area density $\lambda$ kg/m$^2$ occupies the top half of the ellipse $4x^2 + y^2 = 4$. You may use the fact that the area of the lamina is $\pi$ m$^2$. Find the moments $M_x$ and $M_y$ about the $x$ and $y$ axes, respectively. Then find the coordinates $(\bar{x}, \bar{y})$ of the centroid. You may use any available symmetries.

3. A lamina has the shape of a right triangle of height $L$ and base $r$ (meters). The base lies along the $x$-axis. It has density $\rho$ kg/m$^2$.
   
a) Make a careful diagram of the problem (like the one on the last page).
   
b) Find the moment $M_x$ about the $x$ axis. Your answer will involve $\rho$, $L$, and $r$. 