CALCULUS II Handout ~ Reference Sheet for Section 6.5 (Stewart, 3rd Edition)
Applications of Integration to Physics and Engineering

UNITS OF MEASURE					
System	**Mass**	**Distance**	**Acceleration**	**Force**	**Work**
English	Slug	Feet (ft.)	ft/s^2	Pound ($Slug\text{-}ft/s^2$)	Foot-Pound (ft-lb)
Mks (Si metric system)	Kilogram (kg)	Meter (m)	m/s^2	Newton ($kg\text{-}m/s^2$)	Joules (J)
cgs	Gram (g)	Centimeter (cm)	cm/s^2	Dyne ($g\text{-}cm/s^2$)	Ergs

Constants: Acceleration of gravity = $9.8\ m/s^2 = 32\ ft/s^2$
Weight density of water = 62.5 lbs per ft^3
Mass density of water = 1000 kg per m^3

WORK

Work = (constant force)(distance)
= (mass)(acceleration of gravity)(distance)
= (weight)(distance)

Liquids: Force = (volume)(mass density)(acceleration of gravity)
= (volume)(weight density)

Springs: F = *kx* is the force to hold a spring stretched *x* meters beyond its natural length.

HYDROSTATIC PRESSURE ON A SURFACE

Pressure = (area of region)(depth of region)(mass-density)(acceleration of gravity)
= (area of region)(depth of region)(weight-density)

MOMENTS AND CENTER OF MASS

M_x = the moment of a system of masses with respect to the x-axis
= $\sum$(mass)(distance to x-axis)
= $\delta\int_a^b \frac{1}{2}[f(x)]^2 dx$ (for a region or lamina between *f(x)* and the y-axis

M_y = the moment of a system of masses with respect to the y-axis
= $\sum$(mass)(distance to y-axis)
= $\delta\int_a^b x \cdot f(x) dx$ (for a region or lamina between *f(x)* and the y-axis)

Center of Mass (Centroid of a Lamina): the point $(\bar{x}, \bar{y})$ where

$$\bar{x} = \frac{M_y}{TotalMass} = \frac{\int_a^b x \cdot f(x)dx}{Area} \quad \text{and} \quad \bar{y} = \frac{M_x}{TotalMass} = \frac{\int_a^b \frac{1}{2}[f(x)]^2 dx}{Area}$$