Second Semester Equation Sheet
Kinematics, Dynamics, and the
Laws of Conservation of Energy and Momentum

d = distance [m]
t = time [s]
v_{avg} = average velocity [m/s]
a_{avg} = average acceleration [m/s^2]

x_0 or y_o = initial displacement (position) [m]
x or y = final displacement (position) [m]
v_0 = initial velocity [m/s]
v = final velocity [m/s]
a or g = acceleration [m/s^2]

Metric Prefixes
10^{12} = Tera
10^{9} = Giga
10^{6} = Mega
10^{3} = Kilo
10^{-2} = centi
10^{-3} = milli
10^{-6} = micro
10^{-9} = nano
10^{-12} = pico

g = the acceleration due to gravity at Earth's surface = -9.8 [m/s^2]

v_{x0} = initial velocity in x direction [m/s]
v_{y0} = initial velocity in y direction [m/s]
v_x = final velocity in x direction [m/s]
v_y = final velocity in y direction [m/s]

Conversions
1 [m] = 3.28 [ft]
1 [lb] = 4.45 [N]
1 [hp] = 746 [W]

m = mass [kg]
F = force [N]
F_N = normal Force [N]
F_C = centripetal force [N]
μ = coefficient of friction [1]

K = kinetic energy [J]
PEg = gravitational potential energy [J]
PEs = elastic (spring) potential energy [J]
W = Work [J]
k = spring constant [N/m]
p = linear momentum [kg m/s]

1. Average velocity

$v_{avg} = \Delta d / \Delta t$

2. Average acceleration

$a_{avg} = \Delta v / \Delta t$

3. Kinematic equations

$x = x_0 + v_{x0}t + 1/2at^2$ $\quad$ $y = y_0 + v_{y0}t + 1/2gt^2$

$v_x = v_{x0} + at$ $\quad$ $v_y = v_{y0} + gt$

$v_x^2 = v_{x0}^2 + 2a(x-x_0)$ $\quad$ $v_y^2 = v_{y0}^2 + 2g(y-y_0)$

4. Newton's Second Law

$F = ma$

5. Frictional Force

$f = \mu F_N$

6. Centripetal Force

$F_c = mv^2/r$

7. Hooke's Law

$F_s = -kx$

8. Kinetic Energy

$K = 1/2mv^2$

9. Gravitational Potential Energy

$PEg = mgh$

10. Elastic (spring) Potential Energy

$PEs = ½kx^2$

11. Work done by a constant force

$W = Fd$

12. Work done by a spring

$W_s = ½kx^2$

13. Linear Momentum

$p = mv$

The Quadratic Formula

$$at^2 + bt + c = 0$$

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$