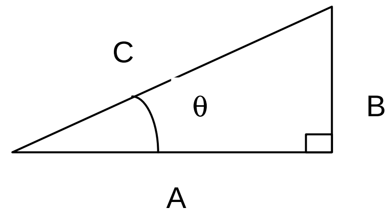
Physics 105 NJIT EQUATION SHEET Fall 2003

Name: ________________________

CONSTANTS AND TRIGONOMETRY

$g = 9.80\ m/s^2$



$sin\,\theta = \frac{B}{C}$ $cos\,\theta = \frac{A}{C}$ $tan\,\theta = \frac{B}{A}$

$C = \sqrt{A^2 + B^2}$

MOTION ALONG A STRAIGHT LINE

$v = v_0 + at$ $x - x_0 = v_0 t + \frac{1}{2} a t^2$

$x - x_0 = \frac{1}{2}(v_0 + v)t$ $v^2 = v_0^2 + 2a(x - x_0)$

TWO-DIMENSIONAL MOTION:

$\mathbf{r} = (v_{ox}\,t + \frac{1}{2} a_x t^2)\,\mathbf{i} + (v_{oy}\,t + \frac{1}{2} a_y t^2)\,\mathbf{j};$ $\mathbf{v} = (v_{ox} + a_x t)\,\mathbf{i} + (v_{oy} + a_y t)\,\mathbf{j};$ $\mathbf{a} = \frac{v_x - v_{ox}}{t}\,\mathbf{i} + \frac{v_y - v_{oy}}{t}\,\mathbf{j}$

PROJECTILE MOTION

$v_{0x} = v_0 \cos\theta_0$ $v_{0y} = v_0 \sin\theta_0$ $\Delta x = v_{0x} t$ $v_y = v_{0y} - gt$

$\Delta y = v_{0y} t - \frac{1}{2} g t^2$ $v_y^2 = v_{0y}^2 - 2g(\Delta y)$

$\Delta y = \frac{v_y^2 - v_{oy}^2}{-2g}$ $\Delta y = \left(\frac{v_{0y} + v_y}{2}\right) \times t$

FORCE AND MOTION

$\mathbf{F_{net}} = m\mathbf{a}$ $F_g = mg$ $f_{s,max} = \mu_s N$ $f_k = \mu_k N$

Uniform circular motion: centripetal acceleration: $a = v^2/r$
centripetal force: $F = mv^2/r$

WORK AND ENERGY:

$W = Fd(\cos\theta)$ $W = F_x d_x + F_y d_y + F_z d_z$ $W_{net} = \Delta K$ $W_{spring} = -\frac{1}{2}k(x_f^2 - x_i^2) = \frac{1}{2}k(x_i^2 - x_f^2)$

$K = \frac{1}{2} m v^2$ $\Delta U_{grav} = mg(y_f - y_i)$

Spring: $F_s = -kx$ $\Delta U_s = \frac{1}{2}k(x_f^2 - x_i^2)$

Power: $P_{avg} = \frac{W}{\Delta t}$

CONSERVATION OF ENERGY

$W = \Delta E_{mec} + \Delta E_{th}$ $\Delta E_{mec} = \Delta K + \Delta U$

Or

Work due to *nonconservative* forces: $W_{nc} = \Delta E_{mec}$

$W_{nc} = \Delta K + \Delta U_g + \Delta U_s$ or $K_i + U_{gi} + U_{si} + W_{nc} = K_f + U_{gf} + U_{sf}$

If the system is isolated (no friction or applied forces do work on system):

$0 = \Delta K + \Delta U_g + \Delta U_s$ or $K_i + U_{gi} + U_{si} = K_f + U_{gf} + U_{sf}$

CENTER OF MASS:

$$x_{com} = \frac{1}{M}\sum_{i=1}^{n} m_i x_i \qquad y_{com} = \frac{1}{M}\sum_{i=1}^{n} m_i y_i$$

LINEAR MOMENTUM:

$\vec{p} = m\vec{v}$ Impulse: $\vec{F}_{avg}\Delta t = \Delta\vec{p} = m\vec{v}_f - m\vec{v}_o$

For system of particles: $\Delta\vec{p}_{sys} = \sum(m\vec{v})_f - \sum(m\vec{v})_o$