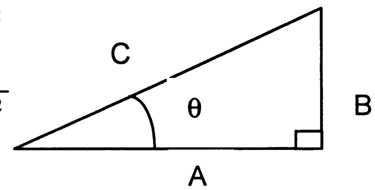
Physics 105 NJIT EQUATION SHEET

Name: ____________________

## CONSTANTS AND TRIGONOMETRY

$g = 9.80\ m/s^2$

$sin\,\theta = \frac{B}{C}$  $cos\,\theta = \frac{A}{C}$  $tan\,\theta = \frac{B}{A}$  $C = \sqrt{A^2 + B^2}$

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MOTION : STRAIGHT LINE $v = v_0 + at$  $x - x_0 = v_0 t + \frac{1}{2}at^2$  $x - x_0 = \frac{1}{2}(v_0 + v)t$  $v^2 = v_0^2 + 2a(x - x_0)$

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

$\Delta y = v_{0y}t - \frac{1}{2}gt^2$  $v_y^{\,2} = v_{0y}^{\,2} - 2g(\Delta y)$  $\Delta y = \frac{v_y^{\,2} - v_{oy}^{\,2}}{-2g}$  $\Delta y = \left(\frac{v_{0y} + v_y}{2}\right)\cdot t$

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FORCE AND MOTION  $\mathbf{F_{net}} = \mathbf{ma}$  $F_g = mg$  $f_{s,max} = \mu_s N$  $f_k = \mu_k N$

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

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WORK/ ENERGY: $K = \frac{1}{2}mv^2$  $\Delta U_{grav} = mg(y_f - y_i)$  $W = Fd(\cos\theta)$  $W = F_x d_x + F_y d_y + F_z d_z$  $W_{net} = \Delta K$

$W_{spring} = -\frac{1}{2}k(x_f^{\,2} - x_i^{\,2}) = \frac{1}{2}k(x_i^{\,2} - x_f^{\,2})$  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: $x_{com} = \frac{1}{M}\sum_{i=1}^{n} m_i x_i$  $y_{com} = \frac{1}{M}\sum_{i=1}^{n} m_i y_i$

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