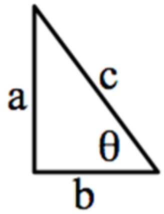
Physics I. Formula Sheet

Right triangle:



$\sin\theta = a/c$

$\cos\theta = b/c$

$\tan\theta = a/b$

$c^2 = a^2 + b^2$

Quadratic Formula:

$Ax^2 + Bx + C = 0$ has solutions:

$$x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$$

Misc Formulas:

Circumference of a circle = $2\pi R$

Area of a circle = πR^2

Surface Area of a Sphere = $4\pi R^2$

Volume of sphere = $(4/3)\pi R^3$

Volume of cylinder = $\pi R^2 L$

Differentiation:

$dx^n/dx = nx^{n-1}$ $(n \neq 0)$

$d\cos(x)/dx = -\sin(x)$ (x in radians)

$d\sin(x)/dx = \cos(x)$ (x in radians)

$d(f(x) + g(x))/dx = df(x)/dx + dg(x)/dx$

Integration: $\int x^n dx = \frac{x^{n+1}}{n+1} + C$

1-D Motion:

displacement = Δx

$v_{average}$: $\Delta x/\Delta t = (x_2 - x_1)/(t_2 - t_1)$

$a_{average}$: $\Delta v/\Delta t = (v_2 - v_1)/(t_2 - t_1)$

Given $x(t)$

$v(t) = dx/dt$ (instantaneous)

$a(t) = dv/dt = d^2x/dt^2$ (instantaneous)

1-D Motion with Const. Acc.:

$x(t) = x_0 + v_{0x}t + (1/2)\,at^2$

$v(t) = v_0 + at$

$v^2 = v_0^2 + 2a(x - x_0)$

Projectile Motion:

$x(t) = x_0 + v_{0x}t$

$v_x(t) = v_{0x}$

$a_x(t) = 0$

$y(t) = y_0 + v_{0y}t + (1/2)\,a_y t^2$

$v_y(t) = v_{0y} + a_y t$

$a_y(t) = a_y$

Acceleration due to gravity:

g = 9.8 m/s^2 downward

Equations connect. trans./rotat. motion

$v_{tan} = R\omega$

$a_{tan} = R\alpha$

Rotat. kinematic eq-ns with const. angular acceleration

$\omega(t) = \omega_0 + \alpha t$

$\theta(t) = \theta_0 + \omega_0 t + (1/2)\alpha t^2$

$\omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$

Centripetal acceleration:

$a_r = v^2/R$; $a_R = \omega^2 R$

Newton 2nd law

$$\sum \vec{F} = m\vec{a}$$

Friction Forces:

$F_s \leq \mu_s N$

$F_k = \mu_k N$

Work and Kinetic Energy

$$W = \vec{F} \cdot \vec{s}$$

$$W = \int_{x_i}^{x_f} F_x\,dx$$

$K = (1/2)mv^2$

$W_{net} = \Delta K$

$\Delta K = K_f - K_i$

Potential Energy:

For gravity on earth's surface:

F=mg

$U(y) = U_0 + mgy$

For a spring:

$F = -kx$

$U(x) = (1/2)kx^2$

$$W = -\frac{k}{2}(x_f^2 - x_i^2)$$

With conservative forces only:

$E_{tot} = K + U$

$E_f = E_i$

With non-conservative forces:

$E_f = E_i + W_{NC}$

Power

$P_{avg} = W/t$

$P = dW/dt$

$P = \vec{F} \bullet \vec{v}$

$\vec{a} \cdot \vec{b} = ab\cos\theta$

$\vec{a} \cdot \vec{b} = a_x b_x + a_y b_y + a_z b_z$