PHYS 4A Exam 2 Cheat Sheet

Write Units

Kinematic Equations

$$v_{avg} = \frac{\Delta x}{\Delta t}; s_{avg} = \frac{distance}{time}; v = \frac{dx}{dt}$$
$$a_{avg} = \frac{\Delta v}{\Delta t}; a = \frac{dv}{dt} = \frac{d^2x}{dt^2}; (1)\ v(t) = v_0 + at$$
$$(2)\ x = x_0 + v_0 t + \frac{1}{2}at^2; (3)\ v^2 = v_0^2 + 2a\Delta x$$

When doing a problem, account for all the variables you know the values of and all those you don't know the value of.

Freefall

Object is in freefall iff only force acting on it is gravity
Kinematic eq'ns apply to freefall
Unless stated otherwise, gravitational acceleration $g = -9.81 m/s^2$

Vectors

$$\vec{a} \cdot \vec{b} = ab\cos(\theta); ||\vec{a} \times \vec{b}|| = ab\sin(\theta)$$
$$\vec{a} \cdot \vec{b} = a_x b_x + a_y b_y \ldots; \vec{a} \times \vec{b} = \det \begin{pmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_x & a_y & a_z \\ b_x & b_y & b_z \end{pmatrix}$$

Vectors work as their separate parts for kinematic eq'ns

Project

Motion in 2D+ (uses vectors)
Generally, vertical motion is freefall, horizontal motion is constant
x-value = magnitude times cosine of angle
y-value = magnitude times sine of angle

$$R = x - x_0 = \frac{v_0^2 * \sin(2\theta)}{g}; t = \frac{R}{v_0 \cos(\theta)}$$
$$\Delta y = \tan\theta \Delta x - \frac{g * \Delta x^2}{2(v_0 \cos\theta)^2}$$

Uniform Circular Motion

$$\vec{x}(t) = x * \cos\theta\hat{i} + x * \sin\theta\hat{j}; a = \frac{v^2}{r}; F_c = \frac{mv^2}{r}$$

Force

Force on an object is always represented on a FBD as starting from that object

Force on an object is calculated from that object's mass and consequent acceleration

$$F_{net} = ma | F_{AB} = -F_{BA}$$

There is no technical equation for the tension force. Treat it as an unknown when it is included.

Friction

$$f_s \leq \mu_s F_N; f_k = \mu_k F_N$$

Spring force

$$\vec{F_s} = -k\vec{d}$$