

Phys1110 Exam 1 Review:

Math skills:

- unit conversion, algebra, trigonometry (sin, cos, tan, Pythagorean Theorem)

Motion in 1D

- graphing: x vs. t , v vs. t , a vs. t
- $v = \frac{dx}{dt} = \lim_{\Delta t \rightarrow 0} \frac{\Delta x}{\Delta t} = \text{slope of a graph of } x \text{ vs. } t$
- $a = \frac{dv}{dt} = \lim_{\Delta t \rightarrow 0} \frac{\Delta v}{\Delta t} = \text{slope of graph of } v \text{ vs. } t$
- average vs. instantaneous value of velocity, acceleration
- "acceleration is not velocity,"
- Constant acceleration ($a = \text{const}$) in 1D:
 - (a) $v = v_o + at$
 - (b) $x = x_o + v_o t + (1/2)at^2$
 - (c) $v^2 = v_o^2 + 2a(x - x_o)$
 - (d) $\bar{v} = \frac{v_o + v}{2}$

Vector Math

- Addition of vectors:
 - graphically (tip-to-tail)
 - analytically (with components)
- Components of vectors, unit vectors $\vec{A} = A_x \hat{i} + A_y \hat{j}$

Motion in 2D

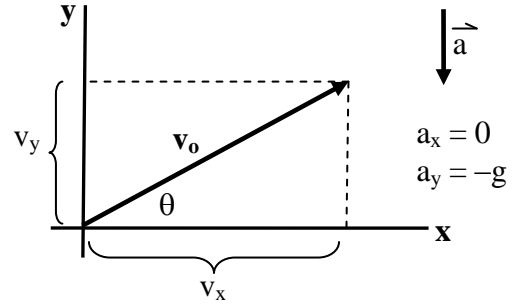
- $\vec{v} = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{r}}{\Delta t}$
- $\vec{a} = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{v}}{\Delta t}$, $\vec{v}_1 + \Delta \vec{v} = \vec{v}_2$
- direction of $\vec{a} = \text{direction of } \Delta \vec{v} = \vec{v}_2 - \vec{v}_1$

- Projectile Motion

treat x- and y-motions independently

$$a_x = 0 \Rightarrow v_x = \text{constant}$$

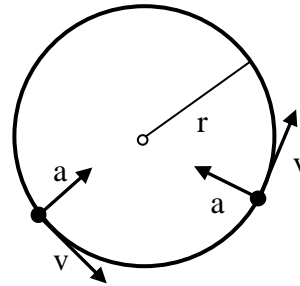
$$a_y = -g \Rightarrow v_y = v_{oy} - g t, \text{ etc}$$



- Circular motion with constant speed v ,

$$a = |\vec{a}| \equiv \frac{v^2}{r}$$

\vec{a} is toward the center (centripetal)



Newton's Laws

$$\vec{F}_{\text{net}} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \dots = \sum_i \vec{F}_i$$

NI: $\vec{F}_{\text{net}} = 0 \Leftrightarrow \vec{v} = \text{constant}$

NII: $\vec{F}_{\text{net}} = m \vec{a}$

NIII: $\vec{F}_{AB} = -\vec{F}_{BA}$

Two circles labeled A and B. A force vector F_{AB} points from A to B, and a force vector F_{BA} points from B to A.

Force and motion problems:

- 1) Free-body diagram
- 2) Coordinate system with +direction of axis = direction of acceleration
- 3) $\sum F_x = m a_x$, $\sum F_y = m a_y$

To prepare for Exam 1:

- Review Concept Tests, MP (MasteringPhysics) problems, Tutorial HW. (Read question and try to remember reasoning that gets to the answer)
- When reviewing MP problems, know how to derive algebraic formula for answer.
- Prepare your formula sheet.
- Take the practice exam.
- It is no good to memorize answers. You have to understand and remember how you construct the answers.