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
- \[ v = \frac{dx}{dt} = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} = \text{slope of a graph of x vs. t} \]
- \[ a = \frac{dv}{dt} = \lim_{\Delta t \to 0} \frac{\Delta v}{\Delta t} = \text{slope of graph of v vs. t} \]
- average vs. instantaneous value of velocity, acceleration
- "acceleration is not velocity, ...."
- Constant acceleration (a = const) in 1D:
  (a) \[ v = v_o + a \, t \]
  (b) \[ x = x_o + v_o \, t + \frac{1}{2} a \, t^2 \]
  (c) \[ v^2 = v_o^2 + 2 a (x - x_o) \]
  (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
- \[ \bar{v} = \lim_{\Delta t \to 0} \frac{\Delta \vec{r}}{\Delta t} \]
- \[ \bar{a} = \lim_{\Delta t \to 0} \frac{\Delta \bar{v}}{\Delta t}, \quad \bar{v}_1 + \Delta \bar{v} = \bar{v}_2 \]
- direction of \[ \bar{a} = \text{direction of } \Delta \bar{v} = \bar{v}_2 - \bar{v}_1 \]
• Projectile Motion
  
  treat x- and y-motions independently

  \[ a_x = 0 \implies v_x = \text{constant} \]
  \[ a_y = -g \implies v_y = v_{oy} - gt, \text{ etc} \]

• Circular motion with constant speed \( v \),
  
  \[ a = \left| \ddot{a} \right| = \frac{v^2}{r} \]
  \( \dddot{a} \) is toward the center (centripetal)

Newton's Laws

\[ \vec{F}_{\text{net}} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \ldots = \sum_i \vec{F}_i \]

NI: \( \vec{F}_{\text{net}} = 0 \iff v = \text{constant} \)

NII: \( F_{\text{net}} = m \dddot{a} \)

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

Force and motion problems:

1) Free-body diagram
2) Coordinate system with +direction of axis = direction of acceleration
3) \[ \sum F_x = ma_x, \quad \sum F_y = ma_y \]

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.