Phys1110 Exam 2 Review:

Everything from Exam I!

- algebra, trigonometry, unit conversions,
- 1D Motion:

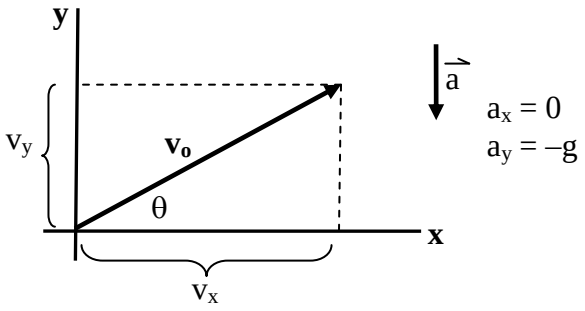
  $v = \frac{\Delta x}{\Delta t}$, $a = \frac{\Delta v}{\Delta t}$, graphs, slopes

  constant acceleration formulas: $v = v_o + a\,t$, etc
- Vectors! vector addition, vector components

2D Motion:

- $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$, $\vec{v}_1 + \Delta\vec{v} = \vec{v}_2$
- Projectile Motion

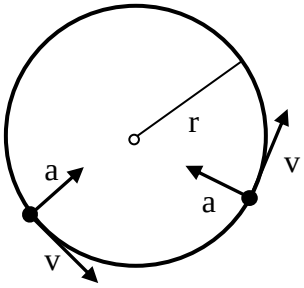
treat x- and y-motions independently
$a_x = 0 \Rightarrow v_x$ = constant
$a_y = -g \Rightarrow v_y = v_{oy} - g\,t$, etc



- Circular Motion with constant speed v,

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

  $\vec{a}$ and $\vec{F}_{net}$ *are toward the center (centripetal)*



- **Newton's Laws**

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

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

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

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

New material since Exam I

Force and motion problems with one or more bodies:

1) Draw Free-body diagram
2) Choose Coordinate system
3) $\sum F_x = m\,a_x$, $\sum F_y = m\,a_y$

Friction f

- sliding friction: $f = \mu_K N$
- static friction: $0 < f < f_{max} = \mu_S N$

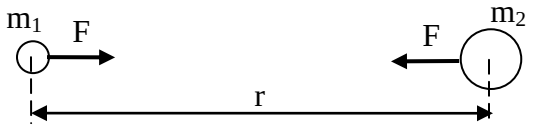
Work and Energy

- work done by force F: $W_F = \vec{F} \cdot \Delta\vec{r}$, work can be (+), (–), or zero
- Hooke's Law: $F_{spring} = -k x$ (k = spring constant)
- work-energy principle: $W_{net} = \Delta KE$
- Definition of PE associated with conservative force F: $\Delta PE_F = -W_F$
- $PE_{grav} = m g h$ $PE_{elastic} = (1/2) k x^2$
- If no sliding friction, so no thermal energy generated : $E_{mech} = KE + PE = \text{constant}$
- If sliding friction, $KE + PE + E_{thermal} = \text{constant}$
- Power $P = \dfrac{\Delta W}{\Delta t}$

Gravity

Newton's Universal Law of gravity:

$$F = G \frac{m_1 m_2}{r^2}$$

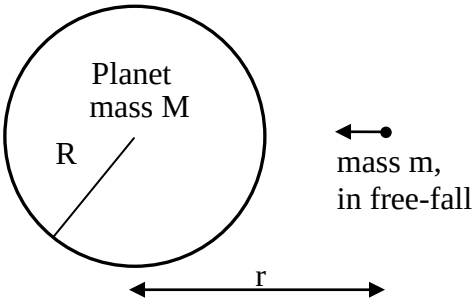


distance measured from centers

Acceleration due to gravity

$$F_{net} = m a$$

$$\frac{G M m}{r^2} = m g \quad \Rightarrow \quad g = \frac{G M}{r^2}$$



r = distance to center of planet

Orbits, Kepler's laws

$$PE_{grav} = U(r) = -\frac{GMm}{r}$$

Know how to use conservation of energy to derive escape speed.

To prepare for Exam 2:

- Review Concept Tests, CAPA problems, Tutorial HW. (Read question and try to remember reasoning that gets to the answer)
- When reviewing CAPA 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.

