Goals for Today

- Quiz time!
- Finish Text LOL
- Kinematic equations

Spirit Week

- There will be a competition among all my classes
- Class most dressed up for the week will get a prize TBD (maybe a HW pass?)

Lab Donations

Eclipse Monday!

Kinematics vs dynamics

- **Kinematics** studies the motion of objects
- **Dynamics** studies the forces that cause that motion

Motion at constant acceleration

- If acceleration is constant (which in many practical situations it is)…
- Can use this fact to derive some pretty convenient relationships between acceleration, velocity, and position with respect to time

Motion at constant acceleration

$$v = \frac{\Delta x}{\Delta t}$$

$$\boldsymbol{a} = \frac{\Delta \boldsymbol{v}}{\Delta \boldsymbol{t}}$$

$$x_f = x_i + v\Delta t$$

$$v_f = v_i + a\Delta t$$

Example #1

- *Kira decelerates for 3.00 seconds from 12.0 m/s at a rate of -2.0 m/s each second. What is her final speed?*

$$v_f = v_i + a\Delta t$$

- v_f=12.0 m/s – (2.0 m/s^2)(3.00s)
- v_f=6.0 m/s

Motion at constant acceleration

- With a little simple calculus, can find acceleration's contribution to a change in position…
- $x_f = x_i + v_i \Delta t + \frac{1}{2} a \Delta t^2$
- Or $\Delta\, x = v_i \Delta t + \frac{1}{2} a \Delta t^2$
- (For the full derivation check out http://physics.info/kinematics-calculus/)

- Extension from our California Screamin' ride problem – if the ride's acceleration is 6.2 m/s^2 at the beginning and goes from 0 to 25 m/s in 6.0 seconds, what is its final position if we say the initial position is 0?

$$x_f = x_i + v_i\Delta t + \frac{1}{2}a\Delta t^2$$

- X_f=(0m)+(0m/s)(6s)+$\frac{1}{2}(6.2\mathrm{m}/s^2)(6\mathrm{s})^2$
- 110m

But what if there's no time??

- $v_f^2 - v_i^2 = 2a\Delta x$

- Just like out of a DMV video – Kay is driving on a residential street at 16 m/s when she sees a ball roll into the road 12.0m ahead and she knows a child is soon to follow. What must be her deceleration in order to stop before hitting the ball or the following child?

$$v_f^2 - v_i^2 = 2a\Delta x$$

- $a = \frac{0 - \left(\frac{16.0m}{s}\right)^2}{2 * 12.0m}$
- a= - 11.0 m/s^2

Your 4 kinematic equations

$$v_f = v_i + a\Delta t \qquad x_f = x_i + v\Delta t$$

$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$v_f^2 - v_i^2 = 2a\Delta x$$