Announcements 1/17

- Assigned seats today! (Sort of)
  - Split half A-M, N-Z (see board)
  - Make groups of three if possible
- Reminder: first lab next week (Mon or Wed)
  - Read lab ahead of time on LON-CAPA

1D Kinematics Highlights

- We describe position and other variables as functions of time: x = x(t), v = v(t), etc.
- Instantaneous quantities are defined as derivatives:

$$v = \frac{dx}{dt}$$

$$a = \frac{dv}{dt} = \frac{d^2x}{dt^2}$$

Special Case: Constant Acceleration

- If you know acceleration as a function of time, can integrate (work backwards) to get velocity, position
- If acceleration is constant, integration is simple

$$v = v_0 + at$$

$$x - x_0 = v_0 t + \frac{1}{2} a t^2$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

$$x - x_0 = \frac{1}{2}(v_0 + v)t$$

From integrating defs

Solve other two for Different vars

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Δx (displacement)

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Variable Definitions

$$v = v_0 + at$$

$$x - x_0 = v_0 t + \frac{1}{2} a t^2$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

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- x_0, v_0 are position and velocity at t = 0
- x, v values at time t (x(t), v(t))
- What if “initial” values given not at t = 0?
  - Change times by shifting

Question

$$v = v_0 + at$$

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$$v^2 = v_0^2 + 2a(x - x_0)$$

$$x - x_0 = \frac{1}{2}(v_0 + v)t$$

- a(t) = 5 t^2. Find the velocity at t = 3 s (the object starts at rest).
  - Which equation?
  - What value for a?

Falling Objects, etc.

- Constant acceleration equations useful if acceleration *constant*
- This is the case much of the time, though
  - Ex: near Earth's surface, freefall $a_y = -g$