Introductory Physics

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1D Motion Activity : Creating graphs from real-world motion using video analysis

- **Choose a System to Model**: Pick a short segment from a sample movie showing **1-D** (straight line) motion.

- **Predict**: Before doing the computer analysis, sketch 3 plots showing what you would expect **position-vs.-time**, **velocity-vs.-time, and acceleration-vs.-time** graphs to look like for your short segment of motion. Show your predictions to an instructor or TA before proceeding.

- **Analyze**: Add points to the segment of motion you want to analyze using the procedure from the handout labeled "Video Analysis using Logger Pro" from last class (also reproduced at the end of this packet). This time you'll want to set your origin and scale (click and drag) to anything reasonable. Logger Pro should automatically create x and y vs. time graphs. (Which graph should match your position-vs.-time prediction?)
- The program automatically calculates velocity; you can click on Data/Column Options to see the calculation. What calculation should you use to find acceleration? You can use Data/New Calculated Column to add acceleration. (Make sure you're using DataSet VideoAnalysis.)
- Use Insert/Graph to add graphs. Right click and use the axis options tab to change what is shown on the graphs. (Again, use DataSet VideoAnalysis.)
- **Assess:** Do the position, velocity, and acceleration vs. time graphs match your predictions? Why or why not? Which of the graphs would you expect to be most accurate?

Make sure **each** person in your group is prepared to report a summary of your analysis and assessment to contribute to a large group discussion.

Vector Activity: Components of a meter stick

- Use a post-it note to mark one end of a meter stick as the "arrow end" of your "meter stick displacement vector". Take turns placing it on the floor in any orientation. Using a coordinate system aligned with the squares on the floor, find the x and y components of your meter stick vector either in units of "tile lengths" or in meters.
- Find a method to check whether your components are correct.
- Write your meter stick vector using unit vector notation.

Reflect: What do vectors and vector components mean physically?

- We're focusing on displacement vectors, since they're easy to visualize, but this can be misleading, since most vectors don't "stretch across space", but represent a quantity at the location of the vector's tail (see note pg. 70).
- Think back to the **velocity** vectors in our motion diagrams:
    - What exactly does the arrow represent?
    - Does the length of the arrow on your paper matter?
    - What do the *x*- and *y*- components of a **velocity** vector represent physically?

Activity : Tennis Ball Toss

- **Background:** Practice until each of you can reliably toss a tennis ball straight up and catch it without moving your hand around.
- **Predict:** Each of you will throw a ball straight up while moving with a constant velocity. Where do you expect the ball to land?
- **Analyze:** Take a chair adjusted to its lowest height setting and a tennis ball out to the hallway. One of you will sit on the chair and throw the ball straight up while your partner is pushing you (slowly and carefully!) with an approximately constant velocity. Change roles and repeat the experiment until everyone has had a try.
- **Assess:** Were your predictions right? Why or why not? What factors might affect whether or not your experimental data matches your prediction?
- **Reflect:** Why did we assign this activity? How is this activity related to the concepts associated with L.O. 6?