HINT for 40 Meter Dash lab report

If you want to see the video again, go to the web page (http://nngroup.physics.sunysb.edu/~kenkou/PHY115.html). I keep the data until October 3rd.

1. Introduction

- What is motivation? What is the meaning of this experiment?
- What do you expect to learn from this experiment?

2. Procedure

- Write exactly what you did.

3. Data

- Numbers in velocity and acceleration are NOT raw data (these are analyzed data). These numbers should be in the analysis section with the method to calculate. Only distance data with time from the Quick-Time Player should be in this section.
- Don't forget errors. The distance errors for y<15m should be 1.5m (3.0/2=1.5). The errors for y>15m should be 2.5m (5.0/2=2.5). Ignore timing errors.
- Don't forget units.
- The time *t* is from Quick-Time Player raw value.
- Make sure that time *t* at y=0m should NOT be 0.0sec.
- Number of position data should be 11 in each measurement.
- Explain how you got errors
- Comment on unclear points if you have.

4. Analysis

- How did you calculate velocities and accelerations?
- Number of velocity data should be 10 in each measurement. Namely calculate velocities for EACH INTERVAL. (More hint: the numerator ($y - y_0$) of $v = \frac{y - y_0}{t - t_0}$ should always be 3.0m or 5.0m)
- Number of acceleration data should be 9 in each measurement.
- Don't forget error propagations (See next page).
- Make graphs with error bars (distance vs. time, velocity vs. time, and acceleration vs. time)

5. Conclusion

- Answer to the questions in the lab manual.
- Discuss the result quantitatively (This is a fun part of physics experiment!).
- How was your measurement? If you think it's failure, write the reason qualitatively.
- What did you learn about your running from this measurement?

If you have comments/suggestions on lab report, lab itself, and/or me, please do not hesitate to write after the conclusion.

An example of calculation for error propagation

In this experiment, **you don't need to take the errors of time.**
You have distance data d_0=5.0±0.5m(t_0=2.0s) and d=15.0±0.5m(t=2.5s) (<- this is an example).
When you calculate velocity, $v = \frac{\Delta d}{\Delta t} = \frac{d - d_0}{t - t_0}$, you need two steps to calculate the error of velocity.

1. calculate error for $\Delta d \left(= 15.0 - 5.0 = 10.0\right)$

   Because $\Delta d = d - d_0$ (subtraction), you need $\Delta S = \sqrt{\Delta A^2 + \Delta B^2}$ type calculation (see lab manual experiment 1)

   The error for Δd is $\sqrt{0.5^2 + 0.5^2} = 0.7$. $\Delta d = 10.0 \pm 0.7$.

2. calculate error for $v\left(= \frac{15.0 - 5.0}{2.5 - 2.0} = \frac{10.0}{0.5} = 20. \right)$

   Because only Δd has the error not Δt, the error of $v = \frac{\Delta d}{\Delta t}$ is the error of Δd divided by Δt.

   The error for v is $0.7 / 0.5 = 1.4$.

The velocity is $v = 20.0 \pm 1.4$**.**