Original

use this paper — grid lines not as dark, and room along edge to show slope cales.

Day 6

→ ~~Quiz 2~~ 1

2011 – B/C of calendar, had to pass out TH lab

Car tie + hat
Car music
Tables along counters
Toys up front on extra table
Great Race due (10 pts)

→ Review graphing techniques

→ Tips on doing GOM #6–8 – due day 7 (10 pts)
Average vs. instantaneous

25-30' → Physics 500

10 pts, groups of 2
Each person graph 3 toys, 4 data pts each

Equipment: Toys, RC cars, stop watches, tape measures, rulers, graph paper

Day 6/8

GRAPHING TECHNIQUES

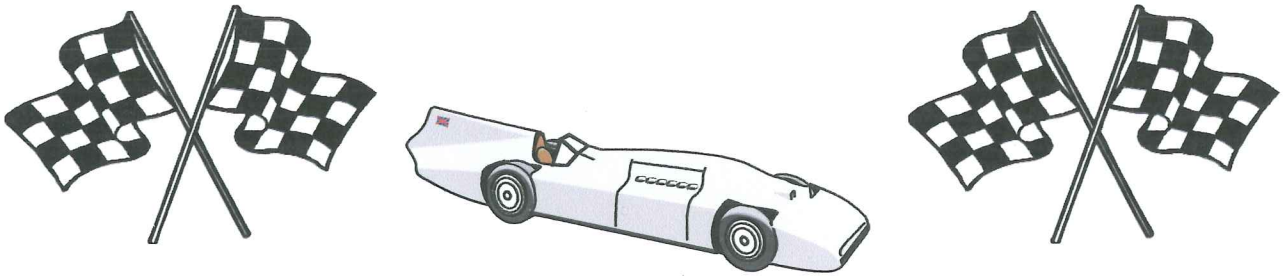
►Label axes with what's being measured and units
►Time is always on the x-axis
►Independent variable = x-axis (time)
►Dependent variable = y-axis (distance)
►To get slope: use ruler to draw "best-fit line" through all points
►SLOPE: Rise/Run = $\Delta s/\Delta t$ = velocity

SO…..to get the velocity of a moving object, simply graph its motion, get a best-fit line, and calculate the slope! This requires a straight line and use of 2 points along the line.

INSTANTANEOUS versus AVERAGE velocity

Slope of a curve

- Review slope calc.
- Do each region
- Same Δt scale
- V vs Δt under Δs-Δt
- Instantaneous (speedom.) = Slope in each region
- Average = $\frac{\Delta s_{Total}}{\Delta t_{Total}}$



PHYSICS 500

- Groups of 2, collect data together
- Obtain 4 data points (Δt, Δs) each for 3 different toys; make a table
- Each person graph Δs vs. Δt data for all 3 toys, draw best fit line, calculate slope
- All 3 toys can be plotted on one graph
- Due tomorrow, worth 10 points

Name _____

I-2 THE PHYSICS 500
Exploration

Purpose

The purpose of this activity is to 1) calculate the average velocity of at least six different races and 2) participate in at least one race.

three

Materials

Meter sticks, stop watch, bike, tricycle, skate board, roller skates, level, straight road, "finish" string, wind-up toys, battery toys, and play ground balls.

Procedure

Work in groups of approximately three students and determine the speed of selected events. You could invent certain "handicap" races such as hopping on same foot, rolling on the lawn, backward walk, three-legged race, etc. Organize your plan to determine the speed of each race in which your group is involved.

When experiments are done in which measurements are taken, a good experimenter organizes a table in which all measurements are recorded that will be used to make the necessary calculations. The final quantity that we desire to measure, such as speed in this activity, should be located in the extreme right-hand column of your table and your other measured quantities necessary to calculate speed in columns to the left of the speed column. Always show the units used in measured and calculated values in the top of each column along with the name of the quantity. Construct a table as is started below by adding columns between "activity" and "speed" to show what you measured. Record as many digits as you can read directly plus one estimated digit from your measuring instruments.

Significant digits

(Add columns, names and units you used in your measurements.)

Activity	Speed ___ (units)
The crawl	
Tricycle	
Running	

Summing Up

1. How are speed, distance and time related?
2. Would the recorded speeds represent the maximum velocity for each event? Explain.
3. List the fastest event in the class in miles per hour if 1.0 m/sec = 2.237 mph.

Teacher Notes
I-2 PHYSICS 500
Exploration

Lab setup	easy	moderate	difficult
Calculations	easy	moderate	difficult
Reliability	excellent	good	fair
Interest	excellent	good	fair
Lab time	- 1 class	1 class	+ 1 class

Teaching Strategies

Students need to be encouraged to find unique races for the timed trials. These calculated speeds are average speeds, although the longer the distance traveled, the closer the average speed will approach the speed at the finish line if speed is uniform after the start.

A wide variety of objects will add interest and excitement, but the teacher must select activities that safely match the location. This lab will prove an effective introduction to accelerated motion if students understand that the recorded motion is not uniform.

Sample Observations/Calculations

Needed equations and conversions

$v = s/t$ — v = average speed; s = distance in meters; t = time in seconds; 1 meter/s = 2.237 mile/hr

students should divide the data table into two additional columns for distance (meters) and time (seconds).

Sample calculations

A student runs 35.0 meters in 4.67 seconds

$$\text{Average speed} = \frac{35.0\text{m}}{4.67\text{ s}} = 7.49\text{ m/s}$$

$$\frac{7.49\text{m}}{\text{s}} = \frac{(7.49\text{m})\ (2.237\ \frac{\text{mile/hr}}{1\text{ m/s}})}{\text{s}} = 17.7\text{ mile/hr.}$$

Summing Up

1) Velocity is directly related to distance and inversely related to time.

2) The recorded speeds will be average speeds that will be less than the maximum attained speed because most objects are starting from rest.

3) Average speeds over 20 miles/hour are approaching the average speed of world class sprinters. 15 miles/hour is the average speed of a four minute mile.