Globisens

Labdisc
activities

for Elementary School Science

Labdisc Activity

What is Distance

Supporting Labdisc Data Logger, GlobiWorld and GlobiLab Software

For Elementary School Science

What is Distance?

Introduction

Some of your class mates live within walking distance from your school, but some need to be driven to school every morning because their homes are quite far. We measure distance by meters. Walking distances cover a few meters to a few thousand meters – called kilo-meters (km). Driving distance can range from a few kilometers to many.

Let's start with some typical distances to help get orientated:

- Our neighbor lives a few meters from us
- Our school can be a few kilometers away
- The nearby city may be 50 kilometers away
- A neighboring country can be a thousand kilometers away

Now consider these amazing distance facts:

- The moon is 384 thousands kilometers away from earth
- Mars is 56 million kilometers away from earth.
- The sun is 150 million kilometers from earth.
- The distance between atoms is only 3 billionth of a meter…

If we want to reach any of the destinations described above we need to walk, run, drive, fly, sail or even use a fast spaceship. Speed is measured by meter per second or kilometer per hour and different modes of transport help us cross distances at different speeds.

We can:

- Walk to our neighbor or our school at a speed of four to six kilometers per hour, or run at 12 kilometer per hour.
- Drive to our school at 50 kilometer per hour
- Fly to a neighboring country at 1000 kilometers per hour
- Fly to another planet at 30,000 kilometer per hour

The most fundamental equation describing distance, time and speed states that: Distance is equal to speed multiplied by time.

Distance = Speed x Time

It means that the faster we travel; we will cover larger distances over the same period of time.

The Experiment

In this activity we will examine the relationship between speed time and distance. We will also explore graphs of distance versus time.

For the experiment we will use the Labdisc distance sensor which measures distances between 0.4 m to 10 m. The sensor works as sonar, transmitting an ultra sonic sound, which travels through air, hits a body and then echoes back to the sensor. The Labdisc measures the time passed from transmitting the sound, to the reception of its echo and then calculates the distance.

Equipment Needed

- No equipment is needed

Labdisc Setup

The best way to perform this experiment is by using wireless communication with the computer.

Setup the Labdisc from the Labdisc menu.

1. Make sure that the Labdisc is fully charged before starting this experiment.
2. Turn on the Labdisc by pressing the On/Off key. 
3. Make sure the BLUETOOTH icon  appears on the Labdisc screen. If not enable Bluetooth communication:
    a. Press SCROLL key  to open the Labdisc menu.
    b. Select the CONFIGURATION icon. 

c. From that menu select the BLUETOOTH icon  , then SCROLL to "BT Enabled" option and press SELECT.

d. Press the ESC key twice  to return to the main menu.

4. **SENSORS:**

Press SCROLL key  to open the Labdisc menu. Select the SETUP icon  and then SET SENSOR icon  . Press the distance sensor key  and make sure that this is the only selected sensor for the activity.

5. **SAMPLING RATE:**

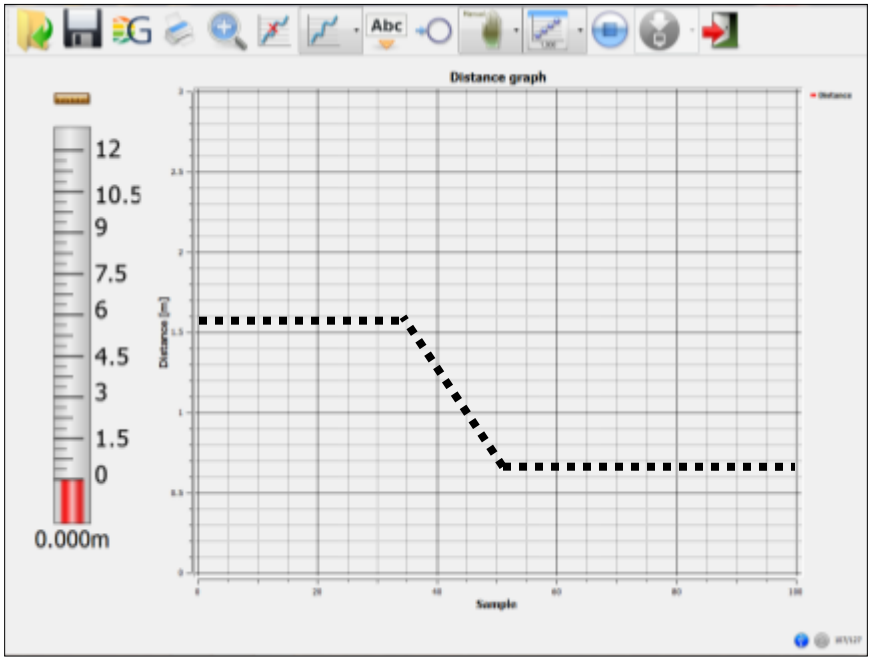
Press the ESC key  to leave the previous menu and then select the SAMPLING RATE icon.  Use the SCROLL key  to choose 10/sec. Press the SELECT key  to confirm.

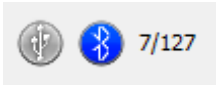
6. **AMOUNT OF SAMPLES:**

Press the ESC key  to leave the previous menu and then select the NUMBER OF SAMPLES icon.  Use the SCROLL key  to choose 1000. Press the SELECT key  to confirm.

Experiment Procedure

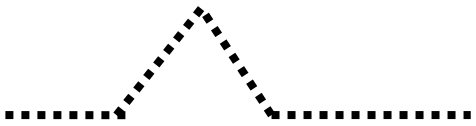
1. Your teacher will use a projector to project the software graph window onto the classroom white board.
2. Your teacher will manually draw a graph on the screen. As shown below:

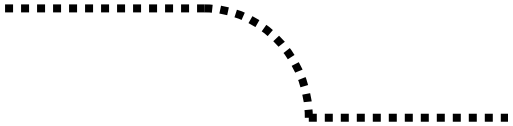


3. If you are using wireless communication - make sure that the computer bottom right BLUETOOTH icon 

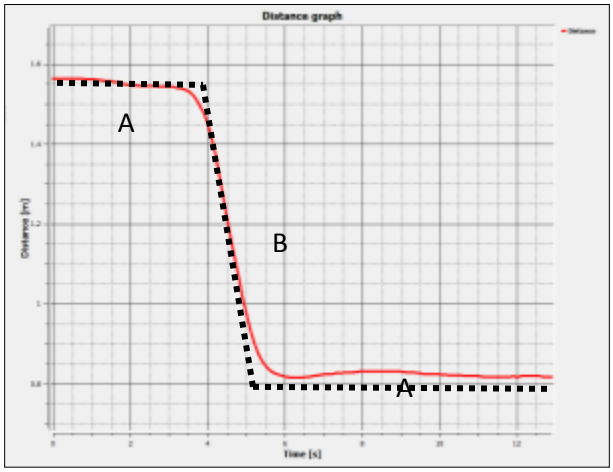
is turned on indicating that the computer is wirelessly connected to your Labdisc.
4. Stand 1.5 m from the classroom white board.
5. Open the distance sensor plastic cap and aim it at the white board.
6. Press the distance sensor key and verify that the Labdisc LCD shows a 1.5 m distance.
7. Press the SELECT key  to start recording.
8. Try to repeat the graph drawn by your teacher, while walking with the Labdisc and changing the distance between the Labdisc and the classroom wall.

9. When you've finished, press the SELECT key and then the SCROLL key to stop recording.
10. Repeat this experiment to imitate the distance graphs below:

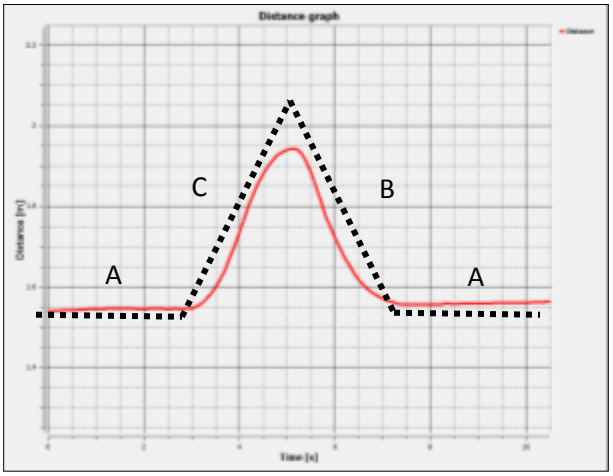




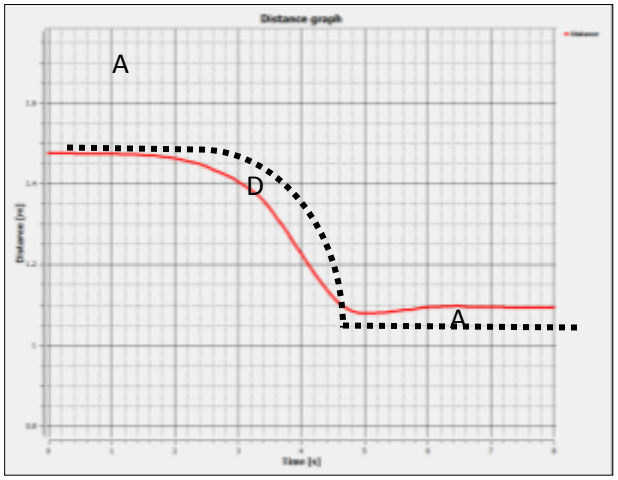
Data Analysis



Activity - 1



Activity - 2



Activity - 3

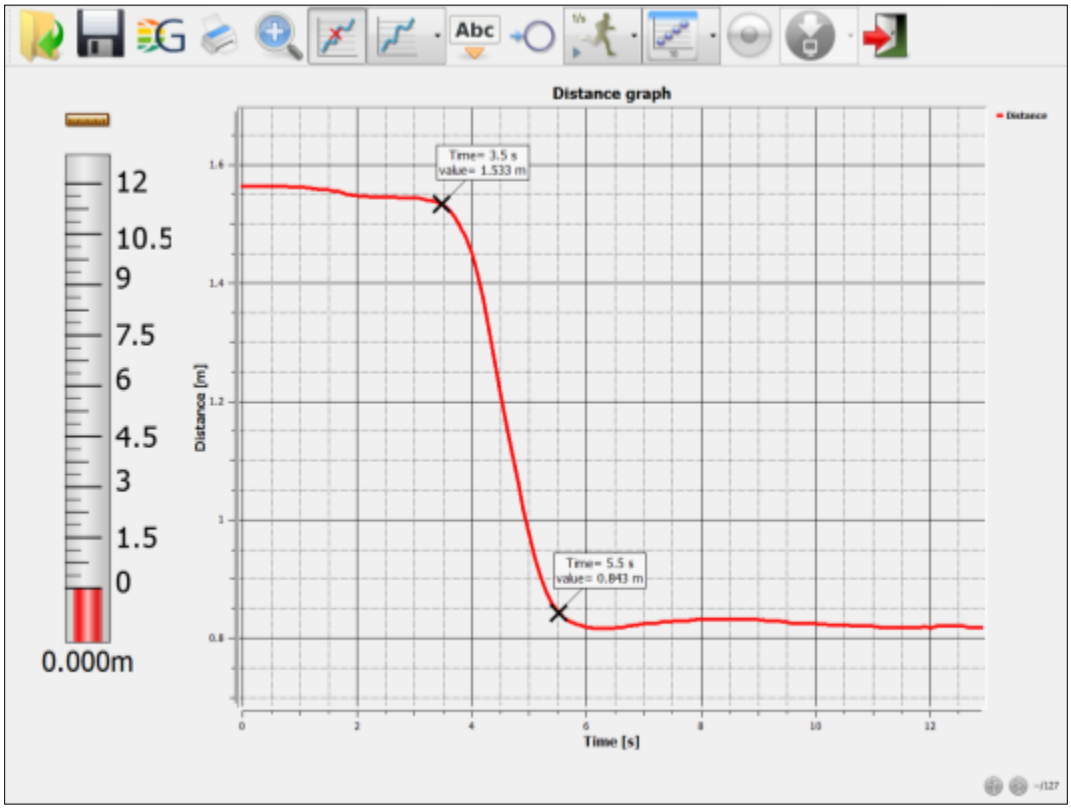
A graph is a "mathematical" way of describing our experiment.

Viewing the graphs on the previous page we can draw the following conclusions:

1. A flat graph (marked A) describes when we were standing still and the distance between us to the classroom wall (or white board) wasn't changing.
2. A straight falling graph (marked B) describes when we were moving at a constant speed, walking toward the classroom wall.
3. In the same way, the straight rising graph (marked C) describes when we were moving away from the wall, increasing our distance from it.
4. The section marked D on the graph, also describes when we were moving towards the classroom wall. However, while section B represented walking at a constant speed, section D describes walking at a variable speed: starting fast and then slowing down.

Let's analyze what distance we crossed, our speed and our final position at the end of each activity.

1. Open Activity - 1
2. Place the markers as shown below:



3. The first marker shows that when we started our recording we were 1.5 m away from the classroom wall; Then we moved towards the wall reaching a distance of 0.8 m - as we see on the 2nd marker.

   Therefore:

   a. We traveled: 1.5 - 0.8 = 0.7 m
   b. Our final position was 0.8 m away from the wall

4. Speed is defined as distance divided by time. From the markers above we can get the following information:

   c. We started walking after 3.5 seconds
   d. We stopped walking after 5.5 seconds

e. Our initial position was 1.5m
f. Our final position was 0.8m

Thus our speed was:

$$Speed = \frac{1.5 - 0.8}{5.5 - 3.5} = 0.35\ meters\ per\ second$$

Investigation and Questions

View your measurements and try to answer the questions below.

1. In the activities above, a flat graph means?
   - ☐ We are moving very slowly towards the wall.
   - ☐ We are moving quickly away from the wall.
   - ☐ We are standing still.

2. In the activities above, a rising graph means?
   - ☐ We are moving towards the wall.
   - ☐ We are moving away from the wall.
   - ☐ We are standing still.

3. A steeper distance graph means:
   - ☐ We traveled faster.
   - ☐ We traveled slower.

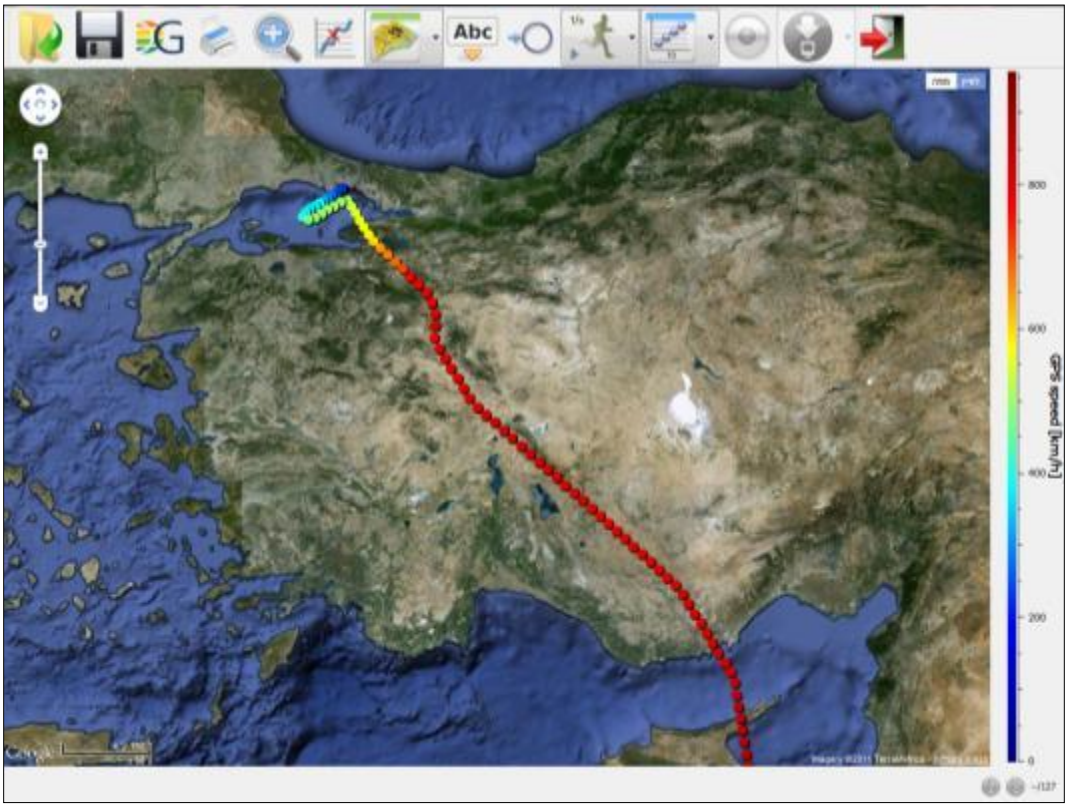
4. What is the distance between your initial and final position in Activity 2?
   - ☐ Initial and final positions are the same
   - ☐ 1.5 m
   - ☐ 0.7 m

5. How much time will it take to move 20 meters, if our speed is two meters per second?
   - ☐ 20 seconds.
   - ☐ 10 seconds.
   - ☐ 11 seconds.

Further Suggestions

The GPS sensor built into the Labdisc measures our global position and our traveling speed. The recording below was taken during a flight to Istanbul – the capital of Turkey, where the Labdisc with GPS was held by a passenger on board the airplane.

The color points on the Google map represent the airplane's speed during the flight. Using the color speed scale to the left of the map, try to determine the cruising speed of the airplane.



Focus on the airplane's decent to landing; Try to guess the landing speed.