

TechLab Prep: Get Smart

once you know the cart it's time to access the smart

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• Purpose •

In this activity you will learn how to monitor a Bluetooth-enabled Smart Cart using Capstone.

• Apparatus •

___ PASCO Introductory Dynamics System (carts, track, leveling feet, end stop, and accessories)

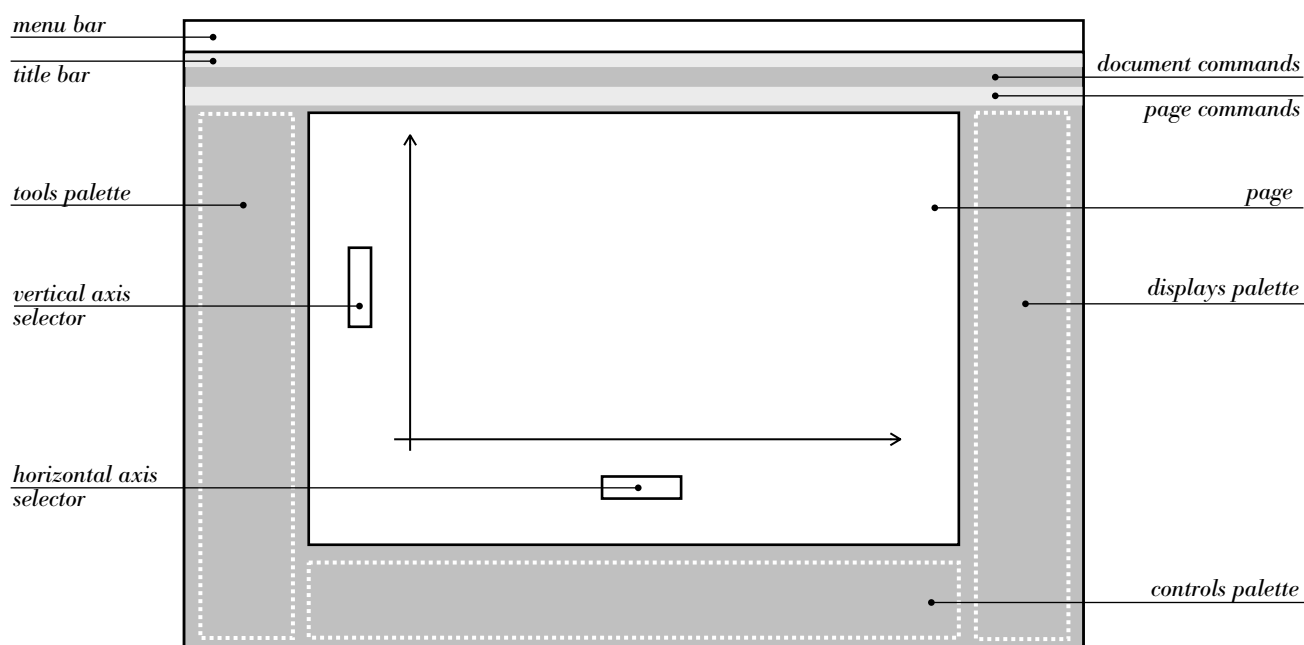
___ Smart Cart

___ computer (with Bluetooth)

___ PASCO Capstone software

• Setup •

1. Start the computer, log in, and allow it to complete its startup cycle..
2. Arrange the track so that it is level.
3. Open the Capstone application. Most (not all) elements of the screen layout shown below will appear.

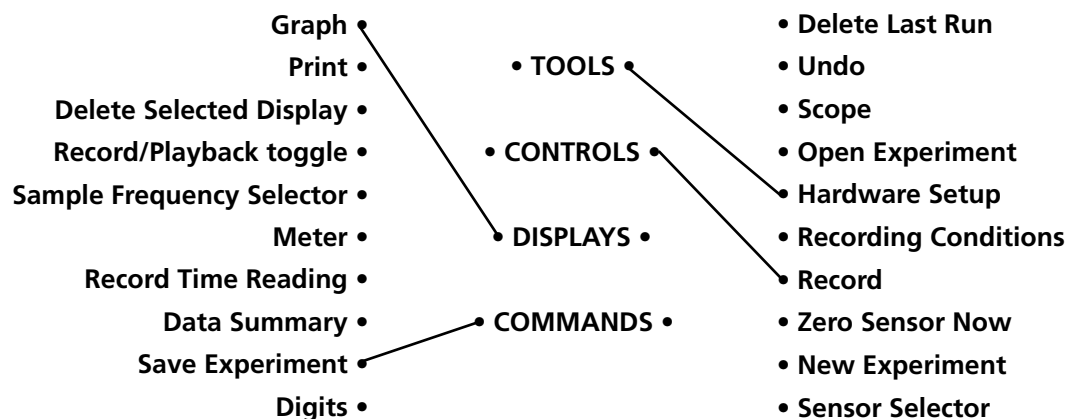


4. In the Displays palette, locate the "Graphs" display icon. You can drag the icon to the page area or double-click the icon to fill the page with a blank graph.
5. In the diagram above, circle the following terms: commands, controls, displays, page, and tools.
6. Locate the power button on the Smart Cart and turn it on.
7. Click the Hardware Setup icon in the Tools palette. Select your Smart Cart (if it hasn't been auto selected already). There may be several Smart Carts listed. Match the device ID number ("license plate") printed on your Smart Cart to the one being monitored by your computer's Capstone software.
8. Use the axis selectors to set the vertical axis to Position and the horizontal axis to Time.

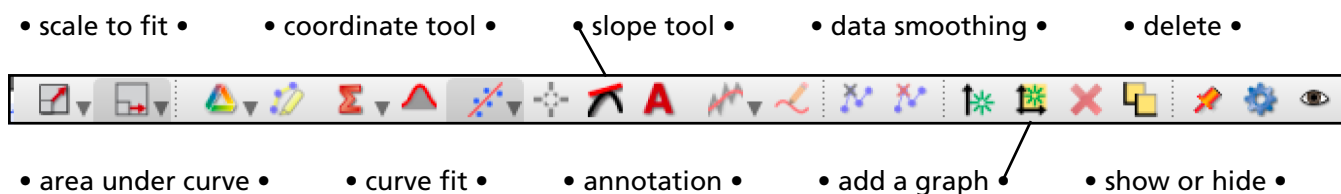
• Procedure •

1. CAPSTONE'S BUTTONS AND GRAPH TOOLS

a. There are permanent areas of the screen layout, such as Tools, Controls, Displays, Page, and Command. Match each buttons with its region. We won't label all of them here; a few have already been done.



b. There are many tools for analyzing plotted graphs. Connect the description (either end) to the tool icon. We won't label all the tools here. A few have already been done.



2. OUT AND BACK

a. Set the cart near the "low end" (0 cm) of the track. Click the on-screen Record button (Controls).

b. Move the cart **slowly** out and back along the **full** length of the track **once** while keeping your hand on the cart at all times. Allow it to take about 8 seconds for the whole trip out and back. Do not slosh the cart back and forth multiple times. Do your best to make the motion smooth both ways.

c. Click the on-screen Stop button to terminate the data sampling. The plot might look like a hill or a valley. We will prefer a hill here. If you got a valley, turn the cart around and try again. If your trial did not go well for **any** reason, click the on-screen "Delete Last Run" control button and try again. **Do-overs are easy, quick, and free.**

d. Use the Scale to Fit graph tool to maximize the use of available graph window space.

e. Using the command button or the File menu, Save Experiment with a title such as "GetSmart PG" to the designated folder but use the Period number and Group letter instead of "PG".

f. What was the cart doing when the resulting plotted line of its position has

i. positive slope?

ii. negative slope?

iii. zero slope?

- g. What was the position of the cart at 3.20 seconds? Add a Coordinates/Delta Tool to find out.
 - i. Click the on-screen Coordinates Tool icon below the graph.
 - ii. Drag the Tool onto the plotted line using the computer's trackpad and trackpad button.
 - iii. Use the arrow buttons to move the Tool along the plotted line until it's on the 3.20 s mark. What is the value of the position?

3. TRACK VELOCITY VS. TIME

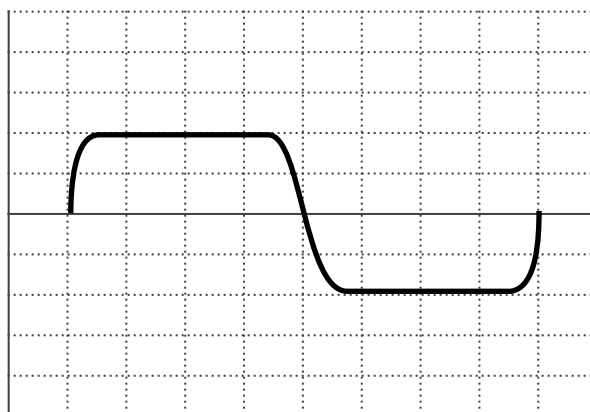
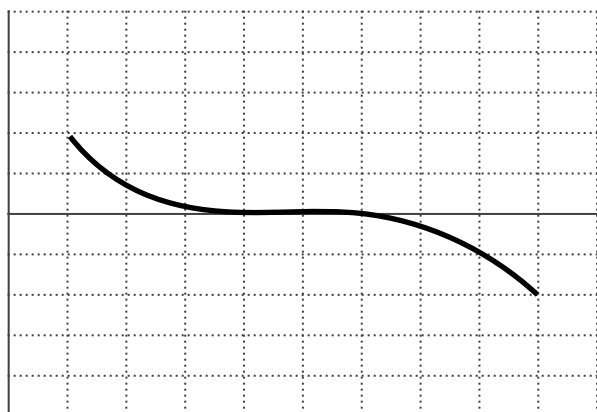
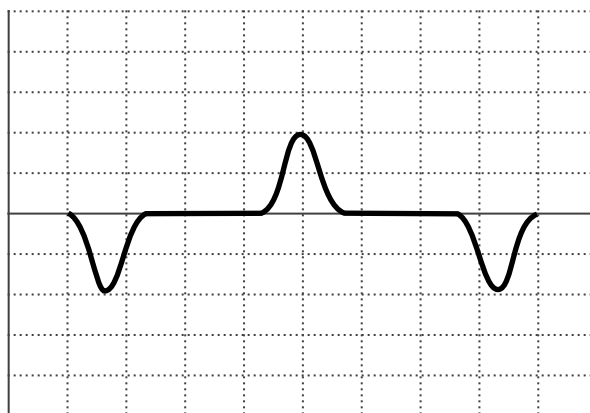
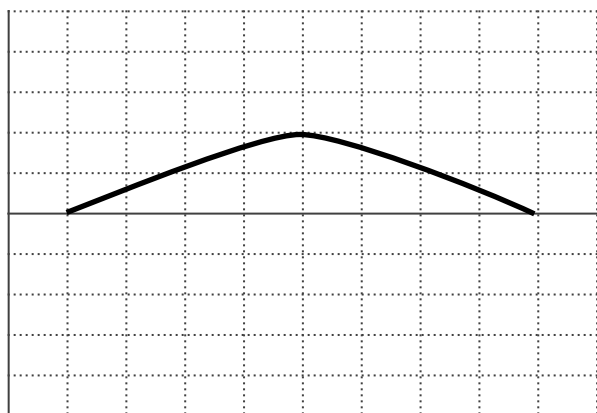
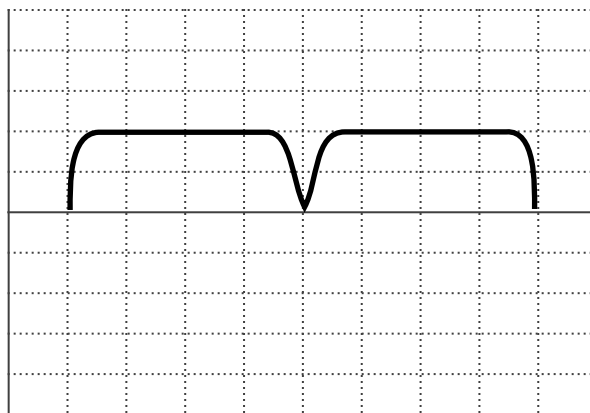
- a. Click down on the vertical axis selector along the vertical axis of the graph. It's currently set to "Position".
- b. Select (release) on "Velocity".
- c. What does it mean when the plotted line on the velocity graph is
 - i. above the time axis?
 - ii. below the time axis?
 - iii. on the time axis?
- d. What was the velocity of the cart at 6.7 seconds? Use the Coordinates Tool to find out.

4. TRACK ACCELERATION VS. TIME

- a. Click down on the vertical axis selector along the vertical axis of the graph. It's currently set to "Velocity".
- b. Select (release) on "Acceleration". The acceleration graph can be "jumpy". Ideally, there was minimal acceleration during most of the "out" and "back".
- c. What was the greatest acceleration of the cart during the turn-around near the middle of your run? Use the Coordinates Tool to find out.

5. GRAPHICAL ANALYSIS

Three of the plotted graphs below have no meaning in the context of this lab activity. Three of them do. Those that do are simplified, smoothed plots of position vs. time, velocity vs. time, and acceleration vs. time. Label the meaningful graphs with their titles; cross out the meaningless graphs.



6. WHAT IF...

Your out and back run lasted approximately 8 seconds. Imagine the same out and back run being completed in 4 seconds. On the position and velocity graphs identified above, add plots to show what such a run would look like. Use a dotted line to draw the 4-second plots. Do not add plots to the other graphs.