Follow that Cart

Linear Functions / Slope as "Velocity"

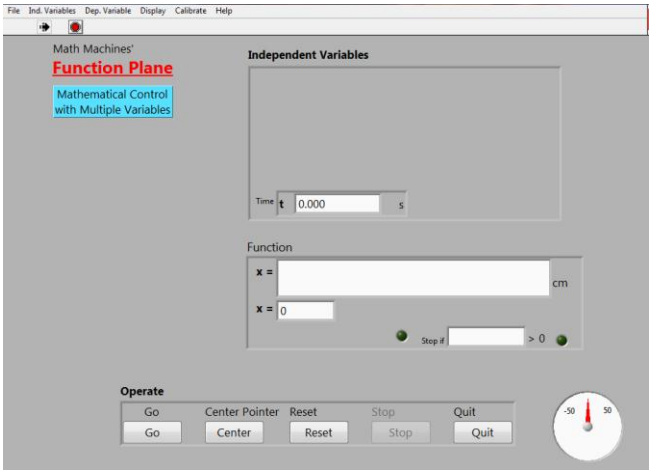
Computer-Controlled Laser

Computer-controlled laser surgery is superior because of the greater accuracy and consistency provided by the collaboration of computer and laser equipment. Creating the "corneal flap" is the first and most crucial step in the LASIK procedure. Even a skilled doctor cannot always prevent a corneal flap from being only partially formed or thinner in the middle, increasing the risk for LASIK complications. Exact dimensions of the corneal flap are pre-programmed into a computer and the cut is made with extreme precision and safety. The speed of the laser allows it to target the tissue without any sensation of heat or pain for the patient eliminating the unnecessary removal of tissue.

Ophthalmologist Performing Laser Eye Treatment

Task: In this activity you will construct a function to control the Function Plane's servo to follow a motorized cart with the laser. The diagram below illustrates the setup.

Additional Materials: Measuring stick or tape, motorized cart (or any moving object such as a toy truck) and stop watch (to help determine the speed of the cart).



Math Machines Program:

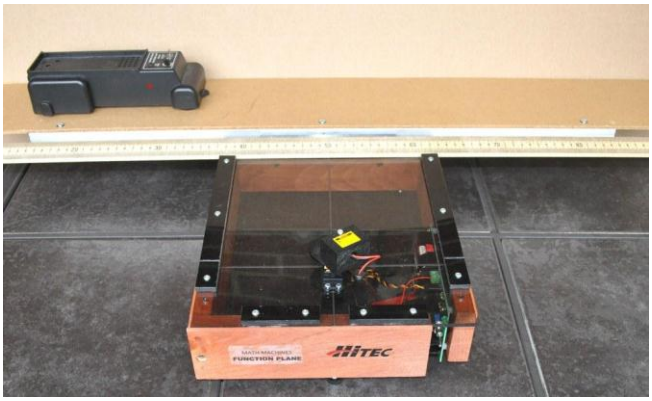
Function Plane

Activity Files: Cart00x

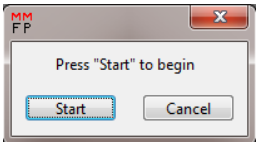
Load Activity File: Cart001

Familiarize yourself with the motorized cart and use the stopwatch and meter stick to determine its speed. You might want to try this several times to get a good estimate.

Your goal is to make the laser follow the cart from some designated starting point as it moves in straight line perpendicular to the front of the Function Plane.



It can be challenging to start the motorized cart while at the same time run the program. For this reason, the program Cart001 utilizes a "run option" called "Wait for Trigger" so that when you select "Go" there will appear a window that will appear allowing you to select "Start".



It's best to start the cart at the end of the platform and wait till it reaches a designated point (30 in the picture) before you select "Start". This also allows the cart to come to full speed before you start tracking it.

1. Determine "x as a function of time t" where 'x' is the position of the cart along the number line. The laser should begin following the cart at a designated point and move with the cart until it reaches the end of the platform. Also determine how many seconds the cart will run before it reaches the end of the platform and set the "Conditional Stop" window (see diagram).

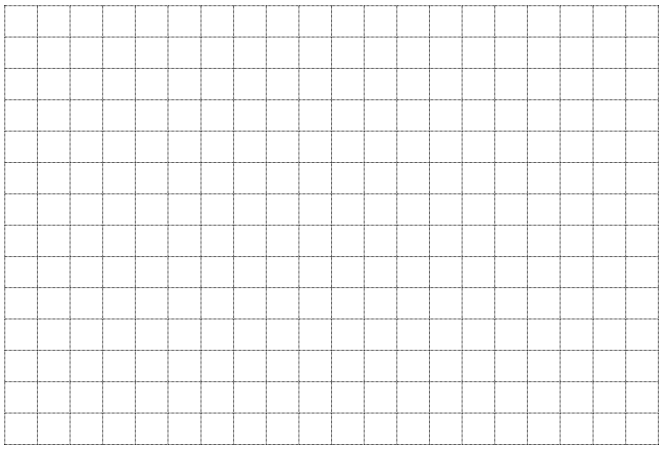
As an example, if 't-6' is placed in the "Conditional Stop" window, the servo will stop after running 6 seconds.

x = _____ Running time = _____

Document carefully how the function was constructed including measurements that you had to make. Also show how the running time was calculated.

2. What would you give as <u>practical</u> domain and range for your function?

3. Graph this function. Label the axes appropriately.



4. Give the slope and intercept values of your function. Explain what these values represent with respect to the motion of the cart?

   Slope: _____

   How does the slope value relate to the motion of the cart?

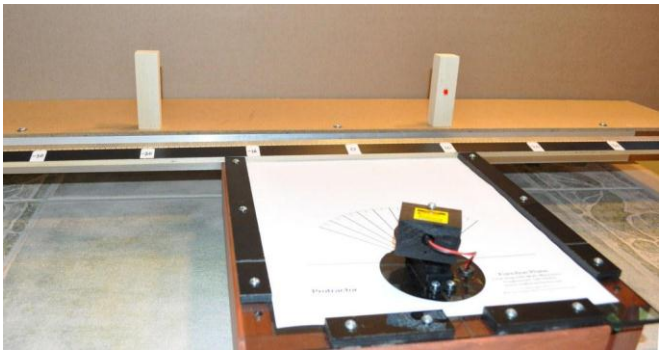
   Intercept: _____

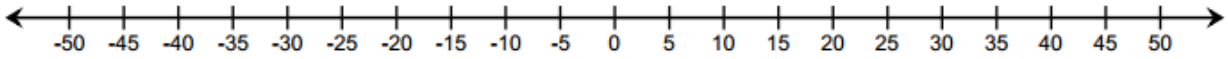
   How does the intercept value relate to the motion of the cart?

5. Evaluate the success of your work. Did the laser follow the cart? How well did it work? List some of the sources that contributed to error.

Load Activity File: Cart002

This file is setup to read the meter stick where 0 is in the center, left is negative & right is positive. Also, there is no "Wait for Trigger" .





6. Construct functions that will move the laser from one target point to another according to the directions below. (Don't forget to set the "Conditional Stop" to the correct time.) After you've tested your function, record it below in the space provided and give its domain and range.

   a. Move the laser from 0 to 20 in 10 seconds.

      x = _____ domain _____ range _____

   b. Move the laser from 0 to -20 in 10 seconds.

      x = _____ domain _____ range _____

   c. Move the laser from 20 to 0 in 10 seconds.

      x = _____ domain _____ range _____

   d. Move the laser from -10 to 35 in 9 seconds.

      x = _____ domain _____ range _____

   e. Move the laser from 35 to -10 in 9 seconds.

      x = _____ domain _____ range _____

   f. Move the laser from -5 to 30 in 15 seconds.

      x = _____ domain _____ range _____

7. How does the slope value relate to the motion of the laser?

How does the intercept value relate to the motion of the laser?

Challenge: Move the laser from -20 to 30 and back in 15 seconds!

