LINEAR MODELS IN STELLA II

© Diana Fisher and Eileen Rogers 1992

LINEAR MODELS

Stock   Stock

In Flow   Out Flow
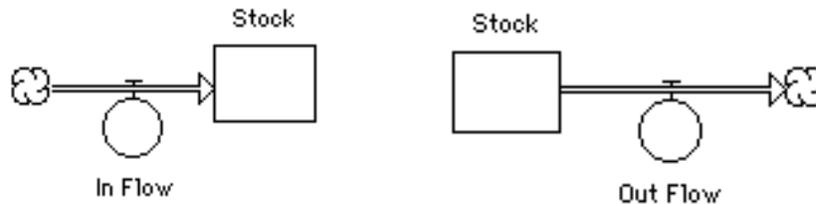
The STELLA II models shown here model a system which varies directly with time. Suppose you want to know how far you have walked if your walking speed is 3 miles per hour. Let's set up a STELLA II model which will create a linear graph using the given information.

a) Ask yourself: What is increasing or decreasing with time? _____
    Make that the stock. Select the Stock icon from the tool bar and click to place it in the window. Be sure to label the stock and set the beginning value.

b) Ask yourself: Is the stock value increasing or decreasing with time? _____
    What is causing the stock to increase or decrease? (That is the flow.)_____
    Select the flow icon from the tool bar. Click and drag it into the stock if you want the stock value to increase. Click inside the stock and drag out of the stock if you want it to decrease over time. Be sure to label the flow icon and set its value.

c) From the first sentence of the problem, determine how many miles you would walk in five hours.

    _____

Now, define a graph in STELLA II to see if your model gives you the same result. (See instructions below)

> Click on the **Graph** icon from the tool bar, click to place it in the diagram window and a new graph will open up. Double click on the graph to open up the dialog box which specifies the details for the graph. Click on the stock name in the "Allowable" list. Click on >> to place it in the "Selected" list. Then click **OK** to return to the graph pad.
> Now choose **Run** from the Menu bar.

d) From your graph, determine approximately how long it takes to walk 20 miles? _____

This same type of model can be used to examine many other situations which vary directly, i.e. linearly, with time. Create STELLA II models to answer the following questions.

1) You bought a car for $15,000 (after making big money as a math consultant). Unfortunately, this car depreciates $175.00 every month.

   a) Set up an appropriate STELLA II model for this situation.

   What is the stock? _____

   What is the flow? _____

   Is the flow into or out of the stock? _____

   b) Set up a table and let the computer calculate this relationship for 50 months.

   (For instructions on creating a table and changing the time, see below.)

   Click on the **Table** icon from the tool bar, click to place it in the diagram window and a new table will open up. Double click on the table to open up the dialog box which specifies the details for the table. Click on the stock name in the "Allowable" list. Click on >> to place it in the "Selected" list. Then click **OK** to return to the table pad.

   To change the time span of the simulation, select **Time Specs...** from the Run menu. Set the **TO** number at 50 and set the **DT** to 1

   Now choose **Run** from the Menu bar.

   c) How much is this car worth at the end of 6 months? _____

   How many months will pass before the "Blue Book" Trade-in Value will be $10,000? _____

   d) When do you predict the car will be worthless? _____

   e) Determine the equation for this relationship. _____

3. If you jump out of an airplane, you've got a lot of guts! If you don't open your parachute for awhile, you will soon be falling at a constant velocity called your "terminal velocity." Assume you are **4500 meters** above the ground when you jump and your **terminal velocity is 60 meters/second**.

   a) Set up a STELLA II model for this situation.

   b) If you neglect to open your parachute, when will you hit the ground?_____

   c) How many meters did you fall between the 20th and 30th second?_____

   d) What do the d-intercept and t-intercept represent in real life?

   d-intercept? _____

   t-intercept? _____

   e) Determine the equation for this relationship:_____

   f) What is the slope? _____

   What is the y-intercept? _____

   How do these numbers relate to the numbers you used in the STELLA II model?

   _____

   _____