

Step-by-Step

Simulating a Predator-Prey System With Algebra Animator

Algebra Animator allows you to create simulations using graphics of your choice. This Step-by-Step Card outlines the process for creating a simulation with different graphics associated with respective equations. The simulation then depicts the equations visually using the graphics you chose. The process is demonstrated for two graphics associated with two equations, one for the predator, one for the prey.

Creating an object in the animation panel

Follow these steps to create an object that represents the predator and another object that represents its prey.

- 1 Open the Algebra Animator application.
- 2 Select the Object tool  in the main tool palette.

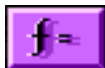


- 3 Select any object from the subpalette that is displayed. Algebra Animator displays the selected object in the Animation panel.

Creating a linear function to control the motion of an object

Follow these steps to create a linear function that controls the motion of the predator and another linear function that controls the motion of its prey.

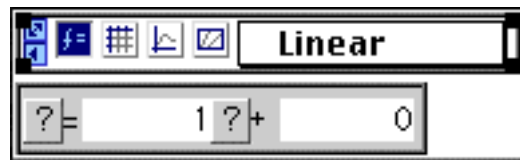
- 1 Select the Functions tool in the main tool palette.



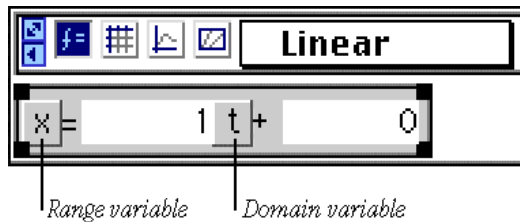
- 2 Move to the desired location in the Math panel and click to place a function box.



- 3 Choose the function type in the function box. (The function type shown in step 2 is Mapping.) Choose Linear from the pop-up menu that appears.



- 4 Choose the range variable in the function box. Choose x from the pop-up menu that appears. Choose the domain variable in the function box. Choose t from the pop-up menu that appears.



- 5 To edit a coefficient in the function, select the coefficient and type the value you want.

Connecting a function to an object

Follow these steps to connect the predator function to the predator object and to connect the prey function to the prey object.

- 1 Select the Connect tool in the function box.



- 2 Drag to an object in the Animation Panel to connect the function to the object. When the object is highlighted, release the mouse button to connect the function to the object.

The object to which you connect the function is displayed in the function box.

Displaying graphs of the functions

- 1 Click the Graph button in the predator function box.



A graph of the predator function is displayed in the function box.

- 2 Select the Connect tool in the prey function box. Drag to the graph of the predator function. When the graph is highlighted, release the mouse button to display the graph of the prey function on the same set of axes as the predator function.

Note that if the predator catches its prey, this happens at the intersection of the graphs for predator and prey.

Stopping an animation at the intersection of two graphs

Follow these steps to simulate the predator catching its prey.

- 1 Choose Intersections from the Model menu.
- 2 In the Intersections Setup dialog box that appears, select X under “Detect Intersections in.” Click OK.

When you run the simulation, the animation stops at the point where the graphs intersect. A dialog box appears, showing the values for x and t at the intersection of the graphs. That is, the dialog box shows the distance and time values at which the predator catches its prey.

Setting the upper limit for the domain of the predator

Use this procedure to simulate the predator running out of steam and ending its chase.

- 1 Double-click the object in the Animation panel that represents the predator.
- 2 In the Object Limits dialog box that appears, enter the value for the upper limit of the of the x variable. Click OK.

When you run the simulation, the predator disappears if it reaches the upper limit you set in the Object Limits dialog box. That is, the predator disappears if it runs out of steam and ends its chase before it has caught its prey.

- 3 Save the simulation.
- 4 Quit the Algebra Animator application.