

**Piecewise Defined Functions : Part One - The Basics**

Most of the functions we have seen have one formula and it is used for all input....for the whole x-axis. However, you might want to switch formulas:

Use  $3x - 1$  up until  $x = 2$  and then use  $-2x + 7$  the rest of the way.

$$f(x) = 3x - 1 \quad \text{for } x < 2$$

$$f(x) = -2x + 7 \quad \text{for } x \geq 2$$

The function is defined in pieces and LiveMath has functionality available for this.



To define a function in pieces use the piecewise button  in the palette.



Create a new statement icon and type



This will create the following:

$$\square f(x) = \begin{cases} ? & (? < 0) \\ ? & (? \geq 0) \end{cases}$$



LiveMath will start you off with two pieces, but you can add more. The structure looks like a 2 by 2 matrix with a curly bracket on the left side.

The first column of question marks is where you will enter the formulas. The second column is where you will enter the interval definitions.

If you click on the question marks to highlight them then you can replace them with your own definitions.

**First column; First Row**

Highlight the question mark in the first column; first row and replace it with a definition for  $3x - 1$ . Remember we are defining a function here.

$$\square f(x) = \begin{cases} 3x - 1 & (? < 0) \\ ? & (? \geq 0) \end{cases}$$

Replace the question mark in the first row; second column with  $x$  and change the  $0$  to  $2$ .

$$\square f(x) = \begin{cases} 3x - 1 & (x < 2) \\ ? & (? \geq 0) \end{cases}$$

Fill in the second row with the second piece of the definition.

$$\blacksquare f(x) = \begin{cases} 3x - 1 & (x < 2) \\ -2x + 7 & (x \geq 2) \end{cases}$$



This is a function.

Weird looking, but you can evaluate it:

$f(0)$

$f(0) = 1$  Calculate

$f(2)$

$f(2) = 3$  Calculate

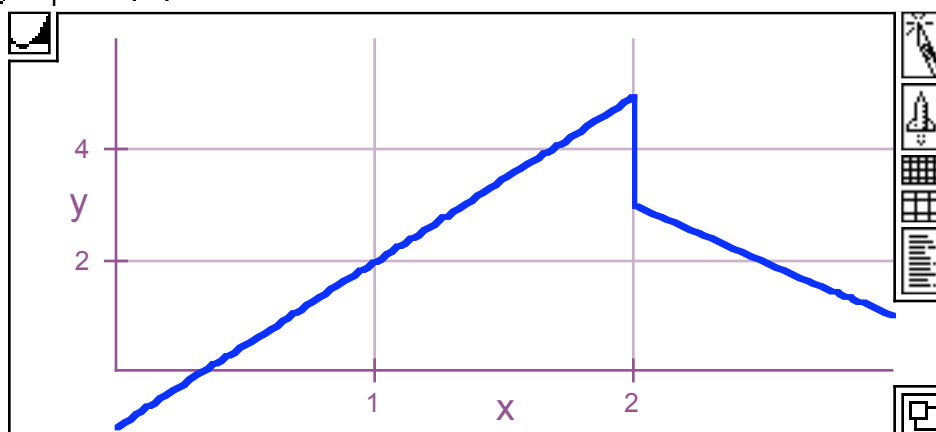
$f(3)$

$f(3) = 1$  Calculate



You can graph it:

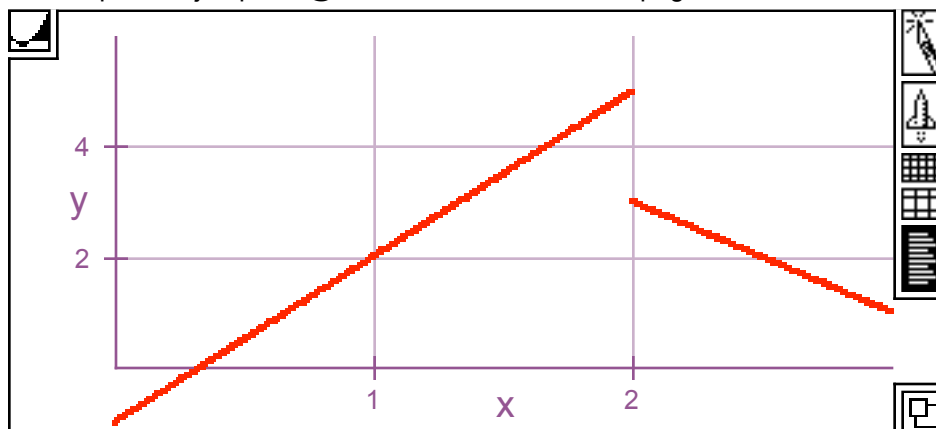
$y_1 = f(x)$



Remember that LiveMath is picking points and then connecting them. This means that the vertical drop is being connected even though it is not part of the function. The graph of a function cannot have a vertical line.

You can remember that this vertical line is really not in the graph of the function **OR** you can switch the Curve graphic statement for this graph to [points only](#). You can thicken the points via the More Points palette button if you want.

$y_2 = f(x)$



0 ... 3 = left...right

Stretch to Fit▼

0 ... 6 = bottom...top

cropping

Moderately▼

### Graph Building Blocks

Curve at  $(x, y_2)$  where  $x = \text{left} \dots \text{right}$  with a

points only▼

line, colored Red▼.

**Now It's Your Turn...** Follow the directions below to get hands on experience.

1.

Define and graph

$$\text{bus}(x) = \begin{cases} x^2 + 1 & x < 3 \\ -x + 13 & x \geq 3 \end{cases}$$