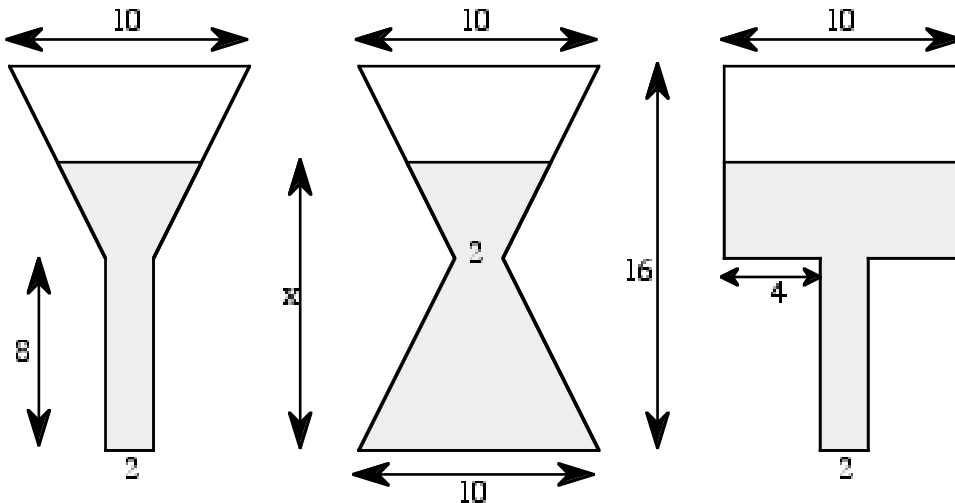# Doctor Dimension

Doctor Dimension is a flat scientist. He pours two-dimensional liquids into these two-dimensional containers:

1. For each container, find a function for the amount of liquid (measured as area, since he lives in a flat universe) as a function of the height of liquid (x). Note that the functions are piecewise: each one consists of one part for 0≤x<8, and another for 8≤x≤16.

To investigate the rate of change of these functions, you will need to set up your calculator as follows:

Program:

Press PRGM , choose NEW, and type the name RATE. Press ENTER .

Then, type:
    :Prompt H
    :Prompt X
    :Disp "LEFT", (Y_0 (X) - Y_0 (X–H)) / H

To get "Prompt", press PRGM , then choose I/O. Likewise to get "Disp". Y_0 is in VARS Y-VARS. To complete the program, add the next line, which should give you the rate of change to the right of x. To use the program, press PRGM , then choose RATE.

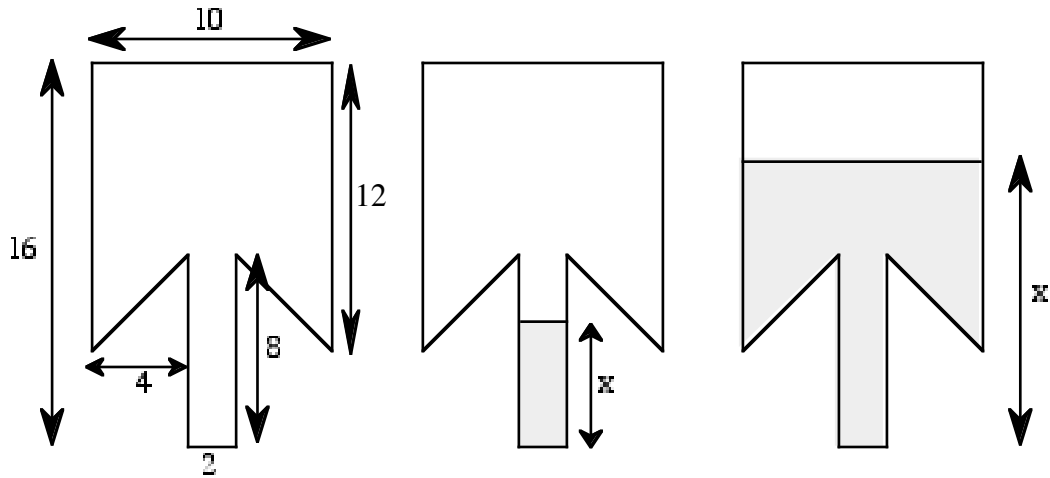**Function:**

You can put the functions you want to study in any Y= place. To use the program on Y_1, for example, go down to "Y_0 =" , and set it to "$Y_0 = Y_1$".

2. For each function above, use the RATE program to find its slope when x = 4, when x = 8, and when x = 12. Remember that to have a slope, the limits of the rates of change on the left and on the right must be equal.

The Return of Doctor Dimension

Doctor Dimension has a new two-dimensional container for his two-dimensional liquids:

He fills it starting in the middle, as shown in the figure.

1. Can you find a function for the amount of liquid (measured as area, since he lives in a flat universe) as a function of the height of liquid (x)?

2. Discuss what happens when x = 8.