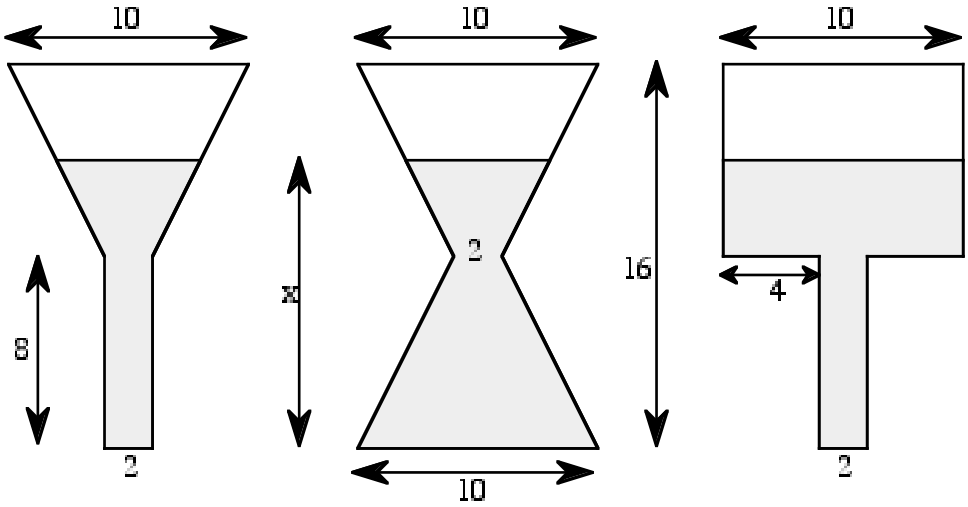
Doctor Dimension

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 $0 \le x < 8$, and another for $8 \le x \le 16$.

Setting Up Your Calculator

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

Press APPS , choose **Program Editor**, then **New…**

In the dialog, select **Type: Program**, **Folder:** `Main`, and for **Variable:** type **rate**. Press ENTER twice.

Now you're ready to enter the program:

```
:rate(x,h)
:Prgm
:Disp "left",(y9(x)-y9(x-h))/h
:EndPrgm
```

How to do it:

`:rate()` is already there, just enter the `x,h` (using alpha for the `h`)
`:Prgm` is already there
`:` is already there, `Disp` is in `F3, "` is `2nd 1`
`:EndPrgm` is already there.

To exit the program, you can just press Home

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_9 =" , and set it to "$Y_9 = Y_1(x)$". (you must remember to put in the (x))

To use it, enter **`rate(2,.01)`**, for example, on the home screen. To exit the program, press F5.

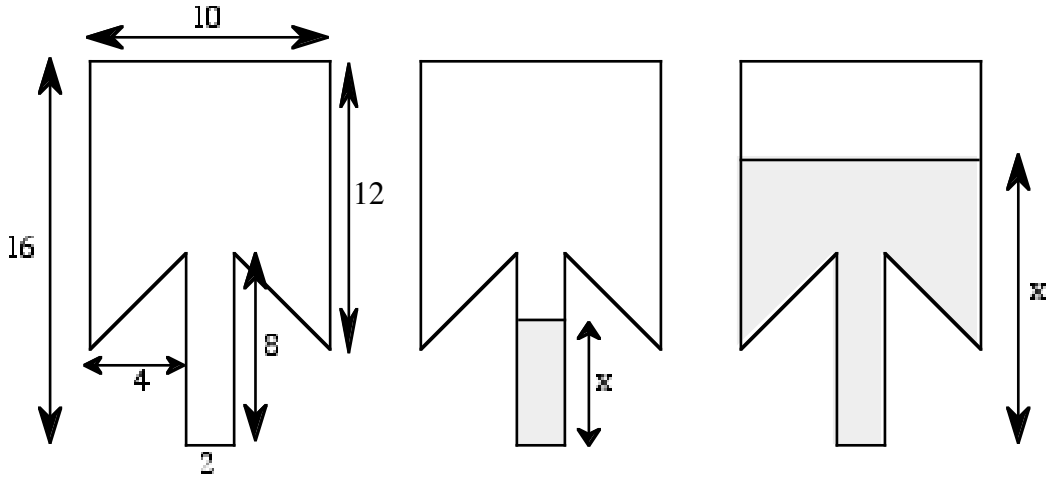
To go back and edit the program, press APPS , choose **Program Editor**, then **Current…**

2. To complete the program, press ENTER after the **`Disp`** line to insert the next line. Use the **`Disp`** line as a model to write a line to display the rate of change to the right of x.

3. 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.

4. Find a (piecewise) function for the amount of liquid (measured as area) as a function of the height of liquid (x).

5. Discuss what happens when x = 8.