Which Is Greater? (TI-89)

You will need: a graphing calculator, a ten-sided die, a coin

Evaluating Functions

Definition: A function is a rule that assigns a single output to each input.

For example, in the polyomino area problem, a given input (area) generated a certain output (minimum perimeter).

Here are some examples of functions, where inputs and outputs are real numbers:
   a. $y = 2x - 3$
   b. $y = .5x + 1$
   c. $y = \dfrac{(x - 4)(x + 5) + 6}{4}$

In these examples, x is the input, and y is the output. This is the traditional notation. To find y, you "plug in" a value for x into the formula, and calculate. This is called *evaluating* a function.

1. If the input is 1, find the output for each function above. In other words, if x is 1, what is y?

You can use the TI-89 calculator to answer questions of this type. For example:
   ◊   enter 2(1) – 3, then press ENTER
   ◊   enter 2x – 3 | x=1, then press ENTER   (the vertical line, which means "when", is below the ⊟ sign.

2. Use these methods to evaluate the functions for x = -1

Another approach is to enter the functions into the calculator:

3. Press ◆ Y= (above the F1 key.) You will see y1=, y2=, etc. Enter our three functions, each in its own line. To enter the fraction, you should put the whole numerator in parentheses, like this: ((x–4)(x+5)+6)/4
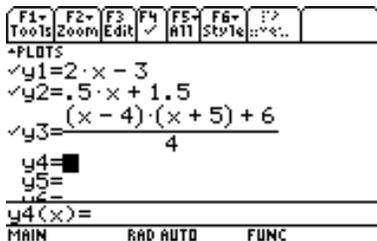
Press HOME to return to the home screen.

To evaluate the functions for x = 1, you need to enter y1(1) on the home screen, and press ENTER, y2(1) and press ENTER, etc. This notation means the function in y1, y2, etc. *evaluated at* the number in parentheses.

4. Use this method to check your answers to #1 and #2.

A Game

Work with a partner. Each one of you should choose a function among the three suggested above.

Your function: Your partner's function:

To play the game:
◊   Roll a ten-sided die to get an x
◊   Evaluate your function for this x (use one of the methods above)
◊   The winner is the player who gets the higher value

5. Play ten rounds of "Which is Greater?", keeping score.

6. Play another game of ten rounds, using a die and a coin to get integer inputs:
◊   Roll a ten-sided die
◊   If the outcome is not zero, flip a coin: heads is plus, tails is minus
◊   Proceed as before: plug into your function, see who wins

To enter negative numbers, you should use the (-) key (opposite), not the – key (subtraction).

7. Is it possible for both players to get the same output from the same input? For what numbers?

8. Is the game fair, or does one player tend to win much more often? Why? Analyze the game.

Using Tables

To investigate the fairness of the game, you can use the table feature of the calculator.
◊   Press ◆ TblSet and make your table look like this one:
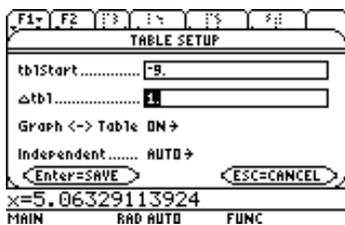
◊   Press ◆ TABLE and examine the outputs (y1, y2, etc) of your functions for various inputs (x).

9. Is the game fair? Explain.

Checkpoint

Write some notes on what you learned about the calculator so far.

Using Graphs

Another way to analyze the game is to look at a graph of the functions.

◊   Press ♦ window

◊   Enter these values:

```
F1▾ F2▾
Tools Zoom
xmin=0.
xmax=10.
xscl=1.
ymin=-10.
ymax=20.
yscl=1.
xres=2
```
```
MAIN          RAD AUTO     FUNC
```

◊   Press ♦ GRAPH. What do these lines tell you about inputs and outputs?

Turning Functions On and Off

If you want to not look at the table or graph of a given function, you can turn it off without deleting it. Press ♦ Y=. Scroll up or down to the function you want to turn off. Press F4. Press it again if you want to turn the function back on.

Creating Games

9. Create two functions that make a fair game.

With one die, you can play with inputs from 0 to 9, or from –9 to 0, or from –9 to 9. By using two dice, you can get inputs from –9.9 to 9.9, or from –99 to 99.