T^3 Workshop
Piecewise Functions

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Define a piecewise function…

Define a piecewise function…

- a function whose definition changes depending on the value of the independent variable
- a function that is given by different expressions on various intervals

Evaluating piecewise functions:

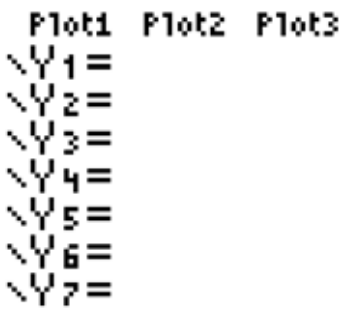
$$f(x) = \begin{cases} x^2 + 1 & x < 2 \\ 3 - x & 2 \le x \end{cases}$$

$$f(x) = \begin{cases} 2x - 3 & x < 2 \\ 5 & x = 2 \\ x + 1 & 2 < x \end{cases}$$

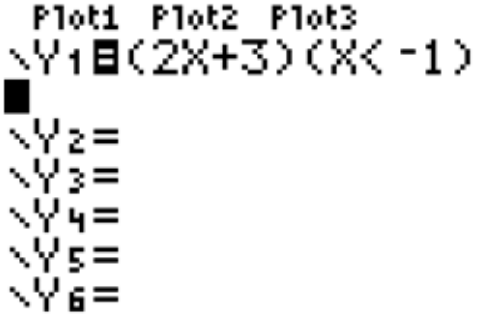
Graphing piecewise functions on TI-83/84:

$$f(x) = \begin{cases} 2x + 3 & x < -1 \\ x^2 & -1 \le x \text{ and } x \le 2 \\ 6 - x & 2 < x \end{cases}$$

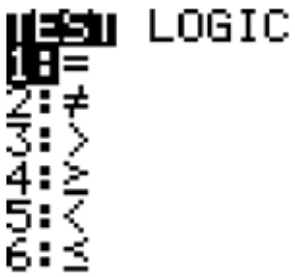
Choose Y=



Enter first function in ( ) with conditional next to it in ( )

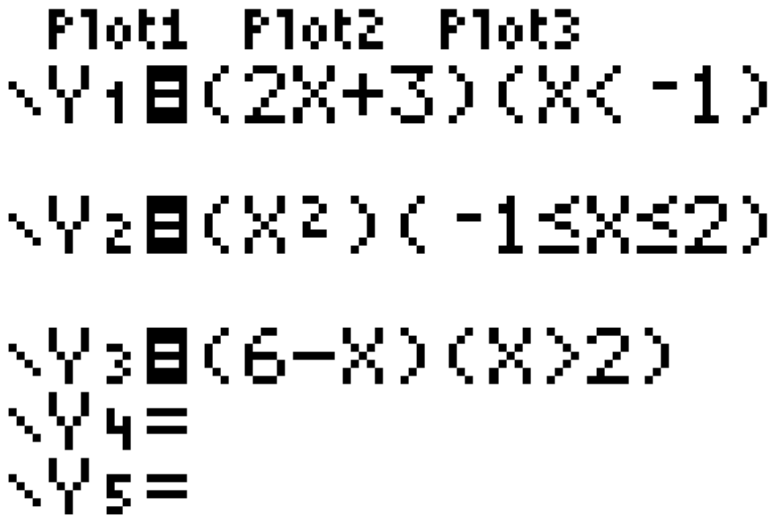


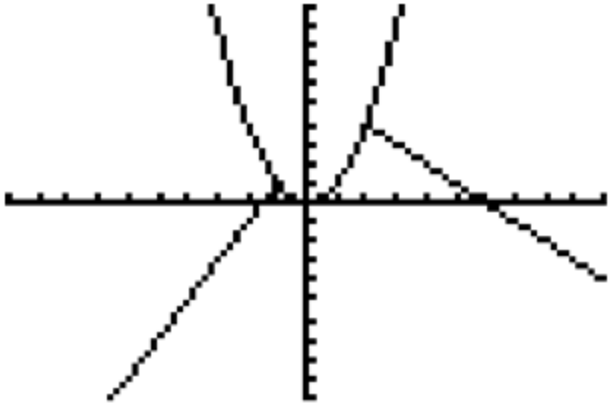
Use 2nd Math for inequality symbols



Lets graph what we have so far.

Suggestions on graphing other “pieces”?





We have a problem with the compound inequality $(-1 \le x \le 2)$
There are two ways to correct this – use one of the following:

$$(-1 \le x)(\ x \le 2)$$

or

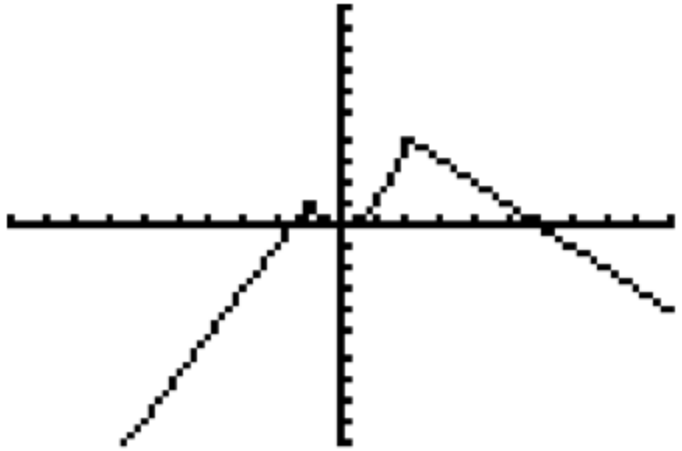
$$(-1 \le x \text{ and } x \le 2)$$

I like to use the second method. To get the "and" operator:

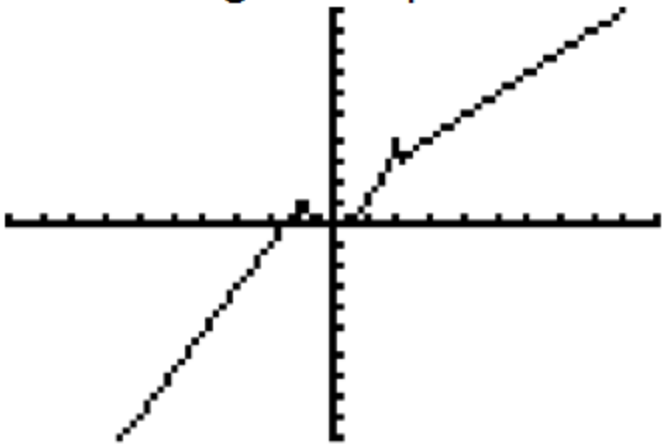
TEST LOGIC
1: and
2: or
3: xor
4: not(

Now we have:

Plot1 Plot2 Plot3
\Y1=(2X+3)(X<-1)
\Y2=(X²)(-1≤X and X≤2)
\Y3=(6-X)(X>2)
\Y4=
\Y5=



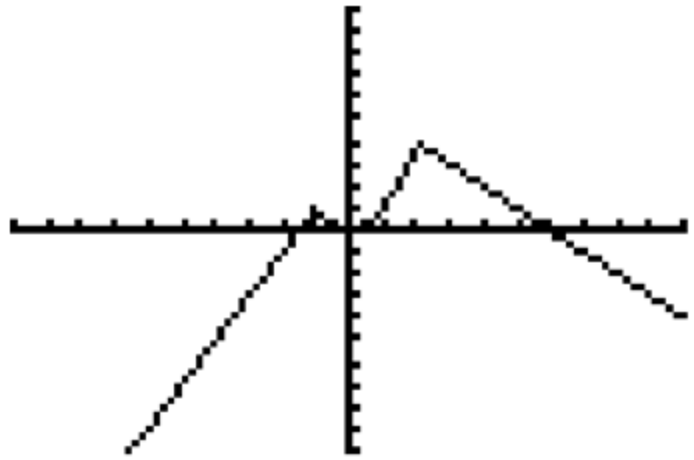
Let's change this up a bit. What if the third "piece" was (x+1)?



Next, what if we want to evaluate different values for our function using the calculator?

We can make these 3 functions into one …..

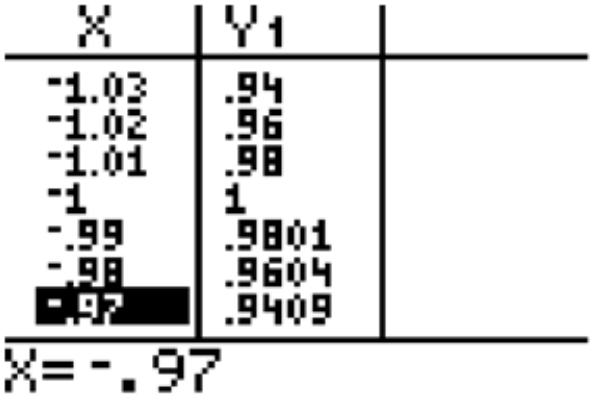
```
 Plot1 Plot2 Plot3
\Y1■(2X+3)(X<-1)
+(X²)(-1≤X and X
≤2)+(6-X)(X>2)
\Y2=
\Y3=
\Y4=
\Y5=
```



Now we can evaluate any value with just one function:

```
Y1(-5)
                -7
Y1(1)
                 1
Y1(8)
                -2
■
```

How about a table:



X	Y1
-1.03	.94
-1.02	.96
-1.01	.98
-1	1
-.99	.9801
-.98	.9604
-.97	.9409

X=-.97

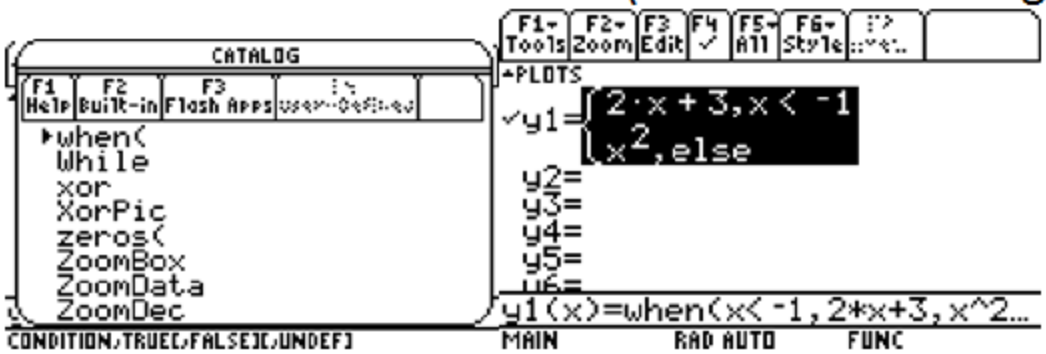
Note: your y-values may be rounded. If you arrow over to the y-value, it will show to more decimal places below.

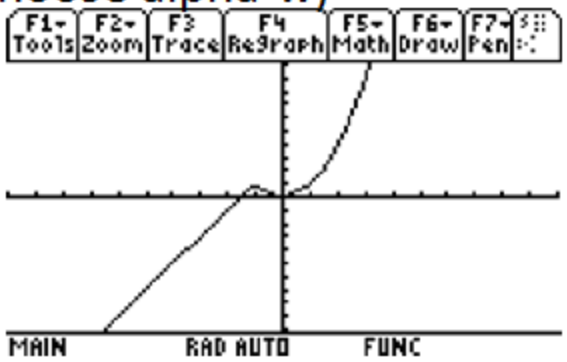
TI-89:

$$f(x) = \begin{cases} 2x + 3 & x < -1 \\ x^2 & -1 \le x \end{cases}$$

Press  and select y1=

Press  and then “when” (instead of scrolling, choose alpha-w)





the < and > are located above ‘0’ and ‘.’

Note: Sometimes the TI calculators "connect" the graphs when they shouldn't. In this case, you want to be in "Dot" mode.

For the TI-89, if you have more than two pieces, you will need to have nested when statements:

$$f(x) = \begin{cases} 2x + 3 & x < -1 \\ x^2 & -1 \le x \text{ and } x \le 2 \\ 6 - x & 2 < x \end{cases}$$

Would be input as y1=when(x<-1,2*x+3,when(x<=2,x^2,6-x))

Let's try some more:

$$f(x) = \begin{cases} x - 4 & x < 1 \\ 2 - x^2 & 1 \le x \end{cases}$$

$$f(x) = \begin{cases} 3 & x < -2 \\ x^3 & -2 \le x \text{ and } x < 3 \\ 2x + 1 & 3 \le x \end{cases}$$

$$f(x) = |x|$$

Limits:

How can we use this with limits?

Given:

$$f(x) = \begin{cases} 2x - 5 & x \neq 1 \\ 4 & x = 1 \end{cases}$$

Find $\lim_{x \to 1} f(x)$

Graph:

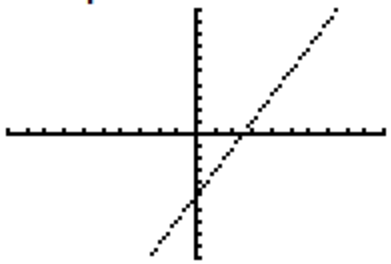


Table:

X	Y1
.85	-3.3
.9	-3.2
.95	-3.1
1	4
1.05	-2.9
1.1	-2.8
1.15	-2.7

X=.85

On the TI-89, enter y1=when(x≠1,2x-5,4). The ≠ is obtained by pressing