Graphing Piecewise Functions MathPrint View

Objectives:

- See why we need TEST to graph piecewise functions
- Use TEST to compare numbers and numbers stored in a variable
- Use TEST to compare many values of a variable to a test value
- Graph one piece of a piecewise function
- Graph a piecewise function

See why we need TEST to graph piecewise functions

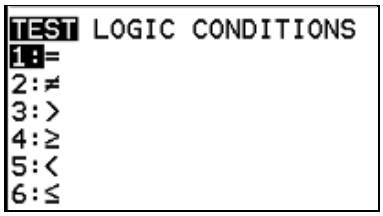
Results from TEST are either zero or one.

To graph a piecewise function like $f(x)=\begin{cases}2x+3 & x\le 0\\ -x-1 & x>0\end{cases}$, use only some values of x for each piece.

The calculator needs to zero out the values of x which are not used.

Use TEST to compare numbers and numbers stored in a variable

The TEST menu is the second function above MATH: Press test A 2nd math See:



KEY POINT: When using TEST, a result of 1 means "yes" or "true", while 0 means "no" or "false".

Example 1: Use TEST to show if

a) $6<10$

b) $6\le 3$

a) Press: L6 V test A L5 U L1 Y catalog ␣ entry solve

6 2nd math 5 1 0 enter See:

$6<10$ is a true statement, so GC says 1.

b) Press: L6 V test A L6 V L3 θ entry solve

6 2nd math 6 3 enter See:

$6\le 3$ is a false statement, so GC says 0.

Example 2: Store $x=-1$ in memory and determine if

a) $x<10$

b) $x\ge 3$

To store $x=-1$ in memory location *x* (graphing *x*), press: ans ? L1 Y rcl X link entry solve

(–) 1 sto→ X,T,θ,n enter

See:

a) Test $x<10$, which means $-1<10$ for the stored value of x.

Press: link test A L5 U L1 Y catalog ␣ entry solve

X,T,θ,n | 2nd | math | 5 | 1 | 0 | enter

```
-1→X
                    -1
X<10
                     1
```

Result 1 means yes, $-1 < 10$.

b) Test $x \geq 3$, which means $-1 \geq 3$ for the stored value of x.

Press: link test A L4 T L3 θ entry solve

X,T,θ,n | 2nd | math | 4 | 3 | enter

See:

```
-1→X
                    -1
X<10
                     1
X≥3
                     0
```

Result 0 means no, so $-1 \geq 3$ is a false statement.

Use TEST to compare many values of a variable to a test value

Example 3: Graph the TEST results for $x \leq 4$

CAUTION: This is NOT graphing the inequality $x \leq 4$, which is graphed on a number line, not a plane!

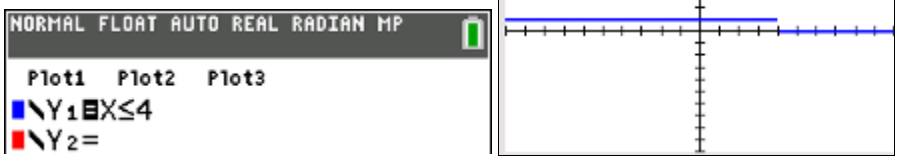
The GC automatically generates the values of *x* from Xmin and Xmax in WINDOW.
For each x, TEST assigns a y-coordinate which is either 0 or 1.

a) Type the test $x \leq 4$ as a function in the Y=menu, then graph in a standard viewing window.

Press: statplot f1 link test A L6 V L4 T format f3 L6 V

y= | X,T,θ,n | 2nd | math | 6 | 4 | zoom | 6

See:



This is a horizontal line $y = 1$ for *x* values less than 4, then a horizontal line $y = 0$ for x-values more than 4.
We can't see what it did at $x = 4$ without checking a table.

Press: table f5

2nd | graph

X	Y1
0	1
1	1
2	1
3	1
4	1
5	0
6	0
7	0
8	0
9	0
10	0

$x = 4$ has *y*-value 1.

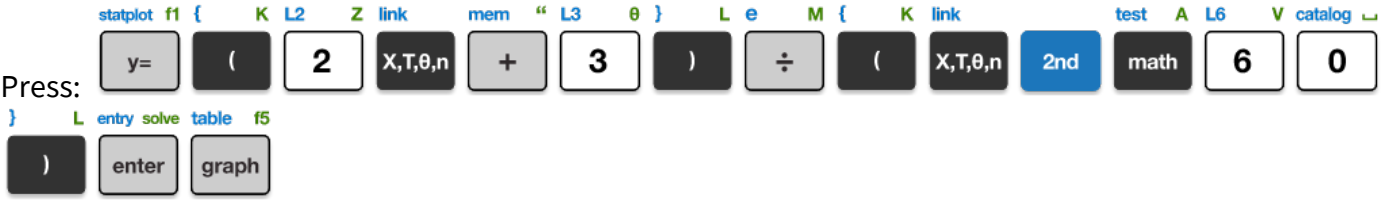
Graph one piece of a piecewise function

Example 4: Graph the function $f(x) = 2x + 3$ for the domain $x \leq 0$

COOL TRICK: Multiplying the function value times TEST sometimes gives zero, which shows on the x-axis.
Newer calculators do not graph values that result in $\div 0$, so in Y=, put the expression DIVIDED by the TEST.

IMPORTANT: We need parentheses!

Press:



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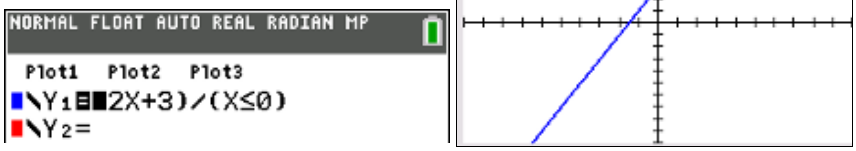
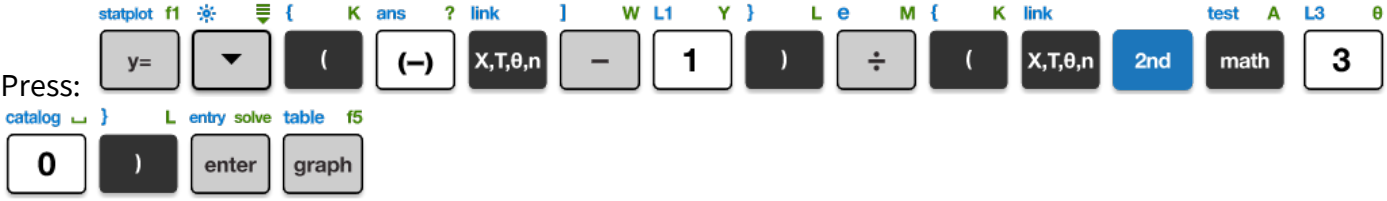


Graph a piecewise function

Example 5: Graph the piecewise function $f(x)=\begin{cases}2x+3 & x\le 0\\ -x-1 & x>0\end{cases}$.

The first piece is the same as Example 4. We continue with the second piece in y_2:

Press:



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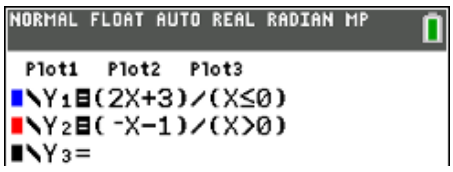
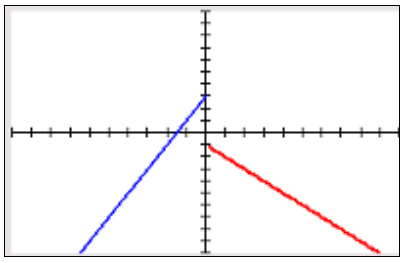




IMPORTANT: When you draw this graph to paper, you must clearly indicate which piece includes its endpoint (closed circle) and which piece does not (open circle)!

PRO TIP: A piecewise function is a function, and the resulting graph must pass the vertical line test!

Try It!

Graph the piecewise function.

1) $f(x)=\begin{cases}3 & x<-1\\ -x^2+4 & x\ge -1\end{cases}$

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

3) $f(x)=\begin{cases}-2x+4 & x\le -1\\ 3 & x>-1\end{cases}$

4) $f(x)=\begin{cases}x-1 & x\le 3\\ -x+5 & x>3\end{cases}$

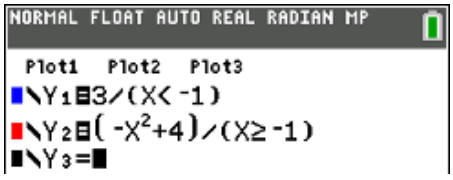
5) $f(x)=\begin{cases}4x-4 & x<2\\ -x+1 & x\ge 2\end{cases}$

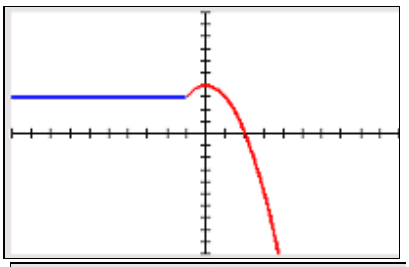
6) $f(x)=\begin{cases}-1 & x<-3\\ 2 & x\ge -3\end{cases}$

7) $f(x)=\begin{cases}-x+7 & x<-1\\ -x^2+9 & x\ge -1\end{cases}$

Solutions

1)





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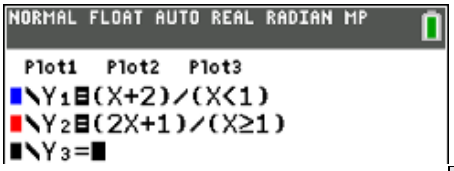

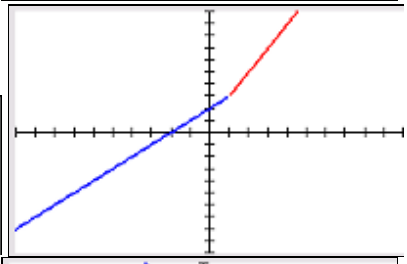

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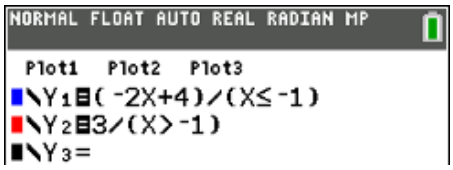

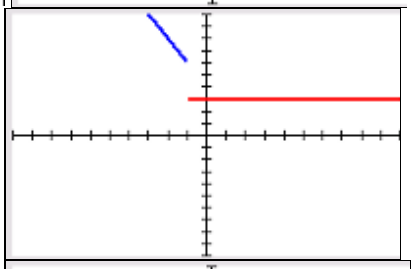

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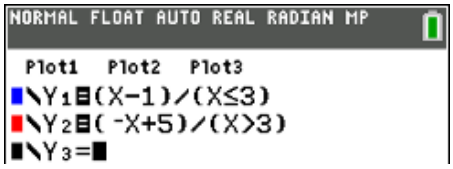

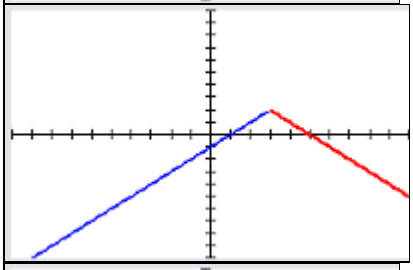

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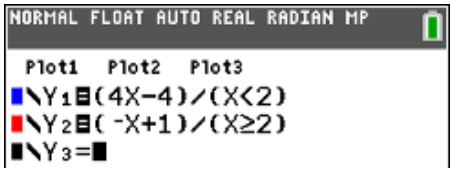

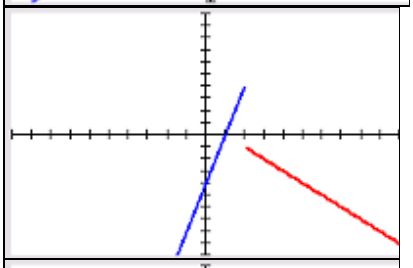

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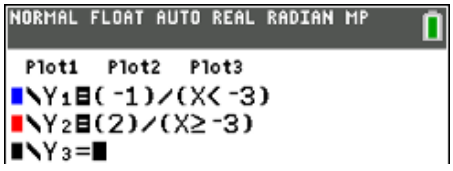

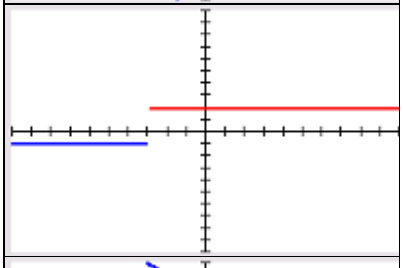

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