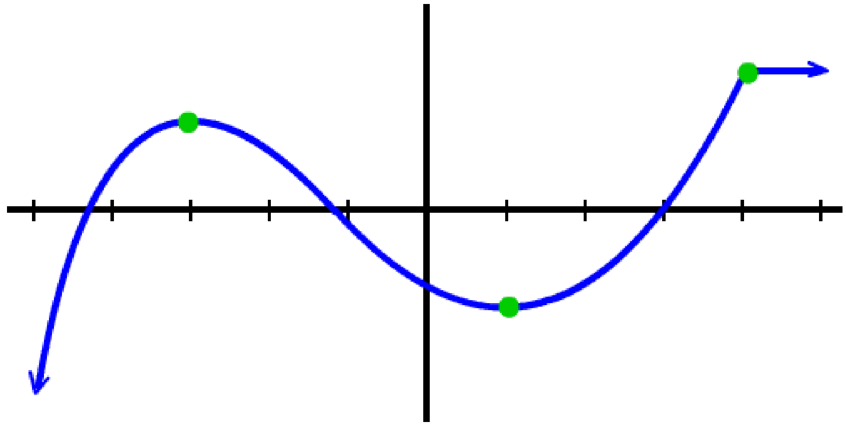
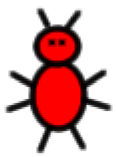
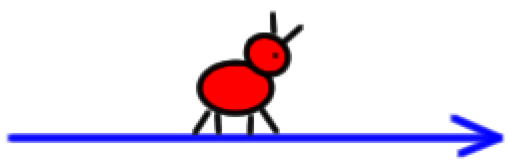
Increasing, Decreasing, Constant



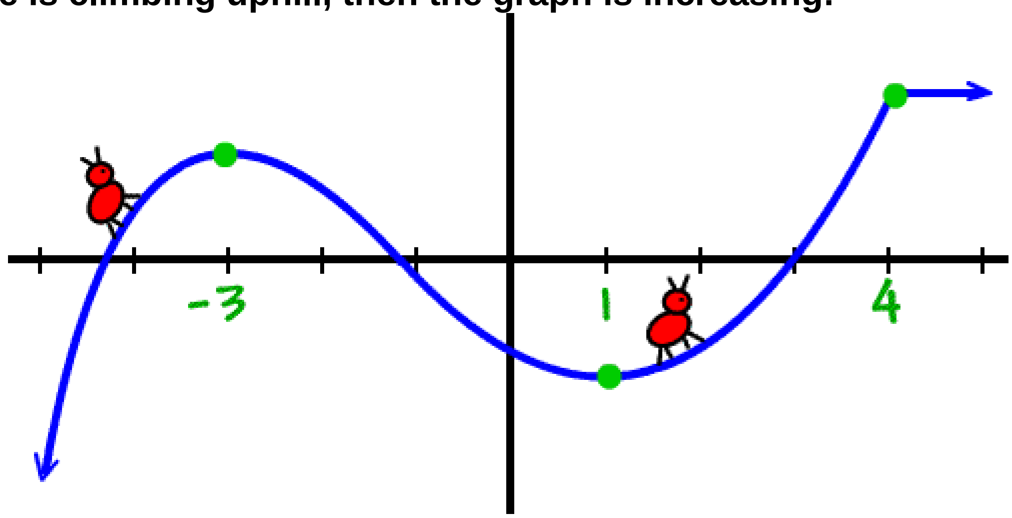
You've got an ant climbing on the graph. Not just any ant... Pierre the Mountain Climbing Ant!



The rule is that Pierre only crawls from left to right (like we read):



If Pierre is climbing uphill, then the graph is increasing:

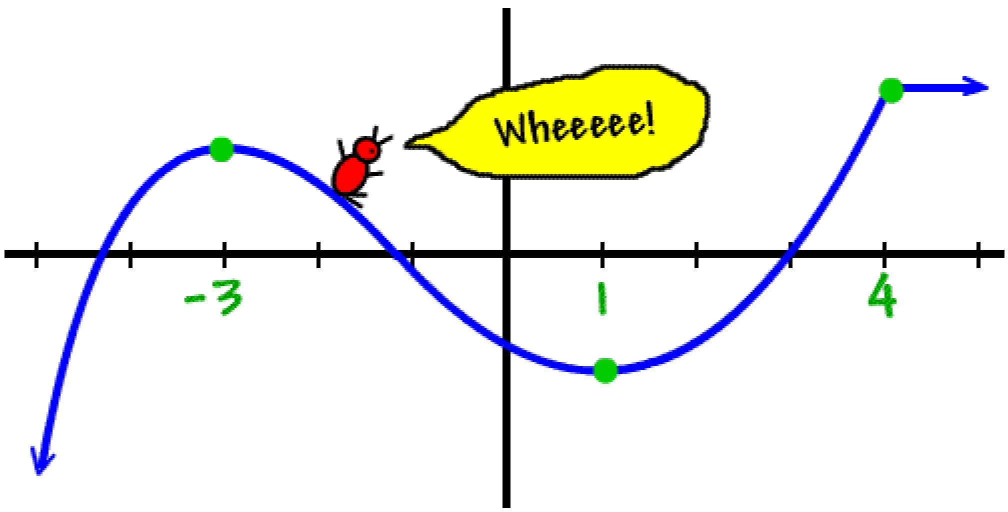


So, our graph is increasing on the interval:

$$(-\infty, -3) \cup (1, 4)$$

(we use interval notation with X VALUES!)

If Pierre is going downhill, then the graph is decreasing:

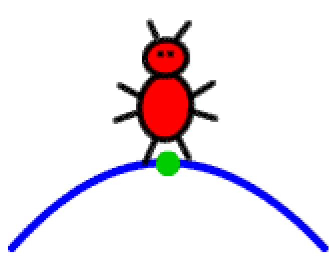


So, our graph is decreasing on

$$(-3, 1)$$

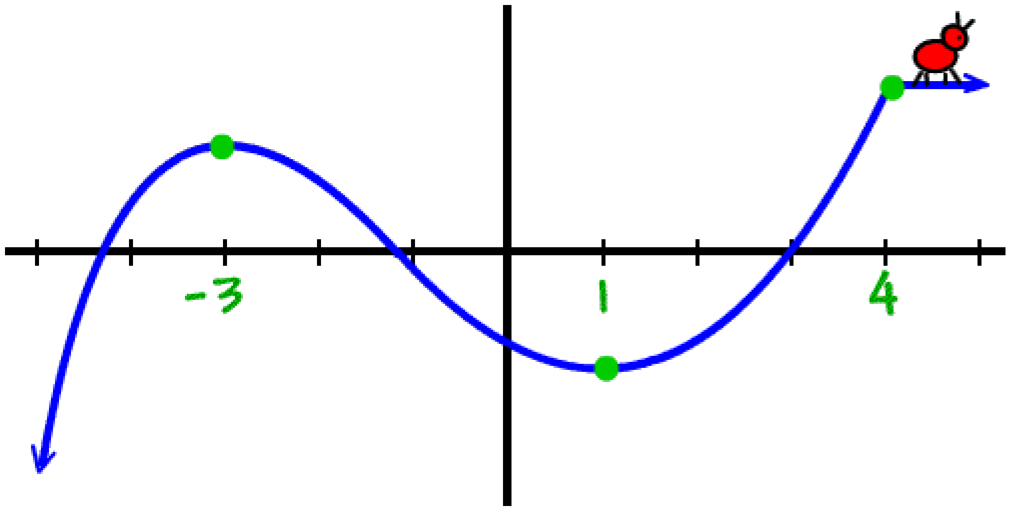
Notice that I'm <u>not using BRACKETS</u> the endpoints on these, but instead using PARENTHESIS

Think about it... When Pierre is standing right ON x = -3 ...



he's not going uphill or downhill. He's just standing there!

What is Pierre doing on (4 , ∞) ?



That line is horizontal (slope of 0). He's not going uphill or downhill, so the graph is not increasing or decreasing there.

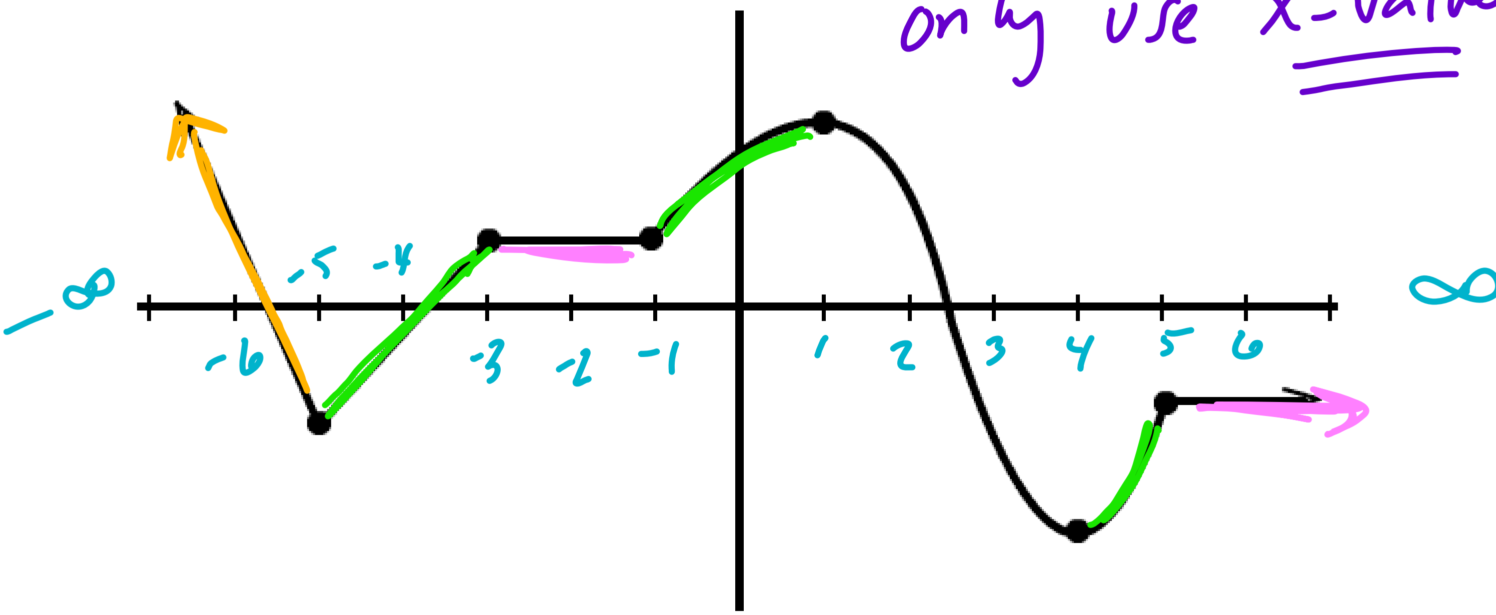
We call this Constant

Example

Read from left to right

Find the intervals of increasing, decreasing, constant

only use x-values



***Remember to answer in interval notation using only X values**

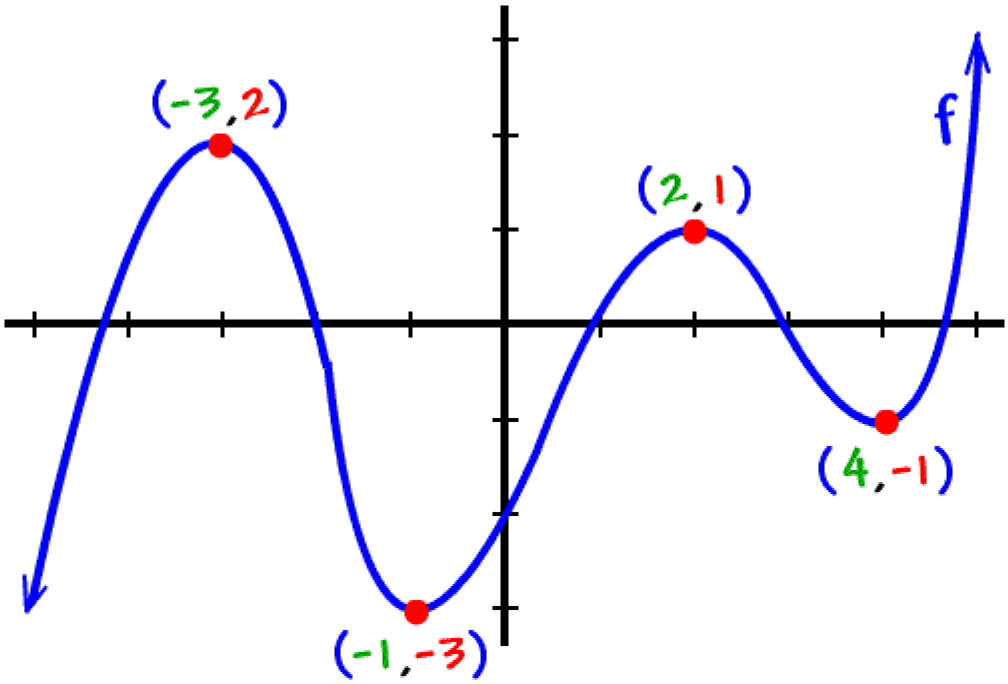
Increasing: $(-5,-3) \cup (-1,1) \cup (4,5)$

Decreasing: $(-\infty,-5) \cup (1,4)$

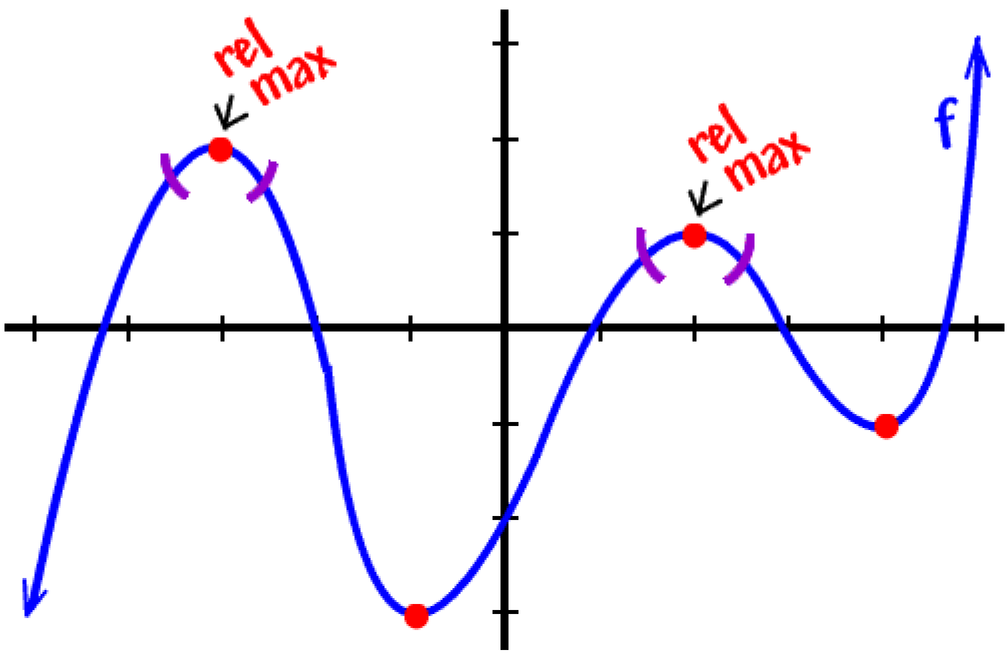
Constant: $(-3,-1) \cup (5,\infty)$

union
'OR'

Relative Minimum and Maximum



The tops of the mountains are relative maximums because they are the highest points in their little neighborhoods (relative to the points right around them):



Relative extrema (maxes and mins) are sometimes called local extrema.

Other than just pointing these things out on the graph, we have a very specific way to write them out.

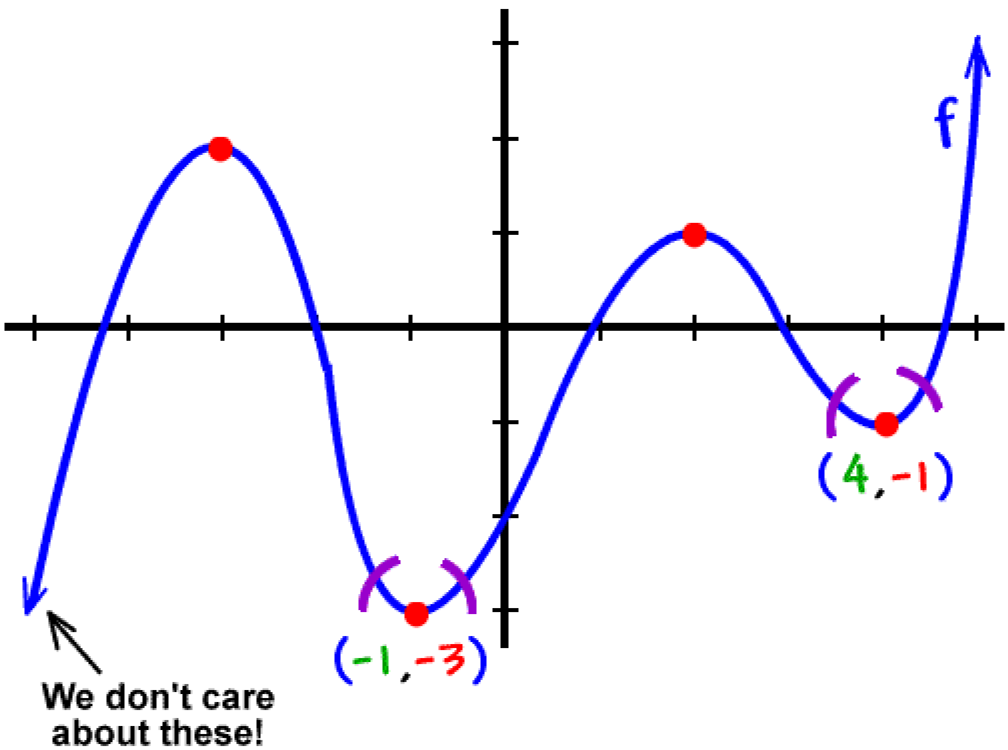
Officially, for this graph, we'd say:

f has a relative max of 2 at x = -3.

f has a relative max of 1 at x = 2.

The max is, actually, the height... the x guy is where the max occurs.

Now, for the relative minimums... Those are the bottoms of the valleys:



Relative mins are the lowest points in their little neighborhoods.

f has a relative min of -3 at x = -1.

f has a relative min of -1 at x = 4.

Piecewise Functions

Up till now, you've been graphing things like

$$y = x^2$$

$$y = 3x - 5$$

$$y = -2|x - 1|$$

Now, we're going to graph something that comes in more than one chunk.

Let's just dive in and do one:

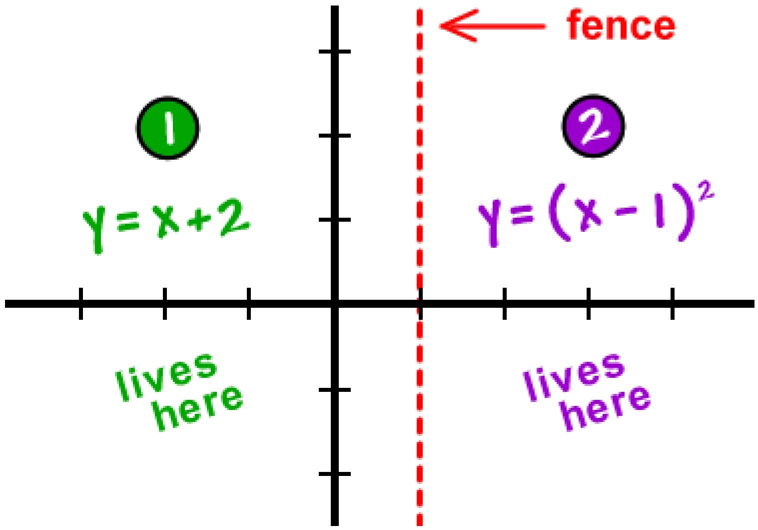
Graph

$$y = \begin{cases} x + 2 \;;\; x < 1 \leftarrow ① \\ (x-1)^2 \;;\; x \geq 1 \leftarrow ② \end{cases}$$

It's in two pieces!

Each piece must live ONLY in its own neighborhood.

Let's put up a fence, so we don't make any mistakes:

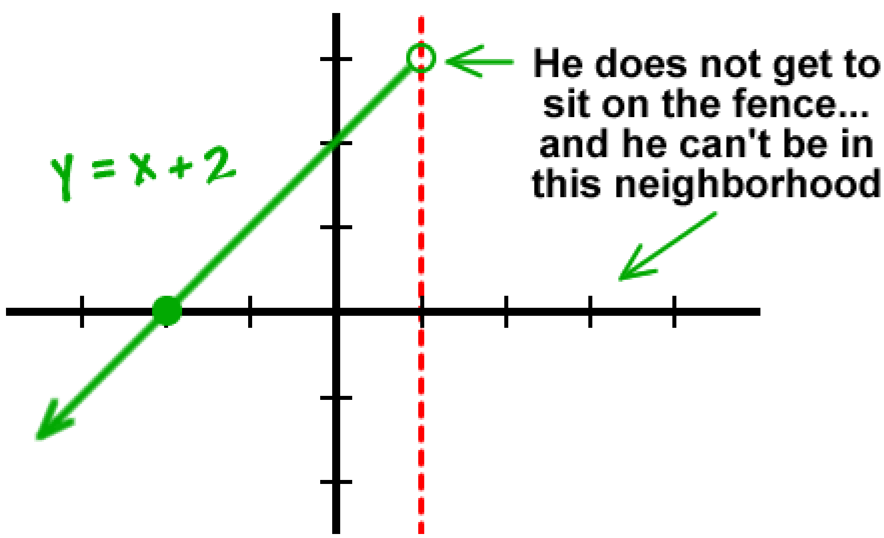


Now, we just need to figure out who the fence owner is...

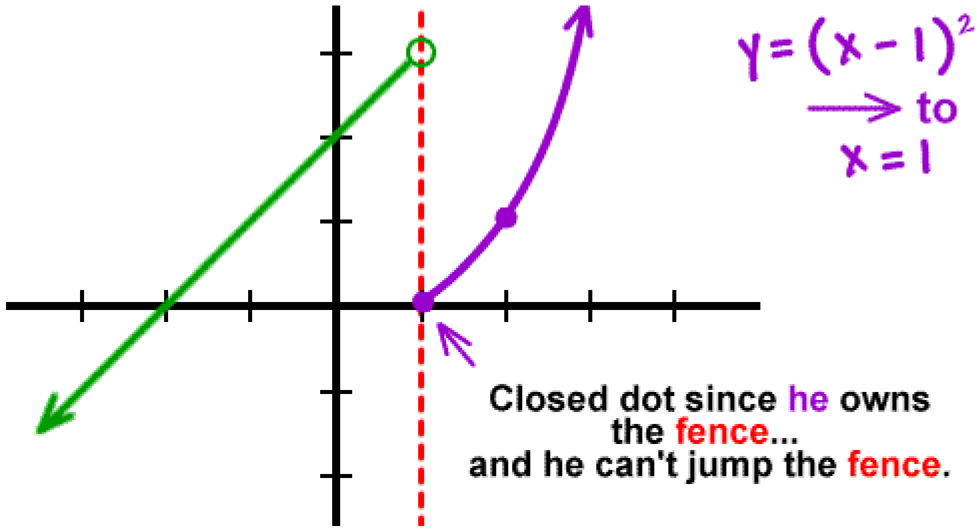
$$y = \begin{cases} x + 2 & ; \; x < 1 \\ (x-1)^2 & ; \; x \geq 1 \end{cases}$$

This guy has the "=", so he gets to live ON the fence.

Let's graph part 1 **:**



Let's graph part ② **:**



OK, so why are we being so careful about not crossing the fences into the other neighborhoods?

Because these guys are functions! Remember that functions have to pass the vertical line test.