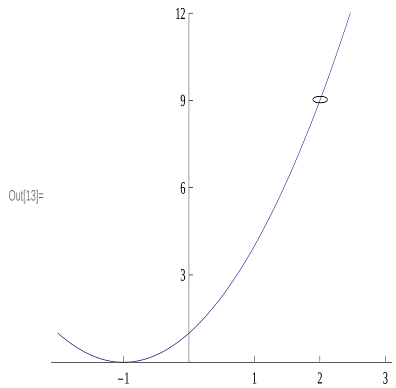
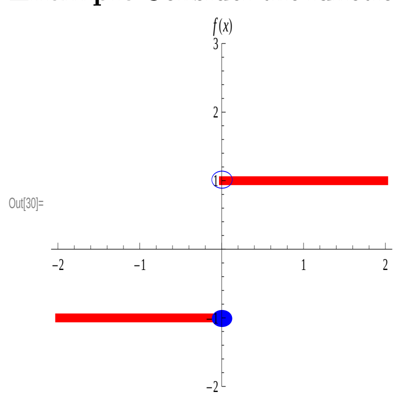
Example Consider the graph of $h(x)$ below. What is $lim_{x\to 2}h(x)$



The function h(x) is the same as f(x) and g(x) except at x=2, where h(x) isn't even defined. But again, computing the limit only requires that we look where the function is headed as $x \to 2$ and not that we know anything about $h(2)$ (which in this case does not exist!!), and so we have $\lim_{x\to 2} h(x) = 9$.

The important lesson to take away from these examples is that the values of the limit $\lim_{x\to a} f(x)$ has (in general) nothing to do with the value of $f(x)$.

Example Consider the function f(x) depicted below. What is $\lim_{x\to 0} f(x)$?



For this function, as inputs approach 0 from the left, outputs approach -1. But as inputs approach 0 from the right, outputs approach 1. Since there is not a single number that outputs as inputs approach 0, we say

$$\lim_{x\to 0} f(x) \text{ does not exist}$$

Because of this, it is convenient to talk about "directional limits."