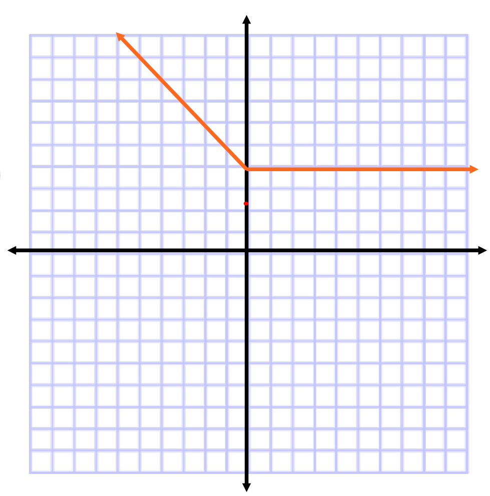
1-3 Piecewise and Step Functions

Objectives:
-I can graph a piecewise function
- I can write the equation of a piecewise function
-I can identify least and greatest integer functions

A piecewise function is a function with a different equations defined over unique intervals of x.

For example:

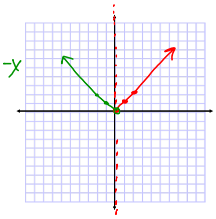
$$f(x)=\begin{cases}-x+4 \text{ if } x\le 0\\ 4 \text{ if } x>0\end{cases}$$



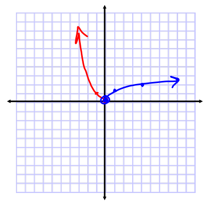
Graph the following:

$$f(x)=\begin{cases} x & if\ x\ge 0 \\ -x & if\ x<0 \end{cases}$$

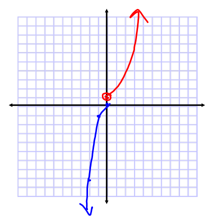
$f(x)=x$ $f(x)=-x$



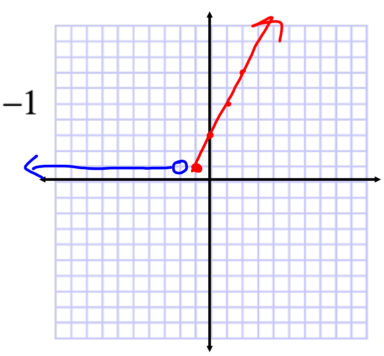
$$f(x)=\begin{cases} x^2 & if\ x\le 0 \\ \sqrt{x} & if\ x>0 \end{cases}$$



$$f(x)=\begin{cases} x^3 & if\ x\le 0 \\ 2^x & if\ x>0 \end{cases}$$



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



$f(x)=1$

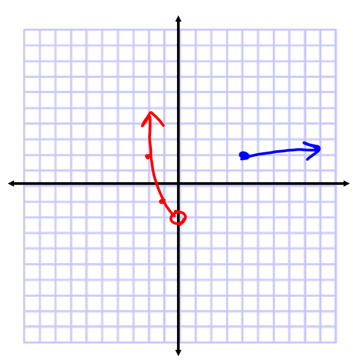
$f(-2)=1$

$(-2,1)$

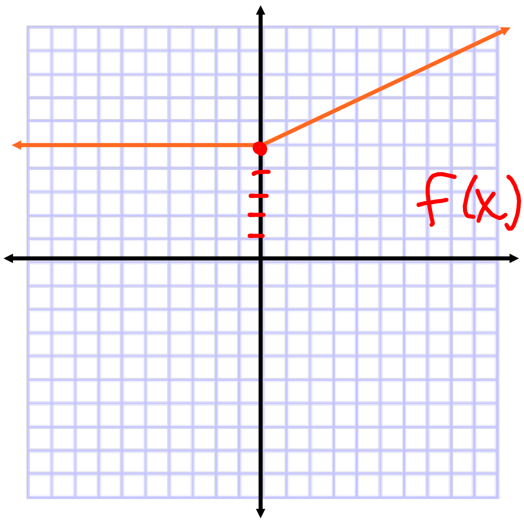
$f(-5)=1$

$(-5,1)$

$$f(x)=\begin{cases} x^2-2, & x<0 \\ \sqrt{x}, & x>4 \end{cases}$$



Write the equation for the following piecewise functions



$$f(x)=\begin{cases} 5, & x \le 0 \\ \frac{1}{2}x+5, & x \ge 0 \end{cases}$$

Problem 2: Taxi Fares

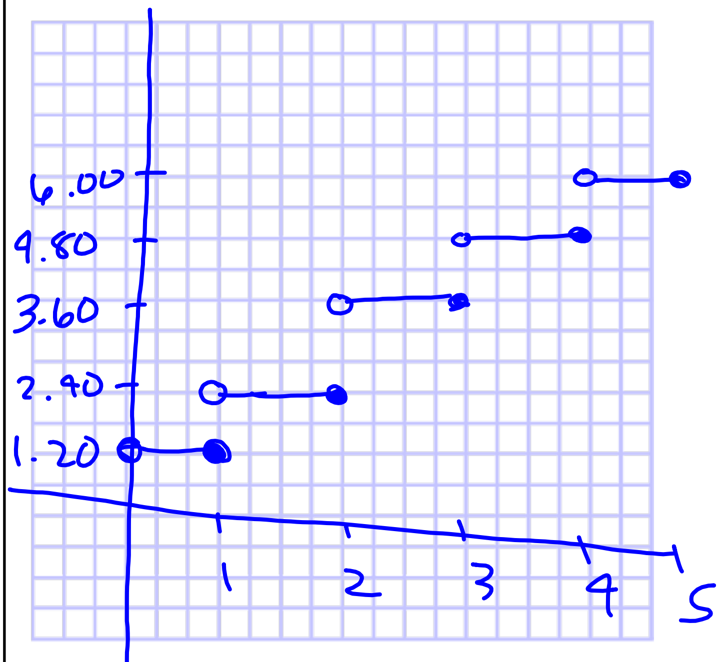
In 2006, the rate for a taxi ride in Macon, Georgia, was \$1.20 for the first mile or part of a mile, and \$1.20 for each additional mile or part of a mile.

1. Define a piecewise function, g(x), for the cost of a taxi ride up to 5 miles.

$$f(x)=\begin{cases} 1.20, & 0 < x \le 1 \\ 2.40, & 1 < x \le 2 \\ 3.60, & 2 < x \le 3 \\ 4.80, & 3 < x \le 4 \\ 6.00, & 4 < x \le 5 \end{cases}$$

2. What is the slope of each interval? Explain your reasoning.

3. Graph g(x) for x < 5 miles.

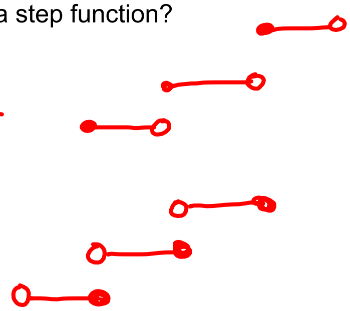


4. Describe the graph of the function as either increasing or decreasing.

You have just graphed a *step function. A* ***step function*** is a piecewise function whose pieces are disjoint constant functions.

5. Why do you think this function is called a step function?

$\lfloor x \rfloor$ floor



$\lceil x \rceil$ ceiling

Problem 3 Special Step Functions

The *greatest integer function* is a special kind of step function. The **greatest integer function**, also known as the **floor function**, $G(x) = \lfloor x \rfloor$ is defined as the greatest integer less than or equal to x.

1. Evaluate each using the greatest integer function.

a. $\lfloor 2 \rfloor = \underline{2}$ **b.** $\lfloor 0.17 \rfloor = \underline{0}$

c. $\lfloor 2.34 \rfloor = \underline{2}$ **d.** $\lfloor -1.2 \rfloor = \underline{-2}$

e. $\lfloor 2.99999 \rfloor = \underline{2}$ **f.** $\lfloor -0.2 \rfloor = \underline{-1}$

The *least integer function* is another special kind of step function. The **least integer function** $L(x) = \lceil x \rceil$ also known as the **ceiling function,** is defined as the least integer greater than or equal to x.

3. Calculate each:

a. $\lceil 2 \rceil = \underline{2}$ **b.** $\lceil 0.17 \rceil = \underline{1}$

c. $\lceil 2.34 \rceil = \underline{3}$ **d.** $\lceil -1.2 \rceil = \underline{-1}$

e. $\lceil 2.99999 \rceil = \underline{3}$ **f.** $\lceil -0.2 \rceil = \underline{0}$

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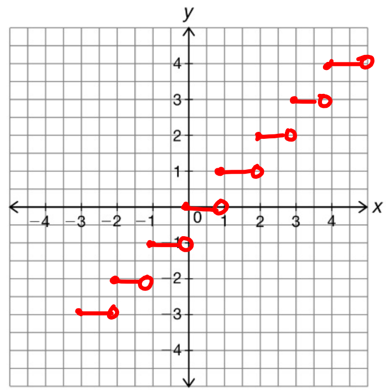
Graph $G(x) = \lfloor x \rfloor$.



Graph $L(x) = \lceil x \rceil$.