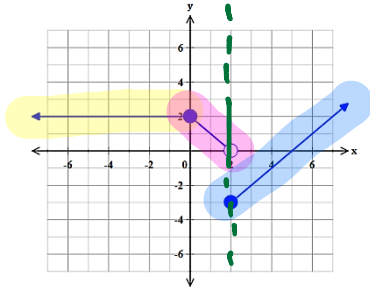


NOTES: SECONDARY 2 HONORS
PIECEWISE FUNCTIONS, STEP FUNCTIONS, AND ABSOLUTE VALUE FUNCTIONS (2.12)

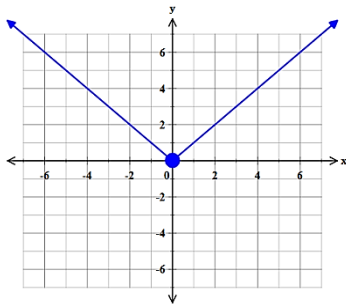
Vocabulary

- A **piecewise-defined function** is a function that consists of *pieces of two or more functions*

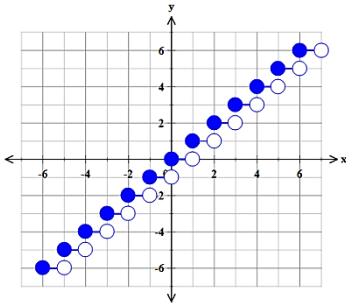


This function consists of pieces of three lines.

- An **absolute value function** is $f(x)=|x|$. The graph of every absolute value function always has a "V" shape.



- **Step functions** are piecewise-defined functions made up of constant functions. It is called a step function because the graph resembles a staircase



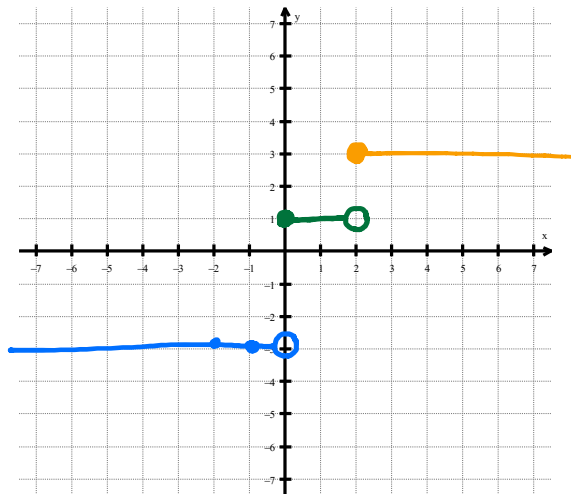
The step function is written $y = \lfloor x \rfloor$. This greatest integer less than or equal to a number.

$\text{int}(0.0001)$	$= 0$
$\text{int}(0.5)$	$= 0$
$\text{int}(0.99999)$	$= 0$
$\text{int}(1)$	$= 1$

Example #1: Consider the piecewise-defined function. Evaluate $f(x)$ at $x = -1, 0, 1, 2,$ and 3 . Sketch the graph of the piecewise function f .

$$f(x) = \begin{cases} -3 & x < 0 \\ 1 & 0 \leq x < 2 \\ 3 & x \geq 2 \end{cases}$$

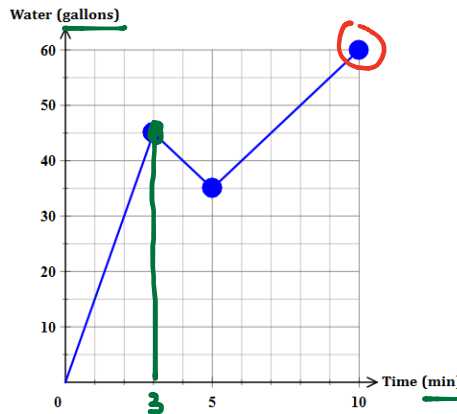
$f(-1) = -3$
 $f(0) = 1$
 $f(1) = 1$
 $f(2) = 3$
 $f(3) = 3$



Example #2 Bathtub problem

The piecewise function $G(t)$ represents the number of gallons of water in a bathtub.

$$G(t) = \begin{cases} 15t & 0 \leq t < 3 \\ -5t + 60 & 3 \leq t < 5 \\ 5t + 10 & 5 \leq t \leq 10 \end{cases}$$



a. What does $G(3)$ represent? $G(3) = 45$
 At 3 minutes there is 45 gallons of water in the bathtub.

b. What does $G(5)$ represent? $G(5) = 35$
 At 5 minutes there is 35 gallons of water in the bathtub.

c. During what time period is the amount of water increasing?
 The water is increasing (0,3) minutes and (5,10) minutes.

d. During what time period is the amount of water decreasing?
 The water is decreasing from (3,5) minutes.

e. Identify the maximum of $G(t)$ and explain its meaning.
 The maximum of $G(t)$ is 60 gallons at 10 minutes.

Example #3: Graph the piecewise-defined function and identify the key features.

$$f(x) = \begin{cases} x+2 & x < -2 \\ 1 & -2 \leq x < 0 \\ -2x+6 & x \geq 0 \end{cases}$$

x-intercept(s): (3,0)
 y-intercept: (0,6)

max/min: max value at 6 when $x=0$.

increasing interval(s): $(-\infty, -2)$

decreasing interval(s): $(0, \infty)$

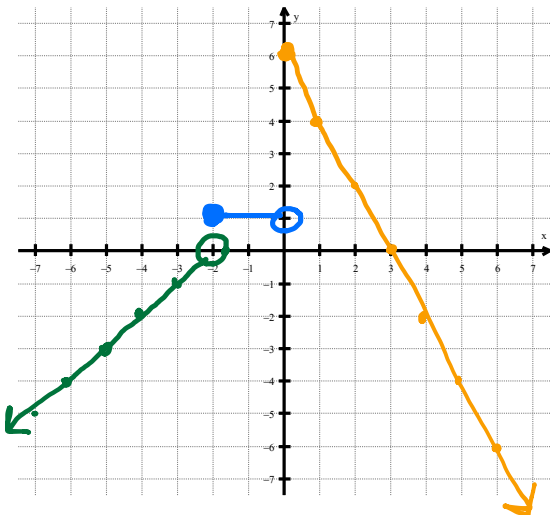
constant interval(s): $[-2, 0)$

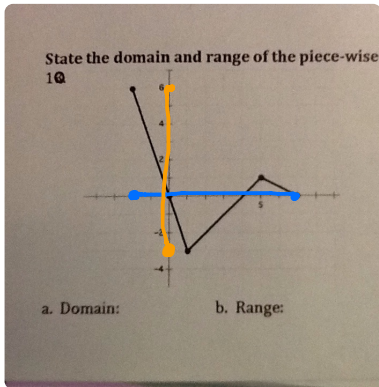
positive interval(s): $[-2, 3)$

negative interval(s): $(-\infty, -2) \cup (3, \infty)$

left end behavior: as $x \rightarrow -\infty$, $y \rightarrow -\infty$

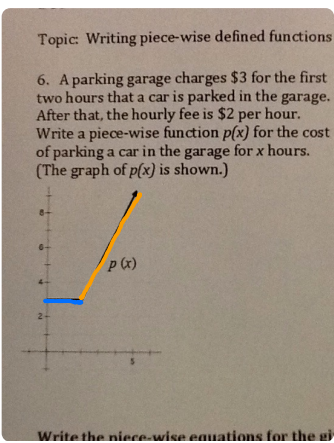
right end behavior: as $x \rightarrow \infty$, $y \rightarrow -\infty$





$$D: [-2, 7]$$

$$R: [-3, 6]$$



$$p(x) = \begin{cases} 3 & 0 \leq x < 2 \\ 2x - 1 & x \geq 2 \end{cases}$$

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