

## 4.6 NOTES - Piecewise Functions

**LESSON 4.6**

# Piecewise Functions

**LEARNING GOALS:**

- 1) Evaluate piecewise functions.
- 2) Graph piecewise functions.
- 3) Write the equations of piecewise functions.
- 4) Graph step functions.

**Common Core State Standards**  
HSA-CED.A.2, HSA-REI.D.10, HSF-IF.C.7b

**BELLWORK: Graph each line on the same plane.**

A)  $y = 3x$

B)  $y = 3$

C)  $y = -\frac{2}{3}x + 7$

What if we only wanted certain pieces of each line? (example to the right)

**LESSON 4.6 - Piecewise Functions**

- A **PIECEWISE FUNCTION** is a function that is represented by more than one equation.
- Each equation in the piecewise function will have a domain that is restricted by a given inequality.
- **EXAMPLE:**  $f(x) = \begin{cases} -3x - 8, & \text{if } x \leq 0 \\ x + 4, & \text{if } x > 0 \end{cases}$

This function is given by two equations, one for when  $x$  is less than 0, and one for when  $x$  is greater than or equal to 0.

- To evaluate a piecewise function, substitute the requested value of  $x$  into the equation whose domain contains that value.

**Evaluate the function for the given values.**

$$f(x) = \begin{cases} -3x - 8, & \text{if } x \leq 0 \\ x + 4, & \text{if } x > 0 \end{cases}$$

A) when  $x = -2$      $-3(-2) - 8 = 6 - 8 = -2$

B) when  $x = 0$      $-3(0) - 8 = 0 - 8 = -8$

C) when  $x = 1$      $1 + 4 = 5$

# Remember function notation?

The problems on the previous slide and the next slide say the exact same thing, but in different ways. The next slide shows function notation, which is more proper.

**Evaluate the function for the given values.**

$$f(x) = \begin{cases} -3x - 8, & \text{if } x \leq 0 \\ x + 4, & \text{if } x > 0 \end{cases}$$

A)  $f(-2)$      $-3(-2) - 8 = 6 - 8 = -2$

B)  $f(0)$      $-3(0) - 8 = 0 - 8 = -8$

C)  $f(1)$      $1 + 4 = 5$

## 4.6 NOTES - Piecewise Functions

Evaluate the function for the given values.

$$f(x) = \begin{cases} x + 5, & \text{if } x \leq 1 \\ \frac{1}{2}x - 3, & \text{if } x > 1 \end{cases}$$

A)  $f(4) = \frac{1}{2}(4) - 3 = 2 - 3 = -1$

B)  $f(1) = 1 + 5 = 6$

C)  $f(-3) = -3 + 5 = 2$

Evaluate the function for the given values.

$$f(x) = \begin{cases} -\frac{2}{3}x, & \text{if } x \leq 6 \\ \frac{1}{4}x + 1, & \text{if } x > 6 \end{cases}$$

A)  $f(0) = -\frac{2}{3}(0) = 0$

B)  $f(6) = -\frac{2}{3}(6) = -4$

C)  $f(10) = \frac{1}{4}(10) + 1 = \frac{5}{2} + 1 = \frac{7}{2}$

### GRAPHING PIECEWISE FUNCTIONS

**STEP 1:** Graph each equation in the piecewise function.

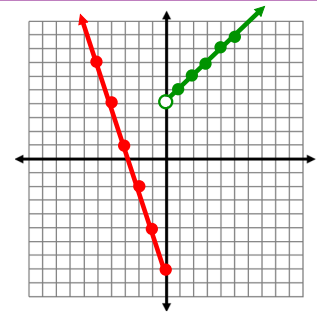
**STEP 2:** Erase the parts of each line that are not in its specified domain.

**STEP 3:** If each part of the graph does not intersect, place an endpoint on each line according to what type of inequality described its domain:

- Place an open dot on a line whose domain was less than or greater than (< or >).
- Place a closed dot on a line whose domain was less than or equal to or greater than or equal to ( $\leq$  or  $\geq$ ).

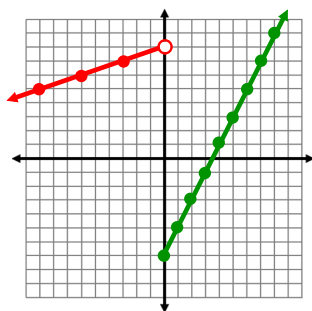
Graph the piecewise function.

$$f(x) = \begin{cases} -3x - 8, & \text{if } x \leq 0 \\ x + 4, & \text{if } x > 0 \end{cases}$$



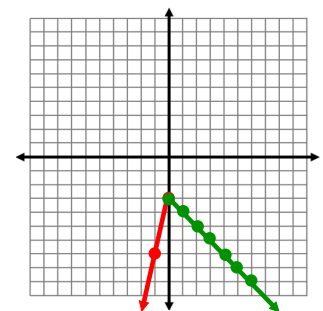
Graph the piecewise function.

$$f(x) = \begin{cases} \frac{1}{3}x + 8, & \text{if } x < 0 \\ 2x - 7, & \text{if } x \geq 0 \end{cases}$$



Graph the piecewise function.

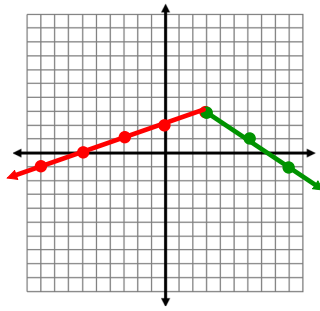
$$f(x) = \begin{cases} 4x - 3, & \text{if } x < 0 \\ -x - 3, & \text{if } x \geq 0 \end{cases}$$



## 4.6 NOTES - Piecewise Functions

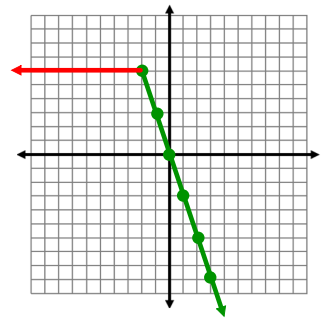
**Graph the piecewise function.**

$$f(x) = \begin{cases} \frac{1}{3}x + 2, & \text{if } x < 3 \\ -\frac{2}{3}x + 5, & \text{if } x \geq 3 \end{cases}$$



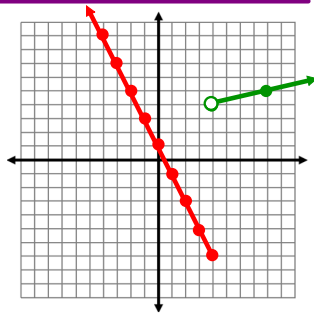
**Graph the piecewise function.**

$$f(x) = \begin{cases} 6, & \text{if } x \leq -2 \\ -3x, & \text{if } x > -2 \end{cases}$$



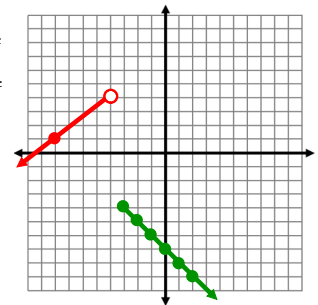
**Graph the piecewise function.**

$$f(x) = \begin{cases} -2x + 1, & \text{if } x \leq 4 \\ \frac{1}{4}x + 5, & \text{if } x > 4 \end{cases}$$



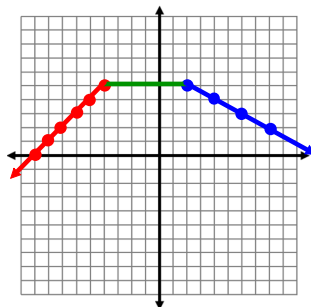
**Graph the piecewise function.**

$$f(x) = \begin{cases} \frac{3}{4}x + 7, & \text{if } x < -4 \\ -x - 7, & \text{if } x \geq -4 \end{cases}$$



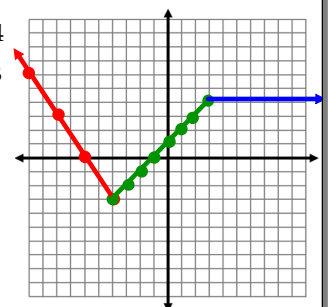
**Graph the piecewise function.**

$$f(x) = \begin{cases} x + 9, & \text{if } x \leq -4 \\ 5, & \text{if } -4 < x \leq 2 \\ -\frac{1}{2}x + 6, & \text{if } x > 2 \end{cases}$$



**Graph the piecewise function.**

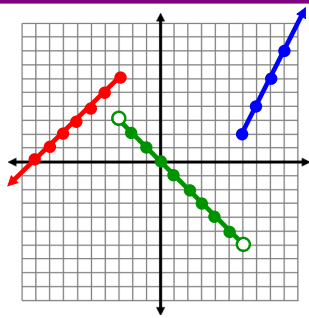
$$f(x) = \begin{cases} -\frac{3}{2}x - 9, & \text{if } x \leq -4 \\ x + 1, & \text{if } -4 < x \leq 3 \\ 4, & \text{if } x > 3 \end{cases}$$



## 4.6 NOTES - Piecewise Functions

Graph the piecewise function.

$$f(x) = \begin{cases} x + 9, & \text{if } x \leq -3 \\ -x, & \text{if } -3 < x < 6 \\ 2x - 10, & \text{if } x \geq 6 \end{cases}$$

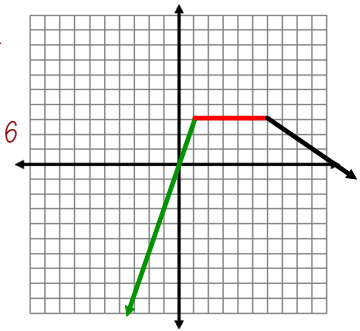


State the inequalities that make this function true.

A)  $y = 3x$  if  $x < 1$

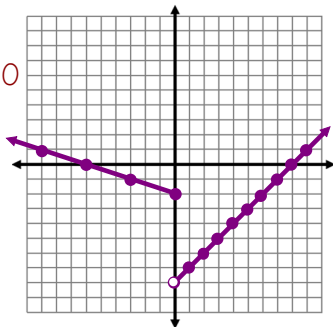
B)  $y = 3$  if  $1 \leq x < 6$

C)  $y = -\frac{2}{3}x + 7$   
if  $x > 6$



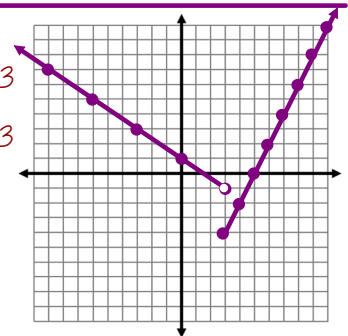
Write the piecewise function that represents the graph.

$$f(x) = \begin{cases} -\frac{1}{3}x - 2, & \text{if } x \leq 0 \\ x - 8, & \text{if } x > 0 \end{cases}$$



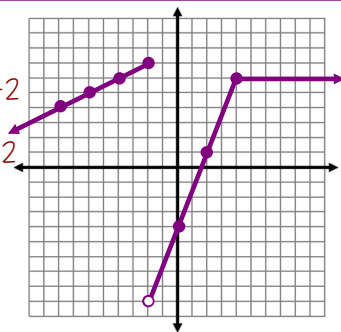
Write the piecewise function that represents the graph.

$$f(x) = \begin{cases} -\frac{2}{3}x + 1, & \text{if } x < 3 \\ 2x - 10, & \text{if } x \geq 3 \end{cases}$$



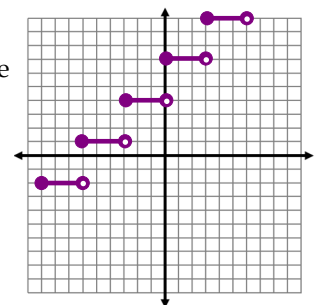
Write the piecewise function that represents the graph.

$$f(x) = \begin{cases} \frac{1}{2}x + 8, & \text{if } x \leq -2 \\ \frac{5}{2}x - 4, & \text{if } x > -2 \end{cases}$$



### STEP FUNCTIONS

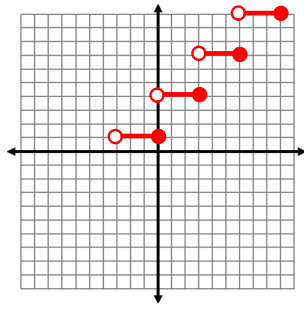
• **STEP FUNCTIONS** are a specific type of piecewise function which are so named because of their resemblance to stairs.



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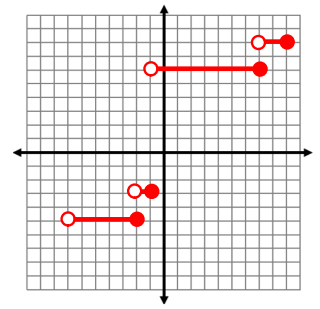
**Graph the piecewise step function.**

$$f(x) = \begin{cases} 1, & \text{if } -3 < x \leq 0 \\ 4, & \text{if } 0 < x \leq 3 \\ 7, & \text{if } 3 < x \leq 6 \\ 10, & \text{if } 6 < x \leq 9 \end{cases}$$



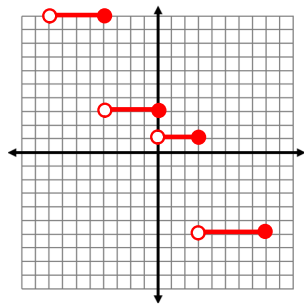
**Graph the piecewise step function.**

$$f(x) = \begin{cases} -5, & \text{if } -7 < x \leq -2 \\ -3, & \text{if } -2 < x \leq -1 \\ 6, & \text{if } -1 < x \leq 7 \\ 8, & \text{if } 7 < x \leq 9 \end{cases}$$



**Graph the piecewise step function.**

$$f(x) = \begin{cases} 10, & \text{if } -8 < x \leq -5 \\ 4, & \text{if } -5 < x \leq 0 \\ 1, & \text{if } 0 < x \leq 3 \\ -6, & \text{if } 3 < x \leq 8 \end{cases}$$



## HOMWORK

4.6 Worksheet - Piecewise Functions