

2.7 PIECEWISE FUNCTIONS

Combination of 2 or more functions

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

Example 1

Evaluate $f(x)$ when...

a) $x = 0$

$$f(0) = x + 2 \\ = 0 + 2$$

$$f(0) = 2$$

b) $x = 2$

$$f(2) = 2x + 1 \\ = 2(2) + 1 \\ = 4 + 1$$

$$f(2) = 5$$

c) $x = 4$

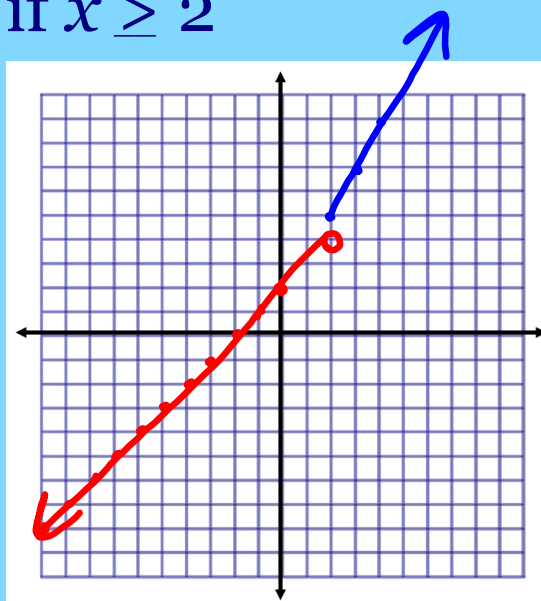
$$f(4) = 2x + 1 \\ = 2(4) + 1 \\ = 8 + 1$$

$$f(4) = 9$$

Example 2

Graph the function from Example 1.

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



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

Example 3Evaluate $f(x)$ when...

a) $x = 0$

$$\begin{aligned} f(0) &= 3x + 2 \\ &= 3(0) + 2 \\ &= 0 + 2 \end{aligned}$$

$$f(0) = 2$$

b) $x = 3$

$$\begin{aligned} f(3) &= 3(3) + 2 \\ &= 9 + 2 \end{aligned}$$

$$f(3) = 11$$

c) $x = 9$

$$\begin{aligned} f(9) &= \sqrt{9} - 1 \\ &= 3 - 1 \end{aligned}$$

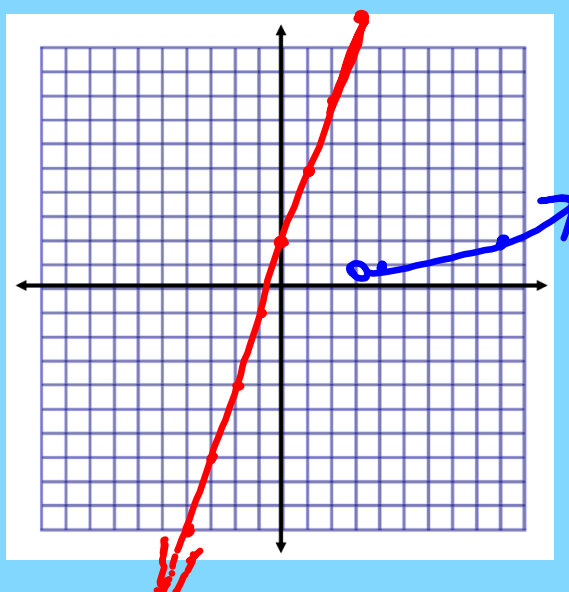
$$f(9) = 2$$

Example 4

Graph the function from Example 3.

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

x	y
4	$\sqrt{4} - 1 = 2 - 1 = 1$
9	$\sqrt{9} - 1 = 3 - 1 = 2$



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

Example 5Evaluate $f(x)$ when...

a) $x = -3$

$$f(-3) = -(-3) + 1 \\ = 3 + 1$$

$$f(-3) = 4$$

b) $x = 2$

$$f(2) = \frac{2}{3}x + \frac{2}{3} \\ = \frac{2}{3}(2) + \frac{2}{3} \\ = \frac{4}{3} + \frac{2}{3} = \frac{6}{3}$$

$$f(2) = 2$$

c) $x = 6$

$$f(6) = \frac{2}{3}(6) + \frac{2}{3} \\ = \frac{12}{3} + \frac{2}{3}$$

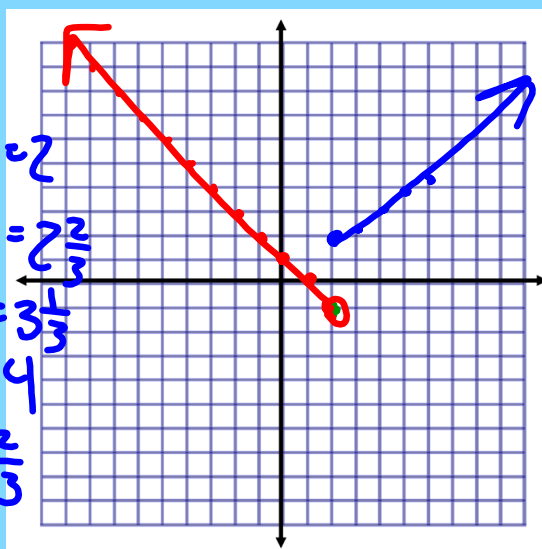
$$f(6) = \frac{14}{3}$$

Example 6

Graph the function from Example 5.

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

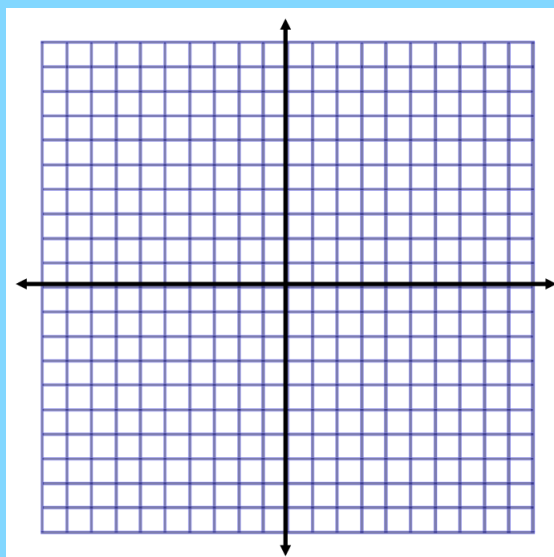
x	y
2	$\frac{2}{3}(2) + \frac{2}{3} = \frac{4}{3} + \frac{2}{3} = \frac{6}{3} = 2$
3	$\frac{2}{3}(3) + \frac{2}{3} = 2 + \frac{2}{3} = \frac{8}{3}$
4	$\frac{2}{3}(4) + \frac{2}{3} = \frac{8}{3} + \frac{2}{3} = \frac{10}{3}$
5	$\frac{2}{3}(5) + \frac{2}{3} = \frac{10}{3} + \frac{2}{3} = \frac{12}{3} = 4$
6	$\frac{2}{3}(6) + \frac{2}{3} = 4 + \frac{2}{3} = \frac{14}{3}$



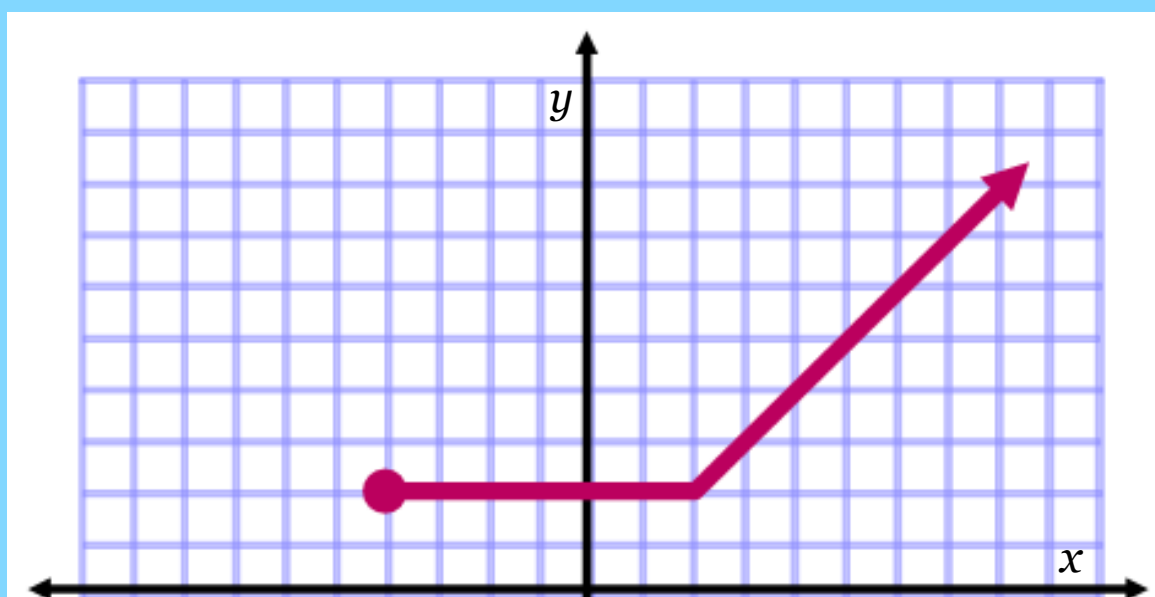
Example 7

Graph the function below.

$$f(x) = \begin{cases} 3x & \text{if } 0 \leq x < 2 \\ 6 & \text{if } 2 < x \leq 4 \\ -x + 10 & \text{if } 4 < x \leq 6 \end{cases}$$

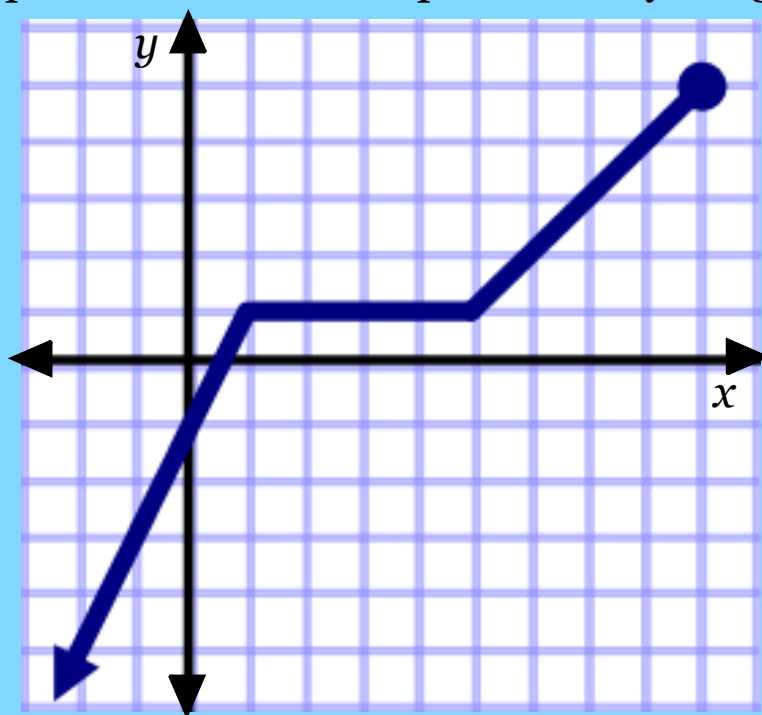
Example 8

Write the piecewise function represented by the graph below.



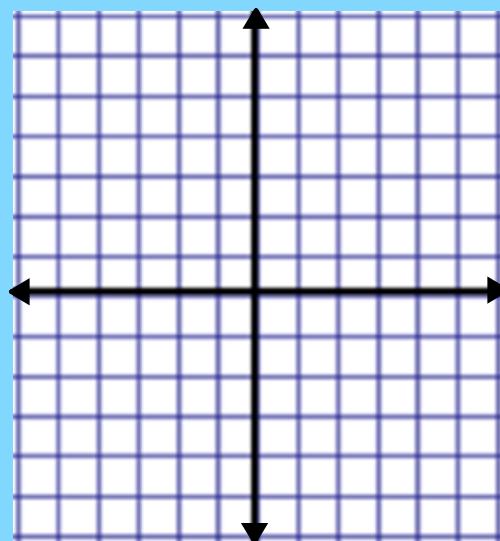
Example 9

Write the piecewise function represented by the graph below.

Example 10

Graph the function below.

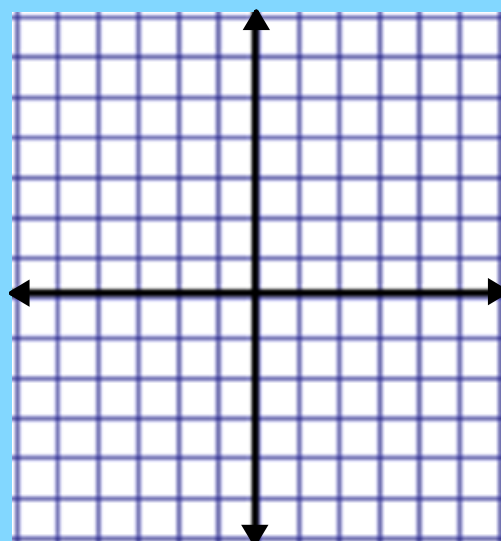
$$f(x) = \begin{cases} 1 & \text{if } 0 \leq x < 1 \\ 2 & \text{if } 1 \leq x < 2 \\ 3 & \text{if } 2 \leq x < 3 \\ 4 & \text{if } 3 \leq x < 4 \end{cases}$$



Example 11

Graph the function below.

$$f(x) = \begin{cases} -5 & \text{if } -4 < x \leq -3 \\ -4 & \text{if } -3 < x \leq -2 \\ -3 & \text{if } -2 < x \leq -1 \\ -2 & \text{if } -1 < x \leq 0 \end{cases}$$



The function in the last two examples are called *step functions* because the graph represents a set of stairs.

Example 12

Write the piecewise function represented by each graph.

