

## Piecewise Functions

What is a piecewise function?? **at least two equations, each of which applies to a different part of the functions domain.**

**\*\*Points on the graph of a function where there is a break, hole, or gap are called points of discontinuity.**

To evaluate a piecewise function:

**FIRST** figure out which equation to use by checking the domain.

**NEVER** use both equations.

**THEN** substitute the value for  $x$  into the correct equation.

Example: Evaluate  $f(x)$  when  $x = 0$ ,  $x = 2$ ,  $x = 4$

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

← Domain

$x = 0$      ~~$0 < 2$~~   
 equation:  ~~$x+2$~~   
 $x+2$   
 $f(0) = 0+2$   
 $f(0) = 2$

$x = 2$      ~~$2 < 2$~~   
 equation:  ~~$x+2$~~   
 $2x+1$   
 $f(2) = 2(2)+1$   
 $f(2) = 5$

$x = 4$      ~~$4 < 2$~~   
 equation:  ~~$x+2$~~   
 $2x+1$   
 $f(4) = 2(4)+1$   
 $f(4) = 9$

Now you try!

1) Evaluate  $f(x)$  for  $f(-3)$ ,  $f(-1)$ ,  $f(5)$

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

$$f(-3) = 2x = 2(-3) = \boxed{-6}$$

$$f(-1) = 2x+1 = 2(-1)+1 = \boxed{-1}$$

$$f(5) = 2x+1 = 2(5)+1 = \boxed{11}$$

2) Evaluate  $f(x)$  for  $f(-2)$ ,  $f(1)$ ,  $f(4)$

$$f(x) = \begin{cases} x-3, & \text{if } x < 1 \\ 4x+1, & \text{if } x \geq 1 \end{cases}$$

$$f(-2) = -5$$

$$f(1) = 5$$

$$f(4) = 17$$

3) Evaluate  $f(x)$  for  $f(x) = \begin{cases} x^2 - 5x, & x \leq -10 \\ x + 19, & -10 < x < -2 \\ \frac{x^3}{x+9}, & x \geq -2 \end{cases}$

$$f(-8) = x + 19 = -8 + 19 = \boxed{11}$$

$$f(0) = \frac{x^3}{x+9} = \frac{0^3}{0+9} = \frac{0}{9} = \boxed{0}$$

$$f(6) = \frac{6^3}{6+9} = \frac{216}{15} = \boxed{14.4}$$

4) Evaluate  $f(x)$  for  $f(x) = \begin{cases} 2|x-5|, & x \leq -3 \\ -x^2 + 4x, & -3 < x < 7 \\ \sqrt{2x+6}, & x \geq 7 \end{cases}$

$$f(10) = \sqrt{26}$$

$$f(0) = 0$$

$$f(-5) = 20$$

$$2|-5-5|$$

$$2|-10|$$

$$2(10)$$

$$20$$