

**Objective:** Evaluate and write piecewise functions

**Warm up:** Given the functions  $f(x) = 2x + 3$  and  $g(x) = 4x$ , evaluate  $f(1)$  and  $g(2)$ .

$$\begin{aligned} f(1) &= 2(1) + 3 \\ &= 2 + 3 \\ &= \boxed{5} \end{aligned}$$

$$\begin{aligned} g(2) &= 4(2) \\ &= \boxed{8} \end{aligned}$$

### Part I: Evaluating

- Just as any function can be evaluated, evaluating a piecewise function comprises of finding the output for an indicated input.
- However, since a piecewise function is comprised of multiple functions, you must look at the domain before you evaluate the function.

### Examples:

1. Given the piecewise function  $f(x) = \begin{cases} 2x & \text{if } x \geq 1 \\ -x + 3 & \text{if } x < 1 \end{cases}$

- Evaluate  $f(-1) = -(-1) + 3 = 1 + 3 = \boxed{4}$
- Evaluate  $f(1) = 2(1) = \boxed{2}$
- Evaluate  $f(4) = 2(4) = \boxed{8}$

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

- Evaluate  $f(1) = -(1) + 3 = \boxed{2}$
- Evaluate  $f(-1) = -(-1) + 3 = 1 + 3 = \boxed{4}$
- Evaluate  $f(-3) = \frac{1}{2}(-3) + \frac{3}{2} = -\frac{3}{2} + \frac{3}{2} = \boxed{0}$

## Part II: Writing (How to Write a Piecewise from a Graph)

Answer the following questions based on the given graph.

1. What type of function is graphed?

A piecewise function!

2. How many equations are drawn? Label each equation with a letter (A, B, etc.)

3

3. For the equation labeled equation A

a) What x-values are being graphed?

All x-values less than -3

b) Is there a "closed dot" or an "open dot"?

Closed dots

c) What restricted domain can you write using parts a & b?

$$x \leq -3$$

d) If you were to write an equation of the line drawn, what would you write?

$$f(x) = -2$$

4. For the equation labeled equation B

a) What x-values are being graphed?

All x-values between -3 and 0

b) Is there a "closed dot" or an "open dot"?

open dots

c) What restricted domain can you write knowing parts a & b?

$$-3 < x < 0$$

d) If you were to write an equation of the line drawn, what would you write?

$$f(x) = -x + 4$$

5. For the equation labeled equation C

a) What x-values are being graphed?

All x-values greater than 0

b) Is there a "closed dot" or an "open dot"?

Closed dot

c) What restricted domain can you write knowing parts a & b?

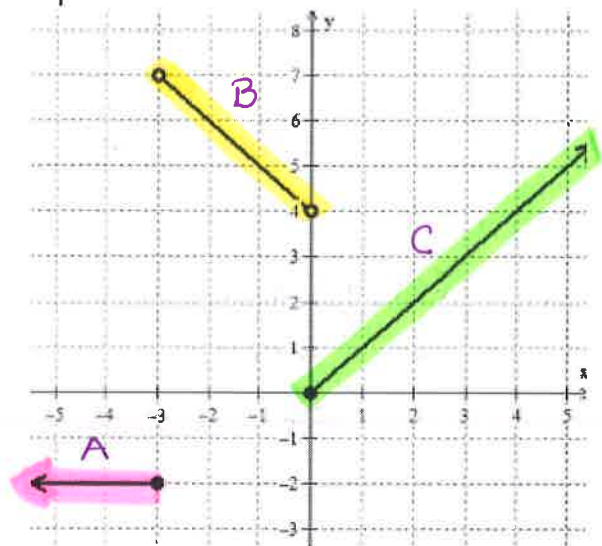
$$x \geq 0$$

d) If you were to write an equation of the line drawn, what would you write?

$$f(x) = x$$

6. Putting together questions 3c,d, 4c,d and 5c,d, please construct the **piecewise function** that is graphed.

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



**In conclusion, a piecewise function must include:**

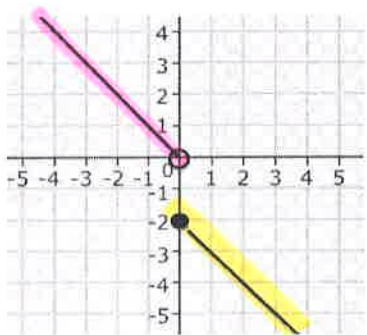
- Function notation
- A separate equation for each "part" of the graph.
- A restricted domain for each "part" of the graph---(what x-values are being included for each "part"?)

**Examples:** Write a piecewise function that corresponds to the graphs below.

Reminder: Point-Slope Form

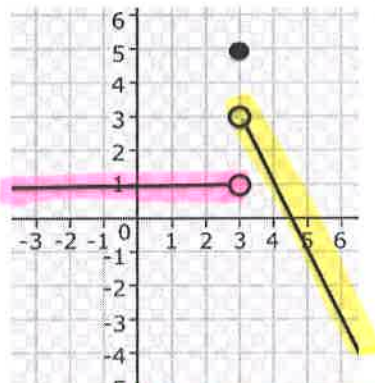
$$y - y_1 = m(x - x_1)$$

a.



$$f(x) = \begin{cases} -x & \text{if } x < 0 \\ -x - 2 & \text{if } x \geq 0 \end{cases}$$

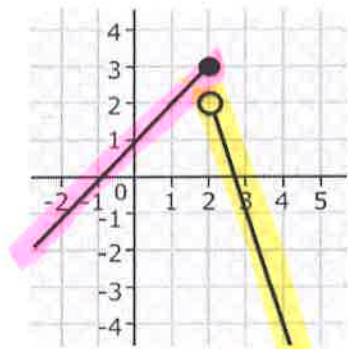
b.



$$f(x) = \begin{cases} 1 & \text{if } x < 3 \\ 5 & \text{if } x = 3 \\ -2x + 9 & \text{if } x > 3 \end{cases}$$

$$\begin{aligned} y - 3 &= -2(x - 3) \\ y - 3 &= -2x + 6 \\ y &= -2x + 9 \end{aligned}$$

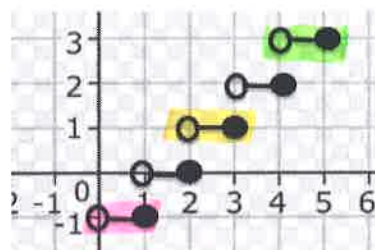
c.



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

$$\begin{aligned} y - 2 &= -3(x - 2) \\ y - 2 &= -3x + 6 \\ y &= -3x + 8 \end{aligned}$$

d.



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