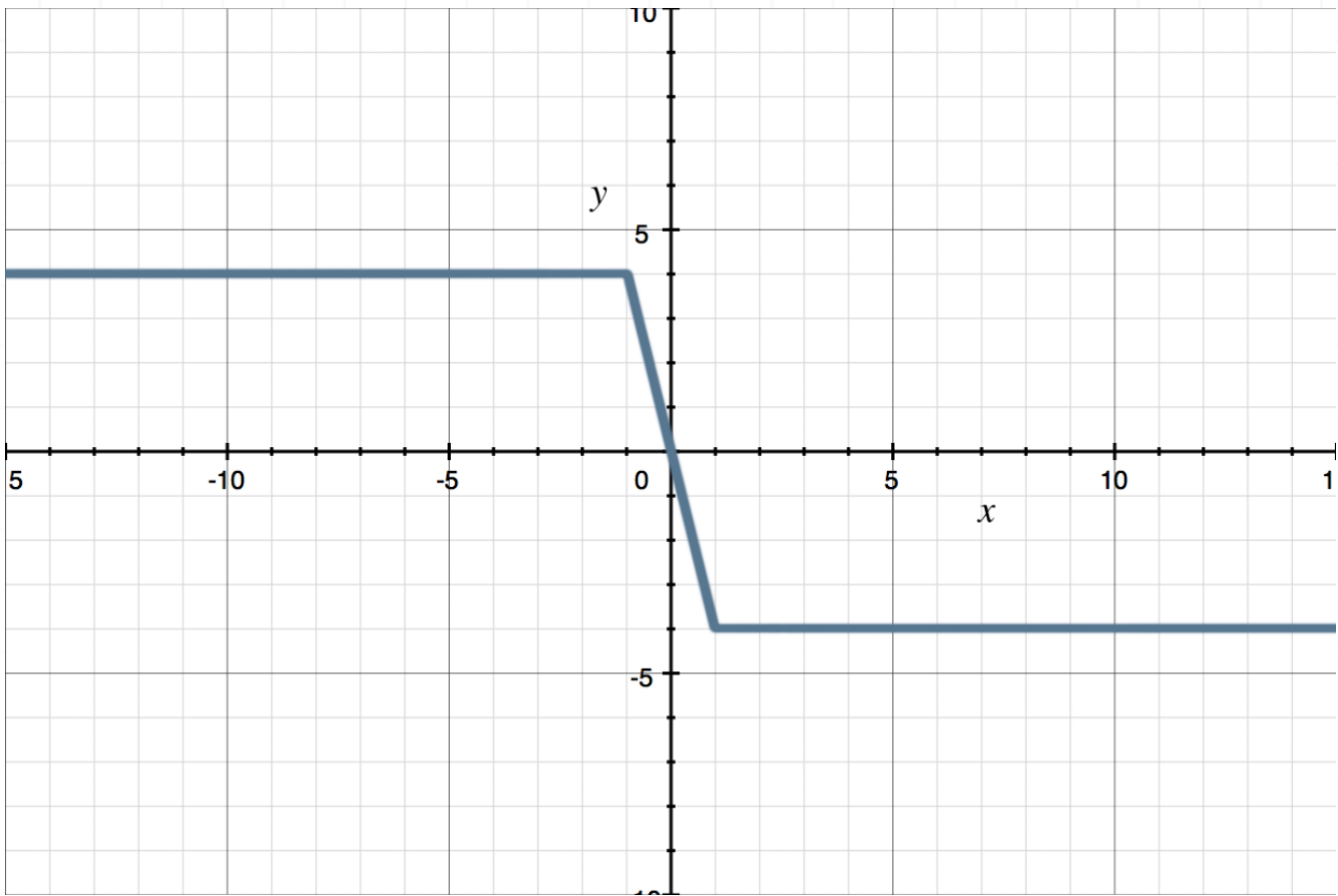


Topic: Modeling a piecewise-defined function

Question: What is the definition of the piecewise function shown in the graph?



Answer choices:

- A

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

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

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

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



**Solution: C**

Going from left to right, the first part of the graph is part of the line  $y = 4$  and it goes from the left, to  $x = -1$ . For this piece, we write 4 for the function and  $x \leq -1$  for its domain.

The second part of the graph is part of the line that has a slope of  $-4$  and a  $y$ -intercept of 0, so the equation of this line is  $y = -4x$ . Remember: the slope-intercept of the equation of a line is  $y = mx + b$ .) To see how to get the slope, notice that  $(-1, 4)$  and  $(0, 0)$  are points on this line, so its slope is

$$m = \frac{0 - 4}{0 - (-1)} = \frac{-4}{1} = -4$$

This part of the graph goes from  $x = -1$  to  $x = 1$ . So for the second piece, we write  $-4x$  for the function and  $-1 < x \leq 1$  for its domain. We can't include  $x = -1$  in the domain of this piece, because we included  $x = -1$  in the domain of the first piece.

The third part of the graph is part of the line  $y = -4$ , and it goes from  $x = 1$  to the right. For this piece, we write  $-4$  for the function and  $1 < x$  for its domain. We can't include  $x = 1$  in the domain of this piece, because we included  $x = 1$  in the domain of the second piece.

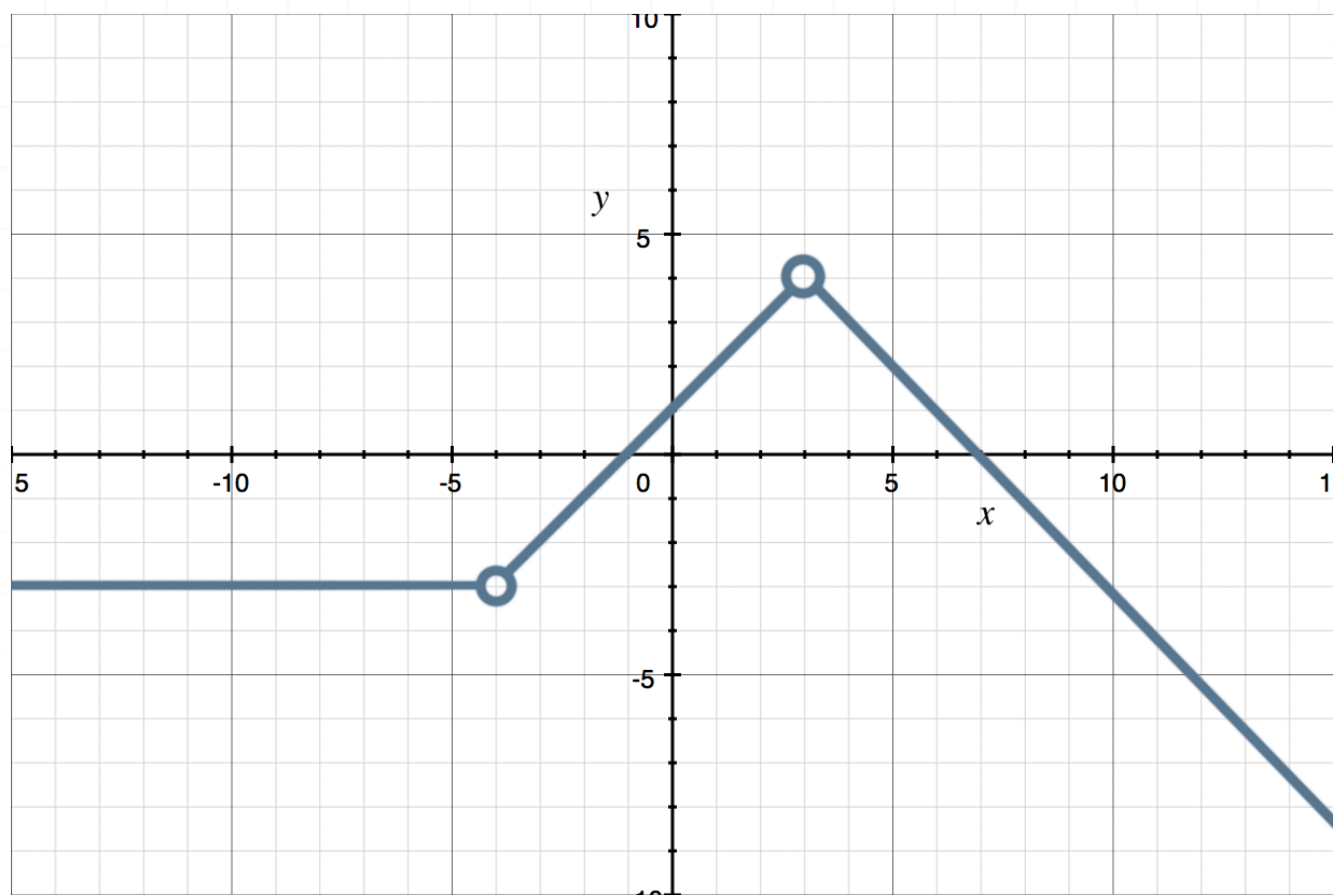
When we put the pieces together, we get this function:

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



Topic: Modeling a piecewise-defined function

Question: What is the definition of the piecewise function shown in the graph?



Answer choices:

- A

$$f(x) = \begin{cases} -4 & \text{if } x < -3 \\ x + 1 & \text{if } -4 < x < 3 \\ -x + 7 & \text{if } x > 3 \end{cases}$$
- B

$$f(x) = \begin{cases} -3 & \text{if } x < -4 \\ x + 1 & \text{if } -4 < x < 3 \\ -x + 7 & \text{if } x > 3 \end{cases}$$
- C

$$f(x) = \begin{cases} -3 & \text{if } x \leq -4 \\ x + 1 & \text{if } -4 < x < 3 \\ -x + 7 & \text{if } x \geq 3 \end{cases}$$
- D

$$f(x) = \begin{cases} -3 & \text{if } x < -4 \\ x - 1 & \text{if } -4 < x < 3 \\ x + 7 & \text{if } x > 3 \end{cases}$$



**Solution: B**

Going from left to right, the first part of the graph is part of the line  $y = -3$ , and it includes all values of  $x$  in the interval  $x < -4$  (but not  $x = -4$ , because there's an open circle on the graph at  $x = -4$ ). For this piece, we write  $-3$  for the function and  $x < -4$  for its domain.

The second part of the graph is (part of) the line that has a slope of 1, so the equation of this line is  $y = x + 1$ . To see how to get the slope, notice that  $(-4, -3)$  and  $(0, 1)$  are points on this line, so its slope is

$$m = \frac{1 - (-3)}{0 - (-4)} = \frac{4}{4} = 1$$

This piece goes from  $x = -4$  to  $x = 3$ , but neither  $-4$  nor  $3$  is in its domain (or in the domain of this entire piecewise function), because there's an open circle at each of those two values of  $x$  on the graph. So for this piece, we write  $x + 1$  for the function and  $-4 < x < 3$  for its domain.

The graph of the third part is part of the line that has a slope of  $-1$  and a  $y$ -intercept of  $7$ , so the equation of this line is  $y = -x + 7$ . To see this, we'll first compute the slope from the points  $(3, 4)$  and  $(5, 2)$ , both of which are on this line. Then we'll use the slope and the point  $(3, 4)$  to get the point-slope form of the equation of the line (and then use that to get the slope-intercept form). The slope is

Combining the three pieces, we get this function:

$$f(x) = \begin{cases} -3 & \text{if } x < -4 \\ x + 1 & \text{if } -4 < x < 3 \\ -x + 7 & \text{if } x > 3 \end{cases}$$



**Topic:** Modeling a piecewise-defined function

**Question:** For the given function, evaluate  $f(-4) + f(8) + f(3)$ .

$$f(x) = \begin{cases} -\frac{1}{2}x - 3 & \text{if } -6 \leq x \leq 2 \\ -4 & \text{if } 2 < x \leq 7 \\ 3x - 25 & \text{if } 7 < x \leq 9 \end{cases}$$

**Answer choices:**

A       $-10$

B       $-6$

C       $-2$

D       $2$



**Solution: B**

Given the piecewise function

$$f(x) = \begin{cases} -\frac{1}{2}x - 3 & \text{if } -6 \leq x \leq 2 \\ -4 & \text{if } 2 < x \leq 7 \\ 3x - 25 & \text{if } 7 < x \leq 9 \end{cases}$$

First, evaluate  $f(-4)$ . Notice that  $-4$  is in the interval  $-6 \leq x \leq 2$ , so we use the function for the first piece.

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

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

Next, evaluate  $f(8)$ . Notice that  $8$  is in the interval  $7 < x \leq 9$ , so we use the function for the third piece.

$$f(x) = 3x - 25$$

$$f(8) = 3(8) - 25 = 24 - 25 = -1$$

Now, evaluate  $f(3)$ . Notice that  $3$  is in the interval  $2 < x \leq 7$ , so we use the function for the second piece.

$$f(x) = -4$$

$$f(3) = -4$$

Finally, compute the sum of the three values.



$$f(-4) + f(8) + f(3) = -1 + (-1) + (-4) = -6$$

