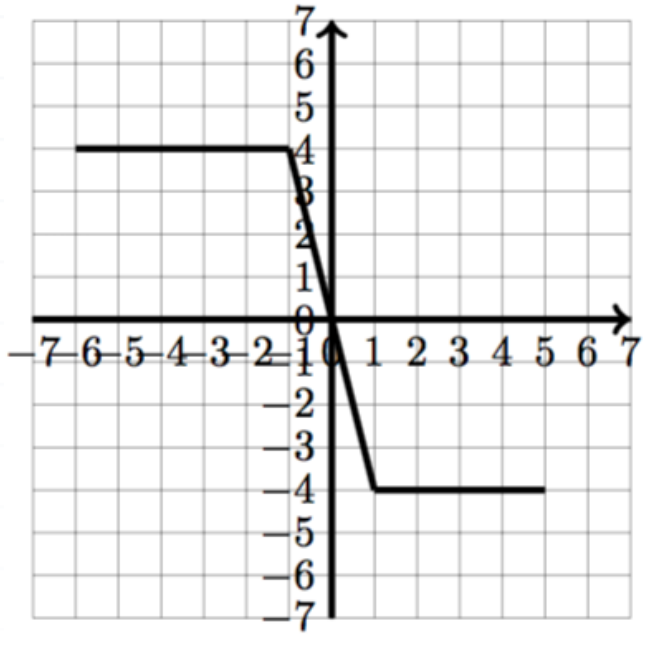
Topic: Modeling a piecewise defined function

Question: Which equation for the graph of the piecewise function shown is correct?



Answer choices:

A $$f(x)=\begin{cases}-4 & \text{if} \quad -6\le x\le -1\\ -4x & \text{if} \quad -1<x\le 1\\ 4 & \text{if} \quad 1<x\le 5\end{cases}$$

B $$f(x)=\begin{cases}4 & \text{if} \quad -6\le x\le -1\\ 4x & \text{if} \quad 1<x\le -1\\ -4 & \text{if} \quad 1<x\le 5\end{cases}$$

C $$f(x)=\begin{cases}4 & \text{if} \quad -6\le x\le -1\\ -4x & \text{if} \quad -1<x\le 1\\ -4 & \text{if} \quad 1<x\le 5\end{cases}$$

D $$f(x)=\begin{cases}4 & \text{if} \quad -6<x<-1\\ -4x & \text{if} \quad -1<x\le 1\\ -4 & \text{if} \quad 1<x\le 5\end{cases}$$

Solution: C

Going from left to right, the first leg of the graph is $y = 4$ and it goes from $x = -6$ to $x = -1$. For this leg we write $f(x) = 4$ if $-6 \leq x \leq -1$.

The second leg has a slope of -4 and a y-intercept of 0. Using $y = mx + b$, we get $y = -4x$. It goes from $x = -1$ to $x = 1$. For this leg we write $f(x) = -4x$ if $-1 \leq x \leq 1$.

The third leg is $y = -4$, and it goes from $x = 1$ to $x = 5$. For this leg we write $f(x) = -4$ if $1 \leq x \leq 5$.

When the three legs are put together into a single function, the first $\leq$ symbols in the second and third legs are changed to $<$ symbols to insure that the result is a true function. The result is this function:

$$f(x) = \begin{cases} 4 & \text{if} \quad -6 \leq x \leq -1 \\ -4x & \text{if} \quad -1 < x \leq 1 \\ -4 & \text{if} \quad 1 < x \leq 5 \end{cases}$$

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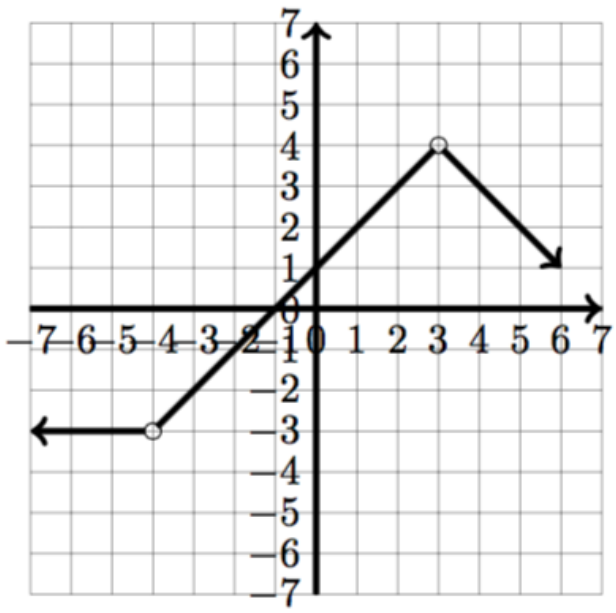

Answer choices:

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

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

C $$f(x)=\begin{cases}-3 & \text{if} \quad x\le-4\\ x+1 & \text{if} \quad -4<x<3\\ -x+7 & \text{if} \quad x\ge3\end{cases}$$

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

Solution: B

Going from left to right, the first leg of the graph is $y = -3$ and it goes from negative infinity to $x = -4$. For this leg we write $f(x) = -3$ if $x < -4$.

The second leg has a slope of 1 and a y-intercept of 1. Using $y = mx + b$, we get $y = x + 1$. It goes from $x = -4$ to $x = 3$. For this leg we write $f(x) = x + 1$ if $-4 < x < 3$.

The third leg has a slope of -1 and if you extend it back to the y-axis, you can see it has a y-intercept of 7. It goes from $x = 3$ to infinity. For this leg we write $f(x) = -x + 7$ if $x > 3$.

Combining the three legs into one function gives us this:

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