**Topic**: One-sided limits

Question: Find the left-hand limit.

$$\lim_{x \to 2^{-}} \frac{|x-2|}{x-2}$$

# **Answer choices:**

A -1

B 1

C -2

D 2

### Solution: A

If we try substitution to evaluate the limit, we get the undefined value 0/0. Instead, let's try substituting a value to the left of x = 2 that's very close to x = 2, like x = 1.9999.

$$\frac{|1.9999 - 2|}{1.9999 - 2}$$

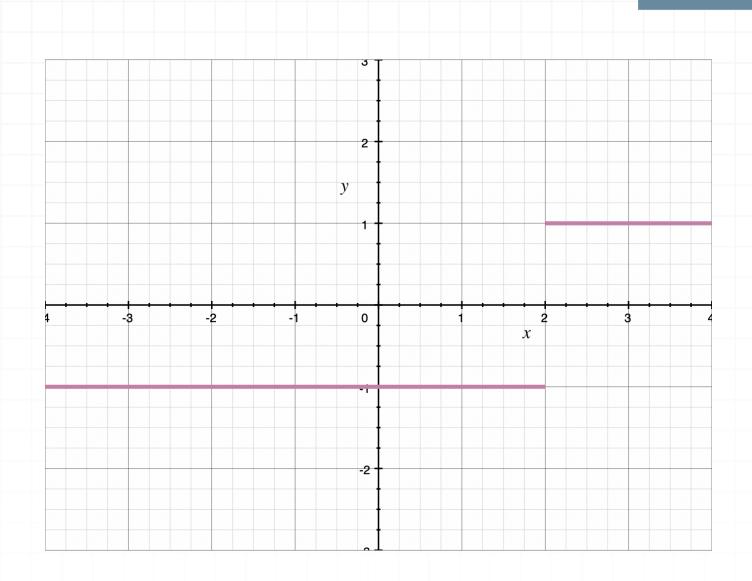
$$\frac{|-0.0001|}{-0.0001}$$

$$\frac{0.0001}{-0.0001}$$

-1

As we approach x=2 from the left, the function is a constant -1 (the numerator is always positive and the denominator is always negative). The graph of the function confirms this value for the left-hand limit.







**Topic**: One-sided limits

Question: Find the right-hand limit.

$$\lim_{x \to 2^{+}} \frac{|x - 2|}{x - 2}$$

# **Answer choices:**

A -1

B 1

C -2

D 2

## Solution: B

If we try substitution to evaluate the limit, we get the undefined value 0/0. Instead, let's try substituting a value to the right of x = 2 that's very close to x = 2, like x = 2.0001.

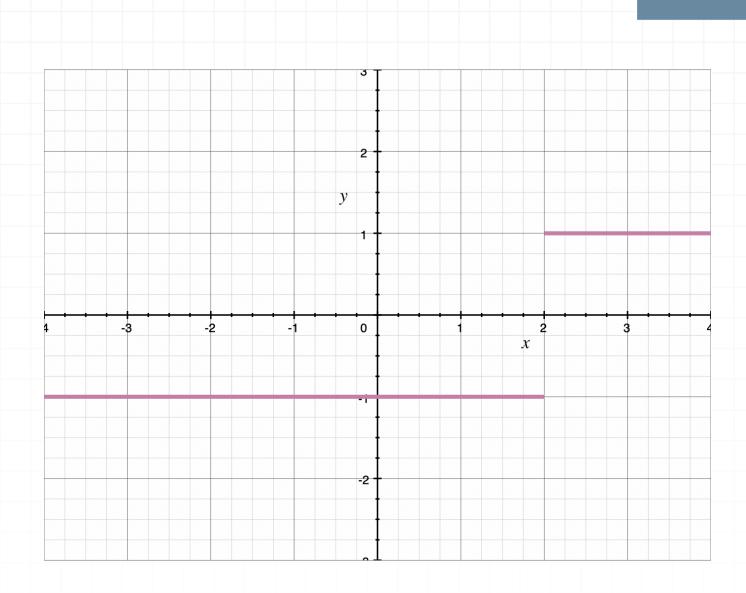
$$\frac{|2.0001 - 2|}{2.0001 - 2}$$

$$\frac{0.0001}{0.0001}$$

1

As we approach x=2 from the right, the function is a constant 1 (the numerator is always positive and the denominator is always positive). The graph of the function confirms this value for the right-hand limit.







**Topic**: One-sided limits

Question: Find the limit.

$$\lim_{x \to 2} \frac{|x-2|}{x-2}$$

# **Answer choices:**

A -1

B 1

C -2

D Does not exist (DNE)

# Solution: D

We can see the left-hand limit of the function at x = 2 if we try substituting x = 1.9999.

$$\frac{|1.9999 - 2|}{1.9999 - 2}$$

$$\frac{|-0.0001|}{-0.0001}$$

$$\frac{0.0001}{-0.0001}$$

$$-1$$

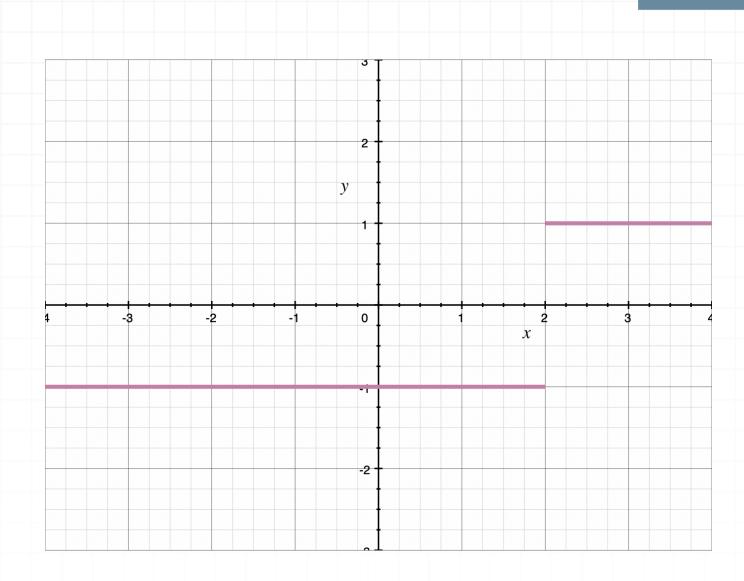
We can see the right-hand limit of the function at x = 2 if we try substituting x = 2.0001.

$$\frac{|2.0001 - 2|}{2.0001 - 2}$$

$$\frac{0.0001}{0.0001}$$

1

The graph of the function confirms these one-sided limits.



Because the one-sided limits aren't equivalent, the general limit of the function doesn't exist at x = 2.