# One-Sided Limits

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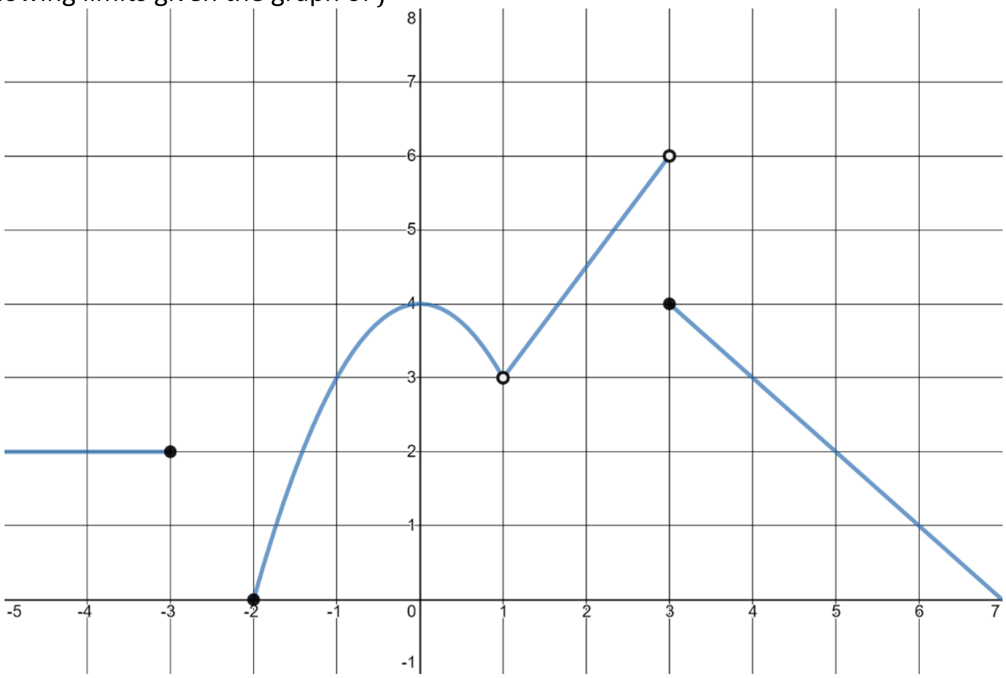
| **Goal**:<br>• Can determine the value of the limit using left and right-hand approaches<br>• Can use the definition of continuity alongside piecewise functions |
| **Terminology**:<br>• Continuous |

**Review**

Determine the following limits given the graph of $f$




1. $\lim_{x \to -4} f(x) =$
2. $\lim_{x \to 1} f(x) =$
3. $\lim_{x \to 3} f(x) =$

**Group:** What about $\lim_{x \to -2} f(x)$? Note that $f(x)$ is undefined for $x \in (-3, -2)$.

This gives us another definition of the limit as $x$ approaches $c$.

We are going to use this definition in conjunction with the definition of continuity.

**Continuity** Definition: A function is continuous at the point $c$ if and only if the following is true.

$$f(c) = \lim_{x \to c^+} f(x) = \lim_{x \to c^-} f(x)$$

**Note that this implies two things aside from the obvious that the limit is the value of the function

1.
2.

**Example**: Determine when the following function is **discontinuous** (not continuous)

$$f(x) = \begin{cases} 1 + x, & x < 0 \\ \sqrt{1 + x}, & 0 < x < 3 \\ 2, & x \geq 3 \end{cases}$$

**Practice**: Determine when the following function is **discontinuous** (not continuous) and add statements to make it continuous.

$$g(x) = \begin{cases} (x + 2)^2, & x \leq -1 \\ 2x + 3, & -1 < x < 4 \\ x + 8, & x > 4 \end{cases}$$

**Practice Problems**: 1.3: # 1-4*, 5-10 (every other), 11, 12, 14

 13, Problems Plus

* are warm up questions – do what you need