Limits — One-sided limits

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last updated: February 13, 2019

Summary: This document provides you a few one-sided limit problems and their solutions
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One-sided limits

1. Let

$$f(x) = \begin{cases} x+2, & \text{if } x < 0 \\ 3x-7, & \text{if } x \geq 0 \end{cases},$$

then

$$\lim_{x \to 0^+} f(x) = ?$$

Solution:

$$\begin{aligned} \lim_{x \to 0^+} f(x) &= \lim_{x \to 0^+} (3x-7) \\ &= 0-7 \\ &= 7. \end{aligned}$$

2. Let

$$f(x) = \begin{cases} x+2, \text{ if } x < 0 \\ 3x-7, \text{ if } x \geq 0 \end{cases}$$

then

$$\lim_{x \to 0^-} \ f(x) = ?$$

Solution:

$$\begin{aligned} \lim_{x \to 0^-} \ f(x) &= \lim_{x \to 0^-} (x+2) \\ &= 0+2 \\ &= 2. \end{aligned}$$

3. Let

$$f(x) = \begin{cases} x+2, & \text{if } x < 0 \\ 3x-7, & \text{if } x \geq 0 \end{cases},$$

then

$$\lim_{x \to 0} \ f(x) = ?$$

Solution:

$$\lim_{x \to 0} \ f(x) \text{ does not exist}$$

since

$$\lim_{x \to 0^+} \ f(x) \neq \lim_{x \to 0^-} \ f(x).$$

Recall from the previous two questions that

$$\lim_{x \to 0^-} \ f(x) = 2$$

and

$$\lim_{x \to 0^+} \ f(x) = -7.$$