

Using the Document

LimitSliders.tns: This calculator file provides a technology tool for investigating the limit of an arbitrary function as x approaches a specific value from the left and from the right. In a separate calculator problem, the user can investigate the limit of a function as x increases or decreases without bound, that is, as $x \rightarrow \infty$ or as $x \rightarrow -\infty$. A short table of values for each type of limit is also automatically computed and displayed in a Lists and Spreadsheet page.

The default limits are

$$\lim_{x \rightarrow 3} \frac{x^2 - 9}{3 - x} \quad (\text{calculator problem 2})$$

and

$$\lim_{x \rightarrow \infty} \tan^{-1} x \quad \text{and} \quad \lim_{x \rightarrow -\infty} \tan^{-1} x \quad (\text{calculator problem 3})$$

Suggested Applications and Extensions

Use Pages 2.1 and 2.2 to estimate the value of the limit, if it exists.

1. $\lim_{x \rightarrow 0} \frac{\sin x}{x}$

2. $\lim_{x \rightarrow 1} \frac{\ln x}{x - 1}$

3. $\lim_{h \rightarrow 0} \frac{(2 + h)^4 - 16}{h}$

4. $\lim_{x \rightarrow 0} \frac{x}{e^{2x} - 1}$

5. $\lim_{x \rightarrow 0} \frac{\tan(2x)}{\sin(5x)}$

6. $\lim_{x \rightarrow 0} |x|^x$

7. $\lim_{x \rightarrow 4} [\sin x + \ln|x - 4|]$

8. $\lim_{x \rightarrow 0} x^2 - \frac{2^x}{10000}$

9. $\lim_{x \rightarrow 0} \sin \frac{1}{x}$

10. $\lim_{x \rightarrow 0} \frac{1}{1 + e^{1/x}}$

11. $\lim_{x \rightarrow 0} f(x)$ where $f(x) = \begin{cases} -(x^2 + 1) & x < 0 \\ e^x & x \geq 0 \end{cases}$

Use Pages 3.1 and 3.2 to estimate the value of the limit, if it exists.

1.
$$\lim_{x \rightarrow \infty} \frac{3x^2 + 7x - 11}{15 - 2x - 9x^2}$$

2.
$$\lim_{x \rightarrow -\infty} \sqrt{\frac{7x^2 - x - 1}{11 - x + 5x^2}}$$

3.
$$\lim_{x \rightarrow \infty} \frac{\sqrt{x} + x}{5x - 3}$$

4.
$$\lim_{x \rightarrow \infty} (\sqrt{3x^2 + 5} - x) \quad \text{and} \quad \lim_{x \rightarrow -\infty} (\sqrt{3x^2 + 5} - x)$$

5.
$$\lim_{x \rightarrow \infty} \frac{x^3}{3^x} \quad \text{and} \quad \lim_{x \rightarrow -\infty} \frac{x^3}{3^x}$$

6.
$$\lim_{x \rightarrow \infty} \frac{\ln|x|}{x} \quad \text{and} \quad \lim_{x \rightarrow -\infty} \frac{\ln|x|}{x}$$

7.
$$\lim_{x \rightarrow \infty} \frac{\sqrt{3x^2 + 7}}{2x + 5} \quad \text{and} \quad \lim_{x \rightarrow -\infty} \frac{\sqrt{3x^2 + 7}}{2x + 5}$$

8.
$$\lim_{x \rightarrow \infty} \frac{\sin x}{e^x} \quad \text{and} \quad \lim_{x \rightarrow -\infty} \frac{\sin x}{e^x}$$

9.
$$\lim_{x \rightarrow \infty} (\sqrt{x^2 + 3x + 7} - \sqrt{3x^2 - 7x - 5})$$

10.
$$\lim_{x \rightarrow \infty} \frac{e^{-x}}{\tan^{-1} x} \quad \text{and} \quad \lim_{x \rightarrow -\infty} \frac{e^{-x}}{\tan^{-1} x}$$