

Calculus/Limits/Exercises

Basic Limit Exercises

1. $\lim_{x \rightarrow 2} [4x^2 - 3x + 1]$

2. $\lim_{x \rightarrow 5} [x^2]$

One-Sided Limits

Evaluate the following limits or state that the limit does not exist.

3. $\lim_{x \rightarrow 0^-} \frac{x^3 + x^2}{x^3 + 2x^2}$

4. $\lim_{x \rightarrow 7^-} [|x^2 + x| - x]$

5. $\lim_{x \rightarrow -1^-} \sqrt{1 - x^2}$

6. $\lim_{x \rightarrow -1^+} \sqrt{1 - x^2}$

Two-Sided Limits

Evaluate the following limits or state that the limit does not exist.

7. $\lim_{x \rightarrow -1} \frac{1}{x - 1}$

8. $\lim_{x \rightarrow 4} \frac{1}{x - 4}$

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

10. $\lim_{x \rightarrow -3} \frac{x^2 - 9}{x + 3}$

11. $\lim_{x \rightarrow 3} \frac{x^2 - 9}{x - 3}$

12. $\lim_{x \rightarrow -1} \frac{x^2 + 2x + 1}{x + 1}$

13. $\lim_{x \rightarrow -1} \frac{x^3 + 1}{x + 1}$

14. $\lim_{x \rightarrow 4} \frac{x^2 + 5x - 36}{x^2 - 16}$

15. $\lim_{x \rightarrow 25} \frac{x - 25}{\sqrt{x} - 5}$

16. $\lim_{x \rightarrow 0} \frac{|x|}{x}$

17. $\lim_{x \rightarrow 2} \frac{1}{(x - 2)^2}$

18. $\lim_{x \rightarrow 3} \frac{\sqrt{x^2 + 16}}{x - 3}$

19. $\lim_{x \rightarrow -2} \frac{3x^2 - 8x - 3}{2x^2 - 18}$

20. $\lim_{x \rightarrow 2} \frac{x^2 + 2x + 1}{x^2 - 2x + 1}$

21. $\lim_{x \rightarrow 3} \frac{x + 3}{x^2 - 9}$

22. $\lim_{x \rightarrow -1} \frac{x + 1}{x^2 + x}$

23. $\lim_{x \rightarrow 1} \frac{1}{x^2 + 1}$

24. $\lim_{x \rightarrow 1} \left[x^2 + 5x - \frac{1}{2 - x} \right]$

25. $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x^2 + 2x - 3}$

26. $\lim_{x \rightarrow 1} \frac{5x}{x^2 + 2x - 3}$

Limits to Infinity

Evaluate the following limits or state that the limit does not exist.

27. $\lim_{x \rightarrow \infty} \frac{-x + \pi}{x^2 + 3x + 2}$

28. $\lim_{x \rightarrow -\infty} \frac{x^2 + 2x + 1}{3x^2 + 1}$

29. $\lim_{x \rightarrow -\infty} \frac{3x^2 + x}{2x^2 - 15}$

30. $\lim_{x \rightarrow -\infty} [3x^2 - 2x + 1]$

31. $\lim_{x \rightarrow \infty} \frac{2x^2 - 32}{x^3 - 64}$

32. $\lim_{x \rightarrow \infty} 6$

33. $\lim_{x \rightarrow \infty} \frac{3x^2 + 4x}{x^4 + 2}$

34. $\lim_{x \rightarrow -\infty} \frac{2x + 3x^2 + 1}{2x^2 + 3}$

35. $\lim_{x \rightarrow -\infty} \frac{x^3 - 3x^2 + 1}{3x^2 + x + 5}$

36. $\lim_{x \rightarrow \infty} \frac{x^2 + 2}{x^3 - 2}$

Limits of Piecewise Functions

Evaluate the following limits or state that the limit does not exist.

37. Consider the function

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

a. $\lim_{x \rightarrow 2^-} f(x)$

b. $\lim_{x \rightarrow 2^+} f(x)$

c. $\lim_{x \rightarrow 2} f(x)$

38. Consider the function

$$g(x) = \begin{cases} -2x + 1 & \text{if } x \leq 0 \\ x + 1 & \text{if } 0 < x < 4 \\ x^2 + 2 & \text{if } x \geq 4 \end{cases}$$

a. $\lim_{x \rightarrow 4^+} g(x)$

b. $\lim_{x \rightarrow 4^-} g(x)$

c. $\lim_{x \rightarrow 0^+} g(x)$

d. $\lim_{x \rightarrow 0^-} g(x)$

e. $\lim_{x \rightarrow 0} g(x)$

f. $\lim_{x \rightarrow 1} g(x)$

39. Consider the function

$$h(x) = \begin{cases} 2x - 3 & \text{if } x < 2 \\ 8 & \text{if } x = 2 \\ -x + 3 & \text{if } x > 2 \end{cases}$$

a. $\lim_{x \rightarrow 0} h(x)$

b. $\lim_{x \rightarrow 2^-} h(x)$

c. $\lim_{x \rightarrow 2^+} h(x)$

d. $\lim_{x \rightarrow 2} h(x)$

External Links

- [Limits 1 exercise at Khan Academy \(http://www.khanacademy.org/exercise/limits_1\)](http://www.khanacademy.org/exercise/limits_1)
- [Limits 2 exercise at Khan Academy \(http://www.khanacademy.org/exercise/limits_2\)](http://www.khanacademy.org/exercise/limits_2)

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