1.2 Limits Analytically

Calculus | Name: ______________________________ | **Practice**

Evaluate each limit.

1. $\lim_{x \to 2} (x - x^2)$
2. $\lim_{x \to 5} (x + 1)^2$
3. $\lim_{x \to 1} \frac{x^2 - 5x}{x - 1}$
4. $\lim_{x \to 1} \frac{x^2 + x - 30}{x - 1}$
5. $\lim_{x \to 0} \frac{\sqrt{x+7} - \sqrt{7}}{x}$
6. $\lim_{x \to 7} \frac{\sqrt{x+9} - 4}{x - 7}$
7. $\lim_{x \to 0} \frac{3x}{\sin x}$
8. $\lim_{x \to 0} \frac{\sin(2x)}{3x}$
9. $\lim_{x \to -2} (3x^2 - x + 1)$
10. $\lim_{x \to 3} (2x^2 + 5x - 6)$
11. $\lim_{x \to -7} \frac{2x^3 + 11x^2 - 21x}{x^2 + 7x}$
12. $\lim_{x \to 8} \frac{x^2 + 2x - 80}{x - 8}$
13. $\lim_{x \to 0} \frac{\sqrt{x+9} - 3}{x}$
14. $\lim_{x \to 0} \frac{\sqrt{x+11} - \sqrt{11}}{x}$
15. $\lim_{x \to 5} \sqrt{4x - 9}$
16. $\lim_{x \to -1} \sqrt{3 - x}$
17. $\lim_{h \to 0} \frac{\frac{1}{x+h} - \frac{1}{x}}{h}$
18. $\lim_{h \to 0} \frac{5\sqrt{x+h} - 5\sqrt{x}}{h}$
19. $\lim_{x \to 0} \frac{\sin(5x)}{\sin(8x)}$
20. $\lim_{x \to 0} \frac{\sin(4x)}{\sin(2x)}$
21. $\lim_{x \to 1} 3$
22. $\lim_{x \to -3} 14$
23. $\lim_{x \to 2} \frac{\sqrt{5x - 6}}{x}$
24. $\lim_{x \to \frac{\pi}{2}} \tan\left(\frac{x}{2}\right)$

25. $\lim_{x\to\frac{1}{3}} \frac{6x^2+13x-5}{3x-1}$

26. $\lim_{x\to 0} \frac{7x^2+x}{x}$

27. $\lim_{x\to 0} \frac{\frac{1}{x+3}-\frac{1}{3}}{x}$

28. $\lim_{x\to 0} \frac{\frac{1}{(x+2)^2}-\frac{1}{4}}{x}$

29. $\lim_{x\to 0} \frac{\tan(6x)}{\sin(5x)}$

30. $\lim_{x\to 0} \frac{(1-\cos^2 x)\sin x}{x^2}$

31. $\lim_{x\to 0}(-2)$

32. $\lim_{x\to 1} \frac{\sqrt{x+5}+\sqrt{6}}{x}$

33. $\lim_{x\to 0} \frac{x^2+2x-8}{x-4}$

34. $\lim_{x\to -2} \frac{x^2-4x-10}{x}$

35. $\lim_{x\to 0} \frac{3x^2+5x}{x}$

36. $\lim_{x\to 4} \frac{5x^2-21x+4}{x-4}$

37. $\lim_{h\to 0} \frac{(x+h)^2+6(x+h)-(x^2+6x)}{h}$

38. $\lim_{h\to 0} \frac{4(x+h)^2-5(x+h)-2-(4x^2-5x-2)}{h}$

39. $\lim_{x\to 0} \frac{\sin^2(7x)}{\sin^2(9x)}$

40. $\lim_{x\to 0} \frac{5x}{\tan(4x)}$

41. $\lim_{x\to\frac{1}{2}} \frac{1-x-2x^2}{2x-1}$

42. $\lim_{x\to\pi} \cos x$

43. $\lim_{x\to\frac{\pi}{8}} \sin(4x)$

44. $\lim_{x\to 2} \frac{x^2+6x-16}{2-x}$

45. $\lim_{x\to 5} \frac{2x^2-17x+35}{5-x}$

46. $\lim_{x\to 0} \frac{x\cot(5x)}{\cos(5x)}$

47. $\lim_{h\to 0} \frac{6-3(x+h)-(6-3x)}{h}$

Using the following piecewise functions, find the given values.

$g(x) = \begin{cases} \sqrt{5-x}, & x < -4 \\ x^2 - 5, & -4 \le x < 2 \\ x - 3, & x \ge 2 \end{cases}$	$h(x) = \begin{cases} -\lvert x \rvert, & x \le -5 \\ 20 - x^2, & -5 < x \le 3 \\ 4x - 1, & x > 3 \end{cases}$	$w(\theta) = \begin{cases} \sin\theta, & \theta \le \pi \\ \cos\theta, & \pi < \theta < 2\pi \\ \tan\theta, & \theta > 2\pi \end{cases}$
$\lim_{x\to 2^-} g(x) =$	$\lim_{x\to -5^+} h(x) =$	$\lim_{x\to \pi^-} w(\theta) =$
$\lim_{x\to -4^+} g(x) =$	$\lim_{x\to -5} h(x) =$	$w(\pi) =$
$g(2) =$	$h(3) =$	$\lim_{x\to \pi^+} w(\theta) =$
$\lim_{x\to -4^-} g(x) =$	$\lim_{x\to -5^-} h(x) =$	$\lim_{x\to 2\pi^-} w(\theta) =$
$\lim_{x\to 2^+} g(x) =$	$\lim_{x\to 3^+} h(x) =$	$\lim_{x\to \pi} w(\theta) =$
$\lim_{x\to 2} g(x) =$	$\lim_{x\to 3} h(x) =$	$\lim_{x\to 2\pi^+} w(\theta) =$
$\lim_{x\to -4} g(x) =$	$h(-5) =$	$\lim_{x\to 2\pi} w(\theta) =$
$g(-4) =$	$\lim_{x\to 3^-} h(x) =$	$w(2\pi) =$

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Test Prep

1. $\lim_{x\to -1} \cos(\pi x) =$

(A) π (B) 1 (C) 0 (D) -1 (E) The limit does not exist

2. If $f(x) = \begin{cases} \ln 3x, & 0 < x \le 3 \\ x \ln 3, & 3 < x \le 4 \end{cases}$, then $\lim_{x\to 3} f(x)$ is

(A) $\ln 9$ (B) $\ln 27$ (C) $3\ln 3$ (D) $3 + \ln 3$ (E) nonexistent

3. Evaluate $\lim_{x\to 1} \frac{\ln x}{3x}$ is

(A) 0 (B) $\frac{3}{e}$ (C) e (D) 3 (E) The limit does not exist.

4. $\lim_{x\to 0} 4\frac{\sin x\cos x - \sin x}{x^2}$ is

(A) 2 (B) $\frac{40}{3}$ (C) ∞ (D) 0 (E) undefined

5. $\lim_{x\to 0} \frac{\tan^3(2x)}{x^3} =$

(A) -8 (B) -2 (C) 2 (D) 8 (E) The limit does not exist.

6. $\lim_{x\to a} \frac{x^2-2ax+a^2}{x-a} =$

(A) $-\infty$ (B) a (C) 0 (D) ∞ (E) The limit does not exist.

7. Let $f(x) = \begin{cases} \frac{\sin x}{x}, & x \geq 0 \\ \cos x, & x < 0 \end{cases}$ Which of the following statements about $f(x)$ is true?

I. $\lim_{x\to 0^+} f(x) = 1$

II. $\lim_{x\to 0^-} f(x) = 1$

III. $\lim_{x\to 0} f(x) = 1$

(A) None of these statements are true. (B) I only (C) II only (D) I and II only (E) I, II, and III

8. $\lim_{x\to 0} \left(\frac{3x^2+5\cos x-5}{2x}\right) =$

(A) 0 (B) $\frac{5}{2}$ (C) 3 (D) 4 (E) Does not exist

9. If $f(x) = \begin{cases} \ln x & \text{for } 0 < x \leq 2 \\ x^2 \ln 2 & \text{for } 2 < x \leq 4, \end{cases}$ then $\lim_{x\to 2} f(x)$ is

(A) $\ln 2$ (B) $\ln 8$ (C) $\ln 16$ (D) 4 (E) nonexistent