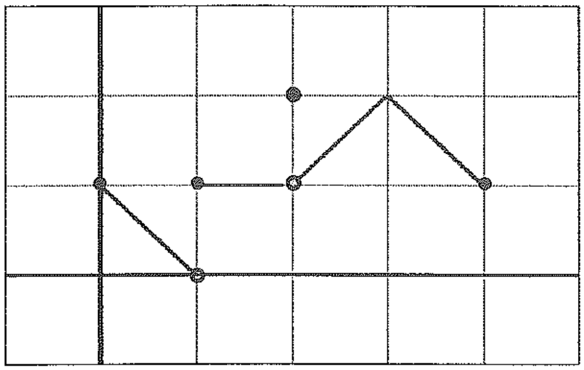
Calculus

Limits, Continuity Organizer

About $f(x)$ at *a*:	**About $\lim_{x\to a} f(x)$:**	**Examples?** **$f(x)$ looks like?**
$f(a)$ is undefined, AND	$\lim_{x\to a} f(x)$ does not exist	
$f(a)=P$, AND	$\lim_{x\to a} f(x)$ does not exist	
$f(a)\neq L$, AND	$\lim_{x\to a} f(x)=L$	
$f(a)=L$, AND	$\lim_{x\to a} f(x)=L$	

Given the following graph, state for what values of x the function is discontinuous and state why it is discontinuous at that point. Also state what type of discontinuity it is and whether it is removable or nonremovable. Explain how any removable discontinuities should be defined or redefined to make the function continuous.



Where?	Why?	Type	Removable (R) or Nonremovable (NR)	If R, what values makes it continuous?

Find the value of k that makes the function continuous.

$$f(x) = \begin{cases} \dfrac{9x^2 - 4}{3x + 2} & \text{if } x \neq -\frac{2}{3} \\ k & \text{if } x = -\frac{2}{3} \end{cases}$$

At what points, if any, is the function $f(x) = \dfrac{x - 4}{x^2 - x - 12}$ discontinuous?

CALCULUS

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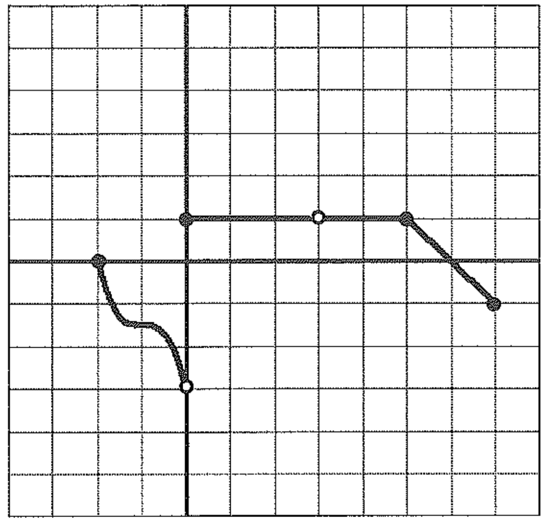
WORKSHEET L.1-2

Based on the graph evaluate the following.



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

2. $\lim_{x\to 0^+} f(x) =$ _____

3. $\lim_{x\to 0} f(x) =$ _____

4. $\lim_{x\to 1^-} f(x) =$ _____

5. $\lim_{x\to 1^+} f(x) =$ _____

6. $\lim_{x\to 1} f(x) =$ _____

7. $\lim_{x\to 5} f(x) =$ _____

8. $f(1) =$ _____

9. $f(0) =$ _____

10. $f(-2) =$ _____

11. $\lim_{x\to 6^-} f(x) =$ _____

12. $\lim_{x\to 6^+} f(x) =$ _____

13. $\lim_{x\to 6} f(x) =$ _____

14. $f(6) =$ _____

15. $\lim_{x\to 3} f(x) =$ _____

16. $f(3) =$ _____

17. $\lim_{x\to -1} f(x) \approx$ _____

18. $f(-1) \approx$ _____

19. True or False: $\lim_{x\to c} f(x)$ exists at every c on (1,3)

20. True or False: $\lim_{x\to c} f(x)$ exists at every c on (−2,1)

Evaluate the following.

21. $\lim_{x\to 9} x =$ _____

22. $\lim_{x\to -30} x =$ _____

23. $\lim_{x\to 2} 5 =$ _____

24. $\lim_{x\to 0} 6 =$ _____

25. $\lim_{x\to 1}\left(12x^3 + x^2 - 1\right) =$ _____

26. $\lim_{x\to -5}\left(3(x-1)\right) =$ _____

27. $\lim_{x\to 5} \dfrac{x+1}{x+2} =$ _____

28. $\lim_{x\to 3} \dfrac{x^2-5x+6}{x-3} =$ _____

29. $\lim_{x\to -7} \dfrac{x+7}{x^2-49} =$ _____

30. $\lim_{x\to \pi}\left(\cos x \sin x\right) =$ _____

31. $\lim_{x\to 0} \dfrac{(x-6)^2-36}{x} =$ _____

32. $\lim_{x\to 4} \dfrac{4-x}{2-\sqrt{x}} =$ _____

33. $\lim_{x\to 2}\left(x^2 - x + 2\right) =$ _____

34. $\lim_{x\to -3} \dfrac{x^2-2x}{x} =$ _____

35. $\lim_{x \to -1} \frac{x^2 - 1}{x + 1}$ = ____

36. $\lim_{x \to -1} \frac{2x^2 - x - 3}{x + 1}$ = ____

37. $\lim_{x \to -3} \frac{2x + 1}{x - 3}$ = ____

38. $\lim_{x \to 3^+} \frac{x + 1}{x + 2}$ = ____

39. $\lim_{x \to 4^-} \frac{\sqrt{x} - 2}{x - 4}$ = ____

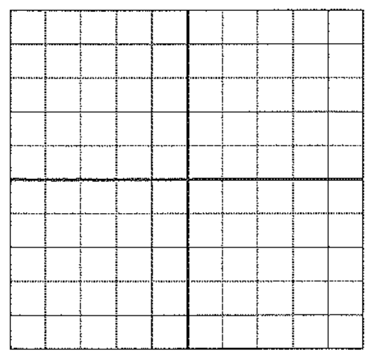
40. $\lim_{x \to 1^-} \frac{x^2 - 2x + 1}{x - 1}$ = ____

41. $\lim_{x \to 3} \frac{\sqrt{x+1} - 2}{x - 3}$ = ____

42. $\lim_{x \to 0} \frac{x}{x^2 - 3x}$ = ____

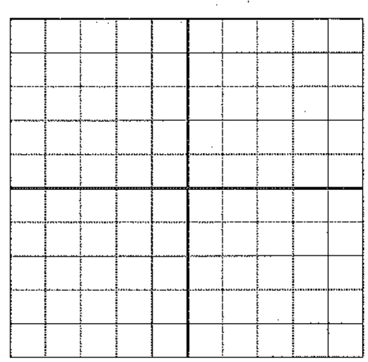
43. $\lim_{x \to 1} f(x), \; f(x) = \begin{cases} 1 - 2x, & x \le 1 \\ x - 3, & x > 1 \end{cases}$

(a graph may help)



44. $\lim_{x \to -1} f(x), \; f(x) = \begin{cases} x + 2, & x < -1 \\ x^2, & x > 1 \end{cases}$

(a graph may help)



45. Suppose $\lim_{x \to 4} f(x) = 2$ and $\lim_{x \to 4} g(x) = -5$, find the $\lim_{x \to 4} 3[f(x) - 2g(x)]$

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WORKSHEET L.2-1

Find the limits.

1. $\lim\limits_{x\to-\infty}\dfrac{5x+1}{x-1}=$

2. $\lim\limits_{x\to\infty}\dfrac{2x+7}{x^2-x}=$

3. $\lim\limits_{x\to\infty}\dfrac{3-2x}{x+5}=$

4. $\lim\limits_{x\to-\infty}\dfrac{2x^2-x+5}{5x^2+6x-1}=$

5. $\lim\limits_{x\to\infty}\dfrac{4x^2-2x+3}{3x-1}=$

6. $\lim\limits_{x\to-\infty}\dfrac{3x^3-x+1}{6x^3+2x^2-7}=$

7. $\lim\limits_{x\to-\infty}\dfrac{-3x^3-6x^2+4x-3}{-2x^2+5x}=$

8. $\lim\limits_{x\to\infty}\dfrac{(3x-2)(2x+4)}{(2x+1)(x+2)}=$

9. $\lim\limits_{x\to\infty}\dfrac{(-3x-1)(-2x+4)(-5x-3)}{(-6x-1)(-2x+3)}=$

10. $\lim\limits_{x\to-\infty}\dfrac{3x^3-4x+1}{(x^2+1)(x^2-1)}=$

11. $\lim\limits_{x\to-\infty}\dfrac{(2x+1)^2}{(x-3)(x+5)}=$

12. $\lim\limits_{x\to\infty}\dfrac{3x\sqrt{x}+3x+1}{x^2-x+11}=$

13. $\lim\limits_{x\to-\infty}\dfrac{3x^{-2}+6x^{-6}}{5x^{-3}}=$

14. $\lim\limits_{x\to-\infty}\dfrac{\frac{1}{x}-\frac{3}{x^2}}{\frac{5}{x}+\frac{6}{x^4}}=$

15. $\lim\limits_{x\to\infty}\dfrac{\sqrt[3]{x}+\sqrt[4]{x}}{\sqrt[2]{x}-\sqrt[6]{x}}=$

16. $\lim\limits_{x\to\infty}\left(3-x^3\right)=$

17. $\lim\limits_{x\to\infty}\left(-\dfrac{5}{x}+6\right)=$

18. $\lim\limits_{x\to\infty}\left(\dfrac{4x-1}{5x+3}-\dfrac{-3x-4}{5x-1}+\dfrac{7x}{2x^2+1}\right)=$

19. $\lim\limits_{x\to\infty}\left(\dfrac{3x^2-2x+5}{5x^3-7x+6}\cdot\dfrac{8x^2-6}{3x^3+1}\right)=$

20. $\lim\limits_{x\to-\infty}\dfrac{\left(\frac{5x-3}{2x+4}\right)}{\left(\frac{10x+6}{6x-2}\right)}=$

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WORKSHEET L.2-2

Evaluate the following.

1. $\lim_{x\to 0^-} \frac{1}{x} =$

2. $\lim_{x\to 0^+} \frac{1}{x} =$

3. $\lim_{x\to 0} \frac{1}{x} =$

4. $\lim_{x\to \infty} \frac{1}{x} =$

5. $\lim_{x\to 0} \frac{1}{x^2} =$

6. $\lim_{x\to \infty} \frac{2-6x}{5x+1} =$

7. $\lim_{x\to \infty} \frac{3x-1}{2x+1} =$

8. $\lim_{x\to \infty} \frac{7x^2+3x+1}{2x^2+6} =$

9. $\lim_{x\to -\infty} \frac{16x^4-3}{5x^4+x^3-8} =$

10. $\lim_{x\to \infty} \frac{1}{x^2+1} =$

11. $\lim_{x\to -\infty} \frac{x}{x^3+2} =$

12. $\lim_{x\to \infty} \frac{5}{2x} =$

13. $\lim_{x\to \infty} \frac{2x^2+1}{x} =$

14. $\lim_{x\to -\infty} \frac{3x^3+x}{5} =$

15. $\lim_{x\to \infty} \frac{x^2-3x+1}{x-4} =$

16. $\lim_{x\to \infty} \frac{1}{x^2} =$

17. $\lim_{x\to 2^+} \frac{x+1}{x+2} =$

18. $\lim_{x\to 5^+} \frac{x^2-25}{x-5} =$

19. $\lim_{x\to -\infty} \frac{x^2-1}{x-1} =$

20. $\lim_{x\to \infty} \frac{2x}{9} =$

21. $\lim_{x\to \infty} 3 =$

22. $\lim_{x\to \infty} \frac{x}{x-3} =$

23. $\lim_{x\to 6^+} \frac{x+6}{x^2-36} =$

24. $\lim_{x\to 0} \frac{6x-9}{x^3-12x+3} =$

25. $\lim_{x\to 0^+} (5x-1) =$

26. $\lim_{x\to 6} \frac{x+6}{x^2-36} =$

27. $\lim_{x\to \infty} \frac{6x^2-9}{x^3-12x+3} =$

28. $\lim_{x\to 4^+} \frac{3}{x-4} =$

29. $\lim_{x\to 6} \frac{x-6}{x^2-36} =$

30. $\lim_{x\to 2} \frac{x^2-4x+4}{x^2+x-6} =$

31. $\lim_{x\to 4^-} \frac{3}{x-4} =$

32. $\lim_{x\to \infty} \frac{x-6}{x^2-36} =$

33. $\lim_{x\to -2} \frac{x^2-4x+4}{x^2+x-6} =$

34. $\lim_{x\to 4} \frac{3}{x-4} =$

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

36. $\lim_{x\to \infty} \frac{x^2-4x+4}{x^2+x-6} =$

37. $\lim_{x\to -\infty} (2-x^2) =$

38. $\lim_{x\to -\infty} \frac{3-4x-x^2}{x+1} =$

39. $\lim_{x\to 3^-} \frac{x}{x-3} =$

40. $\lim_{x\to -\infty} (2-x) =$

41. $\lim_{x\to \infty} \frac{5-x^2}{x} =$

42. $\lim_{x\to \infty} \frac{x^2}{x-3} =$

43. $\lim_{x\to -\infty} \frac{x^{-4}-2x^{-5}}{x^{-2}+4x^{-6}} =$

44. $\lim_{x\to \infty} \frac{\frac{1}{x^2}}{-\frac{1}{x^4}+\frac{1}{x^3}} =$

45. $\lim_{x\to -\infty} \left(\frac{2}{x^2}-3+\frac{6x-1}{-2x+4}\right) =$