<u>Calculators are NOT permitted.</u>

Evaluate each limit.

1. $\lim\limits_{x \to 1} \dfrac{5 - x^2}{4x + 7}$

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

3. $\lim\limits_{x \to 3} \dfrac{\sqrt{x + 1} - 2}{x - 3}$

4. $\lim\limits_{y \to \frac{1}{3}} \dfrac{3y^2 + 5y - 2}{6y^2 - 5y + 1}$

5. $\lim\limits_{x \to 0} \dfrac{\sin 4x}{\sin 3x}$

6. $\lim\limits_{x \to 0^+} \dfrac{[\![x]\!]}{x}$

7. $\lim\limits_{x \to 5^+} \dfrac{x^2 - 24}{x^2 - 25}$

8. $\lim\limits_{x \to 0^+} \left(x - \dfrac{1}{x^3} \right)$

9. $\lim\limits_{x \to 1^-} \dfrac{x^2 + 2x + 1}{x - 1}$

10. $\lim\limits_{x \to \frac{\pi}{2}} \tan x$

11. Sketch the graph of a function $f(x)$ such that $\lim_{x \to 2^-} f(x) = 1$ and $\lim_{x \to 2^+} f(x) = 3$.
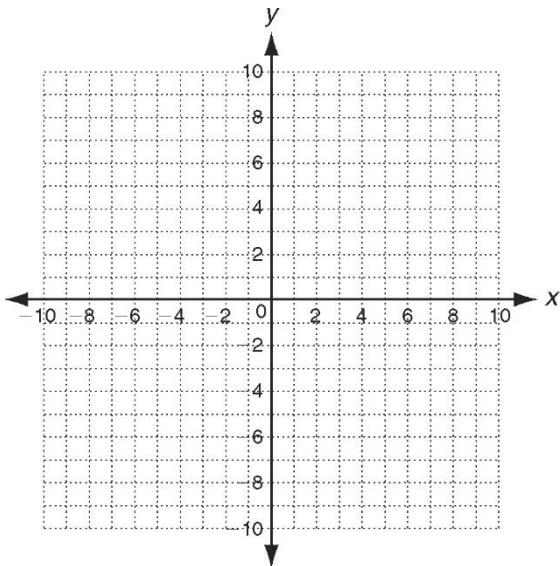
12. Let $(x) = \begin{cases} x^2 - 4, & x \neq 4 \\ 1, & x = 4 \end{cases}$. Find $\lim_{x \to 4} f(x)$.

13. Suppose that $\lim_{x \to c} f(x) = 14$ and $\lim_{x \to c} g(x) = -9$. Find the following.

   A. $\lim_{x \to c}[f(x) + g(x)]$ B. $\lim_{x \to c}[f(x) - g(x)]$

   C. $\lim_{x \to c}[f(x)g(x)]$ D. $\lim_{x \to c}[4f(x) - 3g(x)]$

14. True or false?

   A. If $\lim_{x \to 3} f(x)$ exists, then $\lim_{x \to 3} f(x) = f(3)$.

   B. If $\lim_{x \to 5^+} f(x) = 4$ and $\lim_{x \to 5^-} f(x) = 8$, then $\lim_{x \to 5} f(x) = 6$.

   C. $\lim_{x \to \pi} \frac{\sin x}{x} = 1$

   D. If f is undefined at $x = c$, then $\lim_{x \to c} f(x)$ does not exist.

   E. If $f(c) = L$, then $\lim_{x \to c} f(x) = L$.

   F. If $\lim_{x \to c} f(x) = L$, then $f(c) = L$.

15. Find the x-values (if any) at which the function $f(x) = \frac{x-1}{x^2-6x+5}$ is not continuous. Which of the discontinuities are removable? nonremovable?

16. If the function f is continuous for all real numbers and if $f(x) = \frac{x^2-7x+12}{x-4}$ when $x \neq 4$, then $f(4) =$

Find $\frac{dy}{dx}$.

17. $y = \frac{3x-2}{4x-9}$

18. $y = (x+1)^3(x+4)^4$

19. $y = \frac{x^4 + \sqrt{x}}{x^2}$

20. $y = 4\cos(2 - 3x)$

21. $y = \sin\left(\frac{4}{x}\right)$

22. $y = \tan(\cos x)$

23. $y = \frac{e^{-x}}{x}$

24. $y = x^2 e^{\frac{1}{x}}$

25. $y = \ln(e^x - 4x)$

26. $y = \frac{1+e^x}{1-e^x}$

27. $\frac{y}{x} = x + y$

28. $\sin x = \cos y$

29. $y = \ln x^2$

30. $y = \ln\left(\frac{x(x-1)}{x-2}\right)$

Find y''

31. $y = 12x^3 - 5x^2 + 3x$

32. $y = \tan x^2$

Calculate the indefinite integral.

33. $\int (4x^3 - 2x^2)dx$

34. $\int x^{\frac{9}{4}}dx$

35. $\int \sec^2 x\, dx$

36. $\int \tan 3\theta \sec 3\theta\, d\theta$

37. $\int (y+2)^4 dy$

38. $\int \frac{3x^3 - 9}{x^2}dx$

39. $\int e^{-4x}dx$

40. $\int \sin(4x - 9)dx$

41. $\int \frac{2x^3 + 3x}{(3x^4 + 9x^2)^5}dx$

42. $\int \sin^2(3\theta)\cos(3\theta)d\theta$

43. $\int e^{-2x} \sin(e^{-2x})dx$

44. $\int \frac{dx}{x\sqrt{\ln x}}$

Evaluate each definite integral.

45. $\int_0^\pi \sin x \, dx$

46. $\int_0^2 (12x^3 - 3x^2)dx$

47. $\int_0^1 \left(x^{\frac{7}{3}} - 2x^{\frac{1}{4}}\right) dx$

48. $\int_1^3 e^{4x-3}dx$

49. $\int_0^{\ln 3} e^{x-e^x} dx$

50. $\int_0^3 \frac{xdx}{x^2+9}$