

Exer. 1-48: Use theorems on limits to find the limit, if it exists.

- 1  $\lim_{x \rightarrow \sqrt{2}} 15$
- 3  $\lim_{x \rightarrow -2} x$
- 5  $\lim_{x \rightarrow 4} (3x - 4)$
- 7  $\lim_{x \rightarrow -2} \frac{x - 5}{4x + 3}$
- 9  $\lim_{x \rightarrow 1} (-2x + 5)^4$
- 11  $\lim_{x \rightarrow 3} (3x - 9)^{100}$
- 13  $\lim_{x \rightarrow -2} (3x^3 - 2x + 7)$

- 2  $\lim_{x \rightarrow 15} \sqrt{2}$
- 4  $\lim_{x \rightarrow 3} x$
- 6  $\lim_{x \rightarrow -2} (-3x + 1)$
- 8  $\lim_{x \rightarrow 4} \frac{2x - 1}{3x + 1}$
- 10  $\lim_{x \rightarrow -2} (3x - 1)^5$
- 12  $\lim_{x \rightarrow 1/2} (4x - 1)^{50}$
- 14  $\lim_{x \rightarrow 4} (5x^2 - 9x - 8)$

- 15  $\lim_{x \rightarrow \sqrt{2}} (x^2 + 3)(x - 4)$
- 17  $\lim_{x \rightarrow \pi} (x - 3.1416)$
- 19  $\lim_{s \rightarrow 4} \frac{6s - 1}{2s - 9}$
- 21  $\lim_{x \rightarrow 1/2} \frac{2x^2 + 5x - 3}{6x^2 - 7x + 2}$
- 23  $\lim_{x \rightarrow 2} \frac{x^2 - x - 2}{(x - 2)^2}$
- 25  $\lim_{x \rightarrow -2} \frac{x^3 + 8}{x^4 - 16}$
- 27  $\lim_{x \rightarrow 2} \frac{(1/x) - (1/2)}{x - 2}$

- 16  $\lim_{t \rightarrow -3} (3t + 4)(7t - 9)$
- 18  $\lim_{x \rightarrow \pi} (\frac{1}{2}x - \frac{1}{4})$
- 20  $\lim_{x \rightarrow 1/2} \frac{4x^2 - 6x + 3}{16x^3 + 8x - 7}$
- 22  $\lim_{x \rightarrow 2} \frac{x - 2}{x^3 - 8}$
- 24  $\lim_{x \rightarrow -2} \frac{x^2 + 2x - 3}{x^2 + 5x + 6}$
- 26  $\lim_{x \rightarrow 16} \frac{x - 16}{\sqrt{x} - 4}$
- 28  $\lim_{x \rightarrow -3} \frac{x + 3}{(1/x) + (1/3)}$

29  $\lim_{x \rightarrow 1} \left( \frac{x^2}{x - 1} - \frac{1}{x - 1} \right)$

30  $\lim_{x \rightarrow 1} \left( \sqrt{x} + \frac{1}{\sqrt{x}} \right)^6$

31  $\lim_{x \rightarrow 16} \frac{2\sqrt{x} + x^{3/2}}{\sqrt{x} + 5}$

32  $\lim_{x \rightarrow -8} \frac{16x^{2/3}}{4 - x^{4/3}}$

33  $\lim_{x \rightarrow 4} \sqrt{x^2 - 5x - 4}$

34  $\lim_{x \rightarrow -2} \sqrt{x^4 - 4x + 1}$

35  $\lim_{x \rightarrow 3} \sqrt[3]{\frac{2 + 5x - 3x^3}{x^2 - 1}}$

36  $\lim_{x \rightarrow \pi} \sqrt[5]{\frac{x - \pi}{x + \pi}}$

37  $\lim_{h \rightarrow 0} \frac{4 - \sqrt{16 + h}}{h}$

38  $\lim_{h \rightarrow 0} \left( \frac{1}{h} \right) \left( \frac{1}{\sqrt{1 + h}} - 1 \right)$

39  $\lim_{x \rightarrow 1} \frac{x^2 + x - 2}{x^5 - 1}$

40  $\lim_{x \rightarrow 2} \frac{x^2 - 7x + 10}{x^6 - 64}$

41  $\lim_{v \rightarrow 3} v^2(3v - 4)(9 - v^3)$

42  $\lim_{k \rightarrow 2} \sqrt{3k^2 + 4\sqrt[3]{3k + 2}}$

43  $\lim_{x \rightarrow 5^+} (\sqrt{x^2 - 25} + 3)$

44  $\lim_{x \rightarrow 3^-} x\sqrt{9 - x^2}$

45  $\lim_{x \rightarrow 3^+} \frac{\sqrt{(x - 3)^2}}{x - 3}$

46  $\lim_{x \rightarrow -10^-} \frac{x + 10}{\sqrt{(x + 10)^2}}$

47  $\lim_{x \rightarrow 5^+} \frac{1 + \sqrt{2x - 10}}{x + 3}$

48  $\lim_{x \rightarrow 4^+} \frac{\sqrt{x^2 - 16}}{x + 4}$

62  $\lim_{x \rightarrow 0} \frac{|x|}{\sqrt{x^4 + 4x^2 + 7}} = 0$

(Hint: Use  $f(x) = 0$  and  $g(x) = |x|$ .)

63  $\lim_{x \rightarrow 0} x \sin(1/x) = 0$

(Hint: Use  $f(x) = -|x|$  and  $g(x) = |x|$ .)

64  $\lim_{x \rightarrow 0} x^4 \sin(1/\sqrt[3]{x}) = 0$  (Hint: See Example 8.)

65 If  $0 \leq f(x) \leq c$  for some real number  $c$ , prove that  $\lim_{x \rightarrow 0} x^2 f(x) = 0$ .

66 If  $\lim_{x \rightarrow a} f(x) = L \neq 0$  and  $\lim_{x \rightarrow a} g(x) = 0$ , prove that  $\lim_{x \rightarrow a} [f(x)/g(x)]$  does not exist. (Hint: Assume there is a number  $M$  such that  $\lim_{x \rightarrow a} [f(x)/g(x)] = M$  and consider  $\lim_{x \rightarrow a} f(x) = \lim_{x \rightarrow a} [g(x) \cdot f(x)/g(x)]$ .)

67 Explain why  $\lim_{x \rightarrow 0} \left( x \sin \frac{1}{x} \right) \neq \left( \lim_{x \rightarrow 0} x \right) \left( \lim_{x \rightarrow 0} \sin \frac{1}{x} \right)$ .

68 Explain why  $\lim_{x \rightarrow 0} \left( \frac{1}{x} + x \right) \neq \lim_{x \rightarrow 0} \frac{1}{x} + \lim_{x \rightarrow 0} x$ .

69 Charles' law for gases states that if the pressure remains constant, then the relationship between the volume  $V$  that a gas occupies and its temperature  $T$  (in  $^{\circ}\text{C}$ ) is given by  $V = V_0(1 + \frac{1}{273}T)$ . The temperature  $T = -273^{\circ}\text{C}$  is

9. 81 11. 0 13. -13 15.  $5\sqrt{2}$  -20 17.  $\pi$  -3.1416 19. -23 21. -7 23. DNE 25. -3/8 27. -1/4  
 29. 2 31. 72/7 33. -2 35. -2 37. -1/8 39. 3/5 41. -810 43. 3 45. 1 47. 1/8 22. 1/12