8. Not continuous at $x = b$. $\lim_{x\to b} f(x) \neq f(b)$

9. Not continuous at $x = c$ since $\lim_{x\to c} f(x)$ does not exist.

10. Continuous at $x = d$

11. $\text{Lim}_{x\to -2} x^2(x+1) = (-2)^2(-2+1) = 4(-1) = -4$

12. $\text{Lim}_{x\to 3}(x+2)(x-5) = 5(-2) = -10$ **13.** $\text{Lim}_{x\to 3}\frac{x-3}{x^2} = \frac{3-3}{3^2} = \frac{0}{9} = 0$

14. $\text{Lim}_{x\to -1}\frac{x^2+1}{3x^2-2x+5} = \frac{2}{3+2+5} = \frac{1}{5}$

15. $\text{Lim}_{x\to -2}(\frac{x}{x+1})(\frac{3x+5}{x^2+x}) = (\frac{-2}{-1})(\frac{-1}{4-2}) = -1$

16. $\text{Lim}_{x\to 1}(\frac{1}{x+1})(\frac{x+6}{x})(\frac{3-x}{7}) = \frac{1}{2}\frac{7}{1}\frac{2}{7} = 1$ **17.** $\text{Lim}_{x\to 4}\sqrt{1-2x}$ does not exist.

18. $\text{Lim}_{x\to 5}\sqrt[4]{9-x^2}$ does not exist. **19.** $\lim_{x\to 1}\frac{x^2-1}{x-1} = \lim_{x\to 1} x+1 = 2$

20. $\text{Lim}_{x\to -5}\frac{x^2+3x-10}{x+5} = \lim_{x\to -5}\frac{(x+5)(x-2)}{x+5} = \lim_{x\to -5} x-2 = -7$

21. $\text{Lim}_{x\to 2}\frac{x-2}{x^2+x-6} = \lim_{x\to 2}\frac{x-2}{(x-2)(x+3)} = \lim_{x\to 2}\frac{1}{x+3} = \frac{1}{5}$

22. $\text{Lim}_{x\to 1}\frac{x^2-2x+1}{x^3-2x^2+x} = \lim_{x\to 1}\frac{1}{x} = 1$

23. $\text{Lim}_{x\to 0}\frac{(1+x)(2+x)-2}{x} = \lim_{x\to 0}\frac{3x+x^2}{x} = \lim_{x\to 0} 3+x = 3$

24. $\text{Lim}_{x\to 0}\frac{\frac{1}{2+x}-\frac{1}{2}}{x} = \lim_{x\to 0}\frac{2-(2+x)}{2(2+x)}\frac{1}{x} = \lim_{x\to 0}\frac{-1}{2(2+x)} = -\frac{1}{4}$

25. $\text{Lim}_{x\to\infty}\frac{2x+3}{5x+7} = \lim_{x\to\infty}\frac{2+\frac{3}{x}}{5+\frac{7}{x}} = \frac{2+0}{5+0} = \frac{2}{5}$

26. $\text{Lim}_{x\to\infty}\frac{2x^2+3}{5x^2+7} = \lim_{x\to\infty}\frac{2+\frac{3}{x^2}}{5+\frac{7}{x^2}} = \frac{2}{5}$

27. $\text{Lim}_{x\to -\infty}\frac{x^2-4x+8}{3x^3} = \lim_{x\to -\infty}\frac{\frac{1}{x}-\frac{4}{x^2}+\frac{8}{x^3}}{3} = 0$

28. $\text{Lim}_{x\to\infty}\frac{1}{x^2-7x+1} = \lim_{x\to\infty}\frac{\frac{1}{x^2}}{1-\frac{7}{x}+\frac{1}{x^2}} = \frac{0}{1-0+0} = 0$

29. $\text{Lim}_{x\to -\infty}\frac{x^2-7x}{x+1} = \lim_{x\to -\infty}\frac{x(x-7)}{x+1} = \lim_{x\to -\infty}\frac{x(1-\frac{7}{x})}{1+\frac{1}{x}} = -\infty$
because $\lim_{x\to -\infty}\frac{1-\frac{7}{x}}{1+\frac{1}{x}} = 1$.

30. $\text{Lim}_{x\to\infty}\frac{x^4+x^3}{12x^3+128} = \lim_{x\to\infty}\frac{x(x^3+x^2)}{12x^3+128} = \lim_{x\to\infty} x(\frac{1+\frac{1}{x}}{12+\frac{128}{x^3}}) = \infty$

31. $\text{Lim}_{x\to 3^+}\frac{1}{x-3} = \infty$ **32.** $\text{Lim}_{x\to 3^-}\frac{1}{x-3} = -\infty$

33. $\text{Lim}_{x\to 0^+}\frac{1}{x^2} = \infty$ **34.** $\text{Lim}_{x\to 0^-}\frac{1}{|x|} = \infty$

35. $\text{Lim}_{x\to 0}\frac{\sin 2x}{4x} = \lim_{x\to 0}\frac{1}{2}\frac{\sin 2x}{2x} = \frac{1}{2}\cdot 1 = \frac{1}{2}$

36. $\text{Lim}_{x\to 0}\frac{x+\sin x}{x} = \lim_{x\to 0}(1+\frac{\sin x}{x}) = 1+1 = 2$

37. $\text{Lim}_{x\to 0}\frac{\sin^3 2x}{x^3} = \lim_{x\to 0}(\frac{\sin 2x}{x})^3 = \lim_{x\to 0}(2\frac{\sin 2x}{2x})^3 = (2\cdot 1)^3 = 8$

38. $\text{Lim}_{x\to 0}\frac{2\csc 5x}{\csc 3x} = \lim_{x\to 0}\frac{2\sin 3x}{\sin 5x} = \lim_{x\to 0}\frac{2\sin 3x}{3x}\frac{5x}{\sin 5x}\frac{3x}{5x} = 2\cdot 1\cdot 1\cdot\frac{3}{5} = \frac{6}{5}$

39. a) the y-intercept is approximately 0.78.

b) The values are all close to 0.78

c) f appears to have a minimal value at $x = 0$.

d) $\text{Lim}_{x\to 0}\frac{\sec 2x\csc 9x}{\cot 7x} = \lim_{x\to 0}\frac{1}{\cos 2x}\frac{\sin 7x}{\cos 7x}\frac{1}{\sin 9x}$

$= \lim_{x\to 0}\frac{1}{\cos 2x}\frac{1}{\cos 7x}\frac{\sin 7x}{7x}\frac{1}{\frac{\sin 9x}{9x}}\frac{7x}{9x} = 1\cdot 1\cdot 1\cdot 1\cdot\frac{7}{9} = \frac{7}{9}$

40. a) 1.60 b) quite close for x in the range $[-0.1, 0.1]$

c) f appears to have a minimal value at $x = 0$.

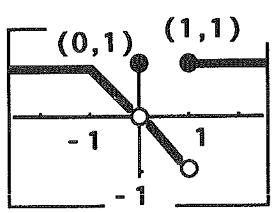
d) $\text{Lim}_{x\to 0}\frac{\sin 8x\cos 3x}{\sin 5x\cos 8x} = \lim_{x\to 0}\cos 3x\frac{1}{\cos 8x}\frac{\sin 8x}{8x}\frac{5x}{\sin 5x}\frac{8x}{5x} = 1\cdot 1\cdot 1\cdot 1\cdot\frac{8}{5} = 8/5$

41. a) $\lim_{x\to -2^+}\frac{x+3}{x+2} = \infty$ b) $\lim_{x\to 2^-}\frac{x+3}{x+2} = -\infty$. As $x\to -2$, $x+3$ is positive and $x+2$ is positive in a) but negative in b). The answer may be confirmed by graphing $y = \frac{x+3}{x+2}$.

42. a) $\lim_{x\to 2^+}\frac{x-1}{x^2(x-2)} = \infty$ b) $\lim_{x\to 2^-}\frac{x-1}{x^2(x-2)} = -\infty$

c) $\lim_{x\to 0^+}\frac{x-1}{x^2(x-2)} = \infty$ d) $\lim_{x\to 0^-}\frac{x-1}{x^2(x-2)} = \infty$

43. a)

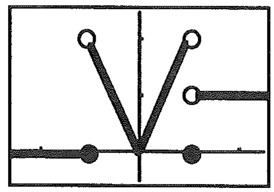


b) $\lim_{x\to -1^+} f(x) = 1$, $\lim_{x\to -1^-} f(x) = 1$, $\lim_{x\to 0^+} f(x) = 0$, $\lim_{x\to 0^-} f(x) = 0$, $\lim_{x\to 1^+} f(x) = 1$, $\lim_{x\to 1^-} f(x) = -1$

c) $\lim_{x\to -1} f(x) = 1$, $\lim_{x\to 0} f(x) = 0$ but $\lim_{x\to 1} f(x)$ does not exist because the right-hand and left-hand limits of f at 1 are not equal.

d) Only at $x = -1$

44. a)

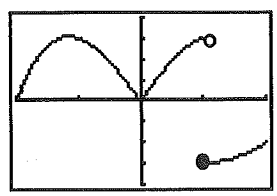


b) $\lim_{x\to -1^-} f(x) = 0$, $\lim_{x\to -1^+} f(x) = 2$, $\lim_{x\to 0^-} f(x) = 0$, $\lim_{x\to 0^+} f(x) = 0$, $\lim_{x\to 1^-} f(x) = 2$, $\lim_{x\to 1^+} f(x) = 1$

c) $\lim_{x\to 0} f(x) = 0$ but $\lim_{x\to -1} f(x)$ and $\lim_{x\to 1} f(x)$ do not exist because the left-hand and right-hand limits at $x = -1$ are not equal and the same is true at $x = 1$.

d) Only at $x = 0$.

45. a) A graph of f may be obtained by graphing the functions $y = abs(x^3 - 4x) + 0\sqrt{1-x}$ and $y = x^2 - 2x - 2 + 0\sqrt{x-1}$ in the viewing rectangle $[-5, 7]$ by $[-4, 10]$.



[-2,2] by [-4,4]

b) $\lim_{x\to 1^+} f(x) = \lim_{x\to 1^+}(x^2 - 2x - 2) = -3$.

$\lim_{x\to 1^-} f(x) = \lim_{x\to 1^-} |x^3 - 4x| = 3$

c) f does not have a limit at $x = 1$ because the right-hand and left-hand limits at $x = 1$ are not equal.

d) $x^3 - 4x$ is continuous by 2.2 Example 5 and $|x|$ is continuous by 2.2 Example 8. Thus $|x^3 - 4x|$ is continuous by Theorem 5 and so f is continuous for $x < 1$. For $x > 1$, $f(x) = x^2 - 2x - 2$, a polynomial, is continuous. Thus $f(x)$ is continuous at all points except $x = 1$.

e) f is not continuous at $x = 1$ because the two limits in b) are not equal and so $\lim_{x\to 1} f(x)$ does note exist.

46. a) A good idea of the graph is obtained by graphing $y = 1 - \sqrt{3-2x} + 0\sqrt{1.5-x}$ and $y = 1 + \sqrt{2x-3} + 0\sqrt{x-1.5}$ in the rectangle $[-2, 4]$ by $[-3, 5]$.

b) Both limits are equal to 1

c) $\lim_{x\to 3/2} f(x) = 1$

d) f is continuous at all points because $f(c) = \lim_{x\to c} f(x)$ for all points c.

e) There are no points of discontinuity because of d)

47. a) A graph of f is obtained by graphing $y = -x + 0\sqrt{1-x}$ and $y = x - 1 + 0\sqrt{x-1}$ in the rectangle $[-2, 4]$ by $[-2, 4]$.

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

c) No value assigned to $f(1)$ makes f continuous at $x = 1$.

48. a) The idea of a complete graph of f can be obtained by graphing $y = 3x^2 + 0\sqrt{1-x}$ and $y = 4 - x^2 + 0\sqrt{x-1}$ in the viewing rectangle $[-2, 4]$ by $[-2, 4]$.

b) $\lim_{x\to 1^+} f(x) = \lim_{x\to 1^-} f(x) = 3$

c) b) shows that $\lim_{x\to 1} f(x) = 3$ so define $f(1) = 3$.

49. f is not defined at $x = \pm 2$ so is not continuous at these points. By 2.2 Example 6 f is continuous at all other points.

50. $3x + 2$ and $\sqrt[3]{x}$ are continuous by Examples 5 and 7 of 2.2. Hence the composite, f, is continuous by Theorem 5. There are no discontinuities.

51. $\lim_{x\to\pm\infty} \frac{2x+1}{x^2-2x+1} = \lim_{x\to\pm\infty} \frac{\frac{2}{x}+\frac{1}{x^2}}{1-\frac{2}{x}+\frac{1}{x^2}} = \frac{0+0}{1-0+0} = 0$.

52. $\lim_{x\to\pm\infty} \frac{2x^2+5x-1}{x^2+2x} = \lim_{x\to\pm\infty} \frac{2+\frac{5}{x}-\frac{1}{x^2}}{1+\frac{2}{x}} = \frac{2+0-0}{1+0} = 2$. $y = 2$ is the end behavior asymptote.

53. By long division $h(x) = x^2 - x + \frac{3}{x-3}$. Thus $y = x^2 - x$ is the end behavior asymptote of h.

54. $T(x) = x - \frac{2x^2+1}{x^3-x+1}$. Thus $y = x$ is the end behavior asymptote of T.

55. a) $\lim_{x\to c} 3f(x) = 3\lim_{x\to c} f(x) = 3(-7) = -21$

b) $\lim_{x\to c}(f(x))^2 = \lim_{x\to c} f(x)\lim_{x\to c} f(x) = (-7)(-7) = 49$

c) $\lim_{x\to c} f(x)\cdot g(x) = \lim_{x\to c} f(x)\lim_{x\to c} g(x) = (-7)(0) = 0$

d) $\lim_{x\to c} \frac{f(x)}{g(x)-7} = \frac{\lim_{x\to c} f(x)}{\lim_{x\to c} g(x)-7} = \frac{-7}{0-7} = 1$

e) $\lim_{x\to c} \cos(g(x)) = \cos[\lim_{x\to c} g(x)] = \cos 0 = 1.$

f) $\lim_{x\to c} |f(x)| = |\lim_{x\to c} f(x)| = |-7| = 7.$

56. a) $\lim_{x\to 0} -g(x) = -\sqrt{2}$ b) $\lim_{x\to 0} g(x)\cdot f(x) = \sqrt{2}\cdot\frac{1}{2} = \frac{\sqrt{2}}{2}$

c) $\lim_{x\to 0}[f(x)+g(x)] = \frac{1}{2}+\sqrt{2}$ d) $\lim_{x\to 0}[1/f(x)] = 2$

e) $\lim_{x\to 0}[x+f(x)] = 0+\frac{1}{2} = \frac{1}{2}$ f) $\lim_{x\to 0} \frac{f(x)\cdot\sin x}{x} = \frac{1}{2}\cdot 1 = \frac{1}{2}$

57. Both 0 and $\sqrt{x}$ approach 0 as $x\to 0$. By the Sandwich Theorem $|\sqrt{x}\sin\frac{1}{x}|\to 0$ and hence $\sqrt{x}\sin\frac{1}{x}\to 0$ as $x\to 0$.

58. Both 0 and x^2 approach 0 as $x\to 0$. By the Sandwich Theorem $|x^2\sin\frac{1}{x}|\to 0$ and hence $x^2\sin\frac{1}{x}\to 0$ as $x\to 0$.

59. $\text{Lim}_{x\to\infty}\frac{x+\sin x}{x} = \lim_{x\to\infty}[1+\frac{\sin x}{x}] = 1+0 = 1$

60. $\text{Lim}_{x\to\infty}\frac{x+\sin x}{x+\cos x} = \lim_{x\to\infty}\frac{1+\frac{\sin x}{x}}{1+\frac{\cos x}{x}} = \frac{1+0}{1+0} = 1$

61. $-1 \leqq \sin x \leqq 1$. Hence $-\frac{1}{\sqrt{x}} \leqq \frac{\sin x}{\sqrt{x}} \leqq \frac{1}{\sqrt{x}}$ for $x>0$. Both $-\frac{1}{\sqrt{x}}$ and $\frac{1}{\sqrt{x}}$ approach 0 as $x\to\infty$. By the Sandwich Theorem $\lim_{x\to\infty}\frac{\sin x}{\sqrt{x}} = 0$.

62. $-\frac{1}{\sqrt{x}} \leqq \frac{\cos x}{\sqrt{x}} \leqq \frac{1}{\sqrt{x}}$. Since $\lim_{x\to\infty}\pm\frac{1}{\sqrt{x}} = 0$, $\lim_{x\to\infty}\frac{\cos x}{\sqrt{x}} = 0$.

63. $\text{Lim}_{x\to 3}\frac{x^2+2x-15}{x-3} = \lim_{x\to 3}\frac{(x-3)(x+5)}{x-3} = \lim_{x\to 3}(x+5) = 8$. In order to have $\lim_{x\to 3} f(x) = f(3) = k$, we should set $k = 8$.

64. $\text{Lim}_{x\to 0^+} x^x = 1$. The limit must be approached from the right-hand side only because x^x is defined only for $x>0$.

65. a) $\lim_{x\to 0^-} f(x) = 0$ b) $\lim_{x\to 0^+} f(x) = \infty$

c) The limit does not exist. To exist both one-sided limits must exist and be equal.

66. $\text{Lim}_{x\to 0}\frac{\sin x}{2x} = \frac{1}{2}\lim_{x\to 0}\frac{\sin x}{x} = \frac{1}{2}$. Thus the value $\frac{1}{2}$ should be assigned to k.

67. This is not a contradiction because $0<x<1$ is not a *closed* interval.

68. Let $y = f(x) = |x|$ on $-1 \leq x < 1$. This function attains its minimum ($f(0) = 0$) and its maximum ($f(-1) = 1$). This is not a contradiction of the theorem which is only a sufficient (not necessary) condition for the attainment of extreme values.

69. True because $0 = f(1) < 2.5 < f(2) = 3$ and so by Theorem 7, $2.5 = f(c)$ for some c in $[1, 2]$.

70. Let $f(x) = x + \cos x$. Then $f(x)$ is continuous. $f(-\pi/2) = -\frac{\pi}{2}$ and $f(0) = 1$. Thus $f(-\pi/2) < 0 < f(0)$. By Theorem 7, $f(c) = 0$ for some c in $[-\pi/2, 0]$.

71. Let $f(x) = x + \log x$. $f(\frac{1}{10}) = \frac{1}{10} - 1 < 0$. $f(1) = 1 > 0$. By the Intermediate Value Theorem there is a number c, $\frac{1}{10} < c < 1$ such that $f(c) = 0$. This means that c is a solution of the given equation.

72. $\text{Lim}_{x \to 1} f(x) = 3$ means given any radius $\varepsilon > 0$ about 3 there exists a radius $\delta > 0$ about 1 such that for all x $0 < |x - 1| < \delta$ implies $|f(x) - 3| < \varepsilon$.

73. $\text{Lim}_{x \to 0} \frac{\sin x}{x} = 1$ means given any radius $\varepsilon > 0$ about 1 there exists a radius $\delta > 0$ about 0 such that, for all x, $0 < |x - 0| < \delta$ implies $|f(x) - 1| < \varepsilon$.

74. Let $f(x) = x^2$. $f(x)$ gets closer to -1 as x approaches 0 but -1 is not equal to $\lim_{x \to 0} f(x)$.

75. This "definition" puts a requirement on $f(x)$ but not necessarily for x near x_0. Thus for any given $\varepsilon > 0$ there is an x such that $|x^2 - 0| < \varepsilon$ but this does not imply $\lim_{x \to x_0} x^2 = 0$ in general.

76. $-1 < \sqrt{x + 2} - 4 < 1$ leads successively to $3 < \sqrt{x + 2} < 5$, $9 < x + 2 < 25$, $7 < x < 23$, the last interval being the solution of the first part of the problem. The midpoint of this interval is $\frac{7+23}{2} = 15$. The interval can be described by $|x - 15| < 8$.

77. $-\frac{1}{2} < \sqrt{\frac{x+1}{2}} - 1 < \frac{1}{2}$ is equivalent to each of $\frac{1}{2} < \sqrt{\frac{x+1}{2}} < \frac{3}{2}$, $\frac{1}{4} < \frac{x+1}{2} < \frac{9}{4}$, $\frac{1}{2} < x + 1 < \frac{9}{2}$, $-\frac{1}{2} < x < \frac{7}{2}$. The midpoint of the latter interval is $(-\frac{1}{2} + \frac{7}{2})/2 = 3/2$ so that it can be written as $|x - 3/2| < 2$.

78. Let $f(x) = \frac{x-1}{x-3}$. Following the method of 2.5 Example 6, we solve the equations $f(x) = 1.9$ and $f(x) = 2.1$, obtaining 5.22 and 4.82. Thus $1.9 < f(x) < 2.1$ if $4.82 < x < 5.22$. Letting $x_0 = 5$, we have $|x - 5| < 0.18$ implies $|f(x) - 2| < 0.1$.

79. Let $f(x) = \frac{x-1}{x-3}$. Following the method of 2.5 Example 6, we solve the equations $f(x) = -2.1$ and $f(x) = -1.9$ obtaining 2.35 and 2.31. Thus $f(x)$ is within 0.1 unit of -2 if $2.31 < x < 2.35$ or $|x - 7/3| < 0.02$.

80. Let $f(x) = x^3 - 4x$. We graph $f(x)$, $y = 3.9$ and $y = 4.1$ and we use zoom-in to find the x-coordinates of the two points of intersection obtaining 2.38 and 2.39. Thus $f(x)$ is within 0.1 unit of 4 if $2.38 < x < 2.39$. If we take $x_0 = 2.383$ (near the root of $f(x) = 4$), we can say $|x - 2.383| < 0.003$ implies $|f(x) - 4| < 0.1$.

81. Let $f(x) = x^3 - 4x$. We graph $f(x)$, $y = 0.9$ and $y = 1.1$ and use zoom-in to find the x-coordinates of the points of intersection $(-1 < x < 0)$ obtaining -0.28 and -0.228. Thus $f(x)$ is within 0.1 unit of 1 if $-0.280 < x < -0.228$ (rounding appropriately) or if $|x + 0.254| < 0.026$.

82. $|f(x) - 1| = |2x - 4| = 2|x - 2| < \varepsilon$ is equivalent to $|x - 2| < \varepsilon/2$. Thus we must have $0 < \delta \leqq \varepsilon/2$.

83. $|f(x) - 0| + \|x\| = |x| < \varepsilon$ is equivalent to $|x - 0| < \varepsilon$. Thus we must have $0 < \delta \leq \varepsilon$.

84. $\text{Lim}_{x\to\infty} \frac{1-2x}{3x-1} = \lim_{x\to\infty} \frac{\frac{1}{x}-2}{3-\frac{1}{x}} = \frac{-2}{3}$. To confirm this using the definition of this type of limit, we follow Example 6. Let $\varepsilon > 0$ be given. $|\frac{1-2x}{3x-1} + \frac{2}{3}| < \varepsilon$ is equivalent to each of the following. $|\frac{3-6x+6x-2}{3(3x-1)}| < \varepsilon$, $\frac{1}{3(3x-1)} < \varepsilon$ (assuming x is large and positive), $\frac{1}{3\varepsilon} < 3x - 1$, $\frac{1}{3\varepsilon} + 1 < 3x$, $x > \frac{1}{9\varepsilon} + \frac{1}{3} = \frac{3\varepsilon+1}{9\varepsilon}$. So we choose $N = \frac{3\varepsilon+1}{9\varepsilon}$. Then $x > N$ implies $|\frac{1-2x}{3x-1} + \frac{2}{3}| < \varepsilon$. This confirms the limit.

85. As $x \to \frac{1}{3}^+$, $1 - 2x \to \frac{1}{3}$ and $3x - 1 \to 0$ through positive values. Hence $\lim_{x\to\frac{1}{3}^+} \frac{1-2x}{3x-1} = \infty$. With $x > \frac{1}{3}$, all of the following are equivalent. $\frac{1-2x}{3x-1} > N$, $1-2x > 3xN - N$, $1 + N > x(3N+2)$, $x < \frac{N+1}{3N+2} = \frac{1}{3} + \frac{1}{3(3N+2)}$, $x - \frac{1}{3} < \frac{1}{3(3N+2)}$. So we choose $\delta = \frac{1}{3(3N+2)}$. Then $0 < x - \frac{1}{3} < \delta$ implies $\frac{1-2x}{3x-1} > N$. Since this is true for any $N > 0$, this confirms the limit.

86. $L = \lim_{x\to 3}(5x - 10) = 5 \cdot 3 - 10 = 5$. $|f(x) - 5| = |5x - 15| = 5|x - 3| < \varepsilon = 0.05$ is equivalent to $|x - 3| < 0.01$. Let $\delta = 0.01$. Then for all x $0 < |x - 3| < \delta \Rightarrow |f(x) - 5| < \varepsilon$.

87. $L = \lim_{x\to 2}(5x - 10) = 0$. $|f(x) - L| = |5x - 10| = 5|x - 2| < \varepsilon$ is equivalent to $|x - 2| < \varepsilon/5$. Thus $\delta = \varepsilon/5 = 0.01$.

88. $L = \lim_{x\to 9}\sqrt{x-5} = \sqrt{4} = 2$. $|f(x) - L| = |\sqrt{x-5} - 2| < \varepsilon = 1$ is equivalent to $-1 < \sqrt{x-5} - 2 < 1$, $1 < \sqrt{x-5} < 3$, $1 < x - 5 < 9$, $6 < x < 14$, $-3 < x - 9 < 5$. Thus $|x - 9| < 3$ guarantees $|f(x) - L| < \varepsilon$ and so we take $\delta = 3$.

89. $L = \lim_{x\to 2}\sqrt{2x-3} = 1$. $1/2 < \sqrt{2x-3} < 3/2$ yields $\frac{1}{4} < 2x-3 < \frac{9}{4}$, $-\frac{3}{4} < 2x - 4 < \frac{5}{4}$, $-\frac{3}{8} < x - 2 < \frac{5}{8}$. Thus $|x - 2| < \frac{3}{8} \Rightarrow |f(x) - L| < \varepsilon$ so $\delta = 3/8$.

90. $L = \lim_{x\to 5}\frac{x^2-x}{x+2} = \frac{20}{7} = 2.86$. We use the method of 2.6. In the viewing rectangle $[4.98, 5.02]$ by $[2.85, 2.87]$, we find the coordinates of two points on the graph of $f(x)$ and use these to determine the slope m. We find $m = 0.88$ approximately and $\delta = \varepsilon/|m| = \varepsilon/0.88 = 1.13\varepsilon$ rounding down to be safe.

91. $L = \lim_{x\to -5}\frac{x-1}{x^2+3x} = \frac{-6}{10} = -0.6$. In the viewing rectangle $[-5.1, -4.9]$ by $[-0.61, -0.59]$ we graph $f(x)$ and using two points on the graph we find $m = -0.32$. Hence we take $\delta = \varepsilon/|m| = 3.12\varepsilon$ rounding down to be safe.

92. $0.8 < \frac{\sqrt{x}}{2} < 1.2$ is equivalent to $1.6 < \sqrt{x} < 2.4$, $1.6^2 < x < 2.4^2$ or $2.56 < x < 5.76$. $0.9 < \frac{\sqrt{x}}{2} < 1.1$ is equivalent to $1.8 < \sqrt{x} < 2.2$ or $3.24 < x < 4.84$.

93. $9.9995 < 10 + (t - 70) \times 10^{-4} < 10.0005$ is equivalent to $-0.0005 < (t - 70)10^{-4} < 0.0005$, $-5 < t - 70 < 5$ or $65° < t < 75°$.

94. $1000x^2 + x - 10^{-15} = 0$. If $x = 0$, the left-hand side becomes $-10^{-15} \neq 0$, so $x = 0$ is not a solution. By the quadratic formula $x = \frac{-1\pm\sqrt{1+4(10^{-12})}}{2000}$. On a calculator the positive solution reads 10^{-15}. Because of the limits of calculator precision the exact solution cannot be found. We can be sure the error is less than 10^{-14}.