

Section 2.1: 7-63 odd, 70

$$7. \lim_{x \rightarrow -\frac{1}{2}} 3x^2(2x-1) = 3\left(-\frac{1}{2}\right)^2(2(-\frac{1}{2})-1) = \frac{3}{4}(-2) = -\frac{6}{4} = \boxed{-\frac{3}{2}}$$

$$9. \lim_{x \rightarrow 1} x^3 + 3x^2 - 2x - 17 = 1^3 + 3 \cdot 1^2 - 2 \cdot 1 - 17 = 1 + 3 - 2 - 17 = \boxed{-15}$$

$$11. \lim_{y \rightarrow -3} \frac{y^2 + 4y + 3}{y^2 - 3} = \frac{(-3)^2 + 4(-3) + 3}{(-3)^2 - 3} = \frac{9 - 12 + 3}{9 - 3} = \frac{0}{6} = \boxed{0}$$

$$13. \lim_{x \rightarrow -2} (x-6)^{2/3} = (-2-6)^{2/3} = (-8)^{2/3} = \sqrt[3]{-8}^2 = (-2)^2 = \boxed{4}$$

15. x	-0.1	-0.01	-0.001	-0.0001	0.0001	0.001	0.01	0.1
f(x)	1.567	1.960	1.996	1.9996	2.0004	2.004	2.040	2.373

$$\lim_{x \rightarrow 0} \frac{x^2 + 6x + 2}{x + 1} = \boxed{2}$$

17. x	-0.1	-0.01	-0.001	-0.0001	0.0001	0.001	0.01	0.1
f(x)	-0.054	-0.005	8.269×10^{-4}	-3.056×10^{-5}	-3.056×10^{-5}	8.269×10^{-4}	-0.005	-0.054

$$\lim_{x \rightarrow 0} x \sin \frac{1}{x} = \boxed{0}$$

19. x	-0.1	-0.01	-0.001	-0.0001	0.0001	0.001	0.01	0.1
f(x)	2.057	2.276	2.230	2.302	2.303	2.305	2.329	2.589

$$\lim_{x \rightarrow 0} \frac{10^x - 1}{x} \approx \boxed{2.3}$$

21. $\lim_{x \rightarrow -2} \sqrt{x-2} = \sqrt{-2-2} = \sqrt{-4}$ is undefined in real numbers. There is no limit.

23. $\lim_{x \rightarrow 0} \frac{|x|}{x} = \frac{|0|}{0} = \frac{0}{0}$ is undefined bc of dividing by 0. There is no limit.

$$25. \lim_{x \rightarrow 1} \frac{x-1}{x^2-1} = \lim_{x \rightarrow 1} \frac{\cancel{x-1}}{(x+1)\cancel{(x-1)}} = \lim_{x \rightarrow 1} \frac{1}{x+1} = \frac{1}{1+1} = \boxed{\frac{1}{2}}$$

$$27. \lim_{x \rightarrow 0} \frac{5x^3 + 8x^2}{3x^4 - 16x^2} = \lim_{x \rightarrow 0} \frac{5x + 8}{3x^2 - 16} = \frac{0 + 8}{0 - 16} = -\frac{8}{16} = \boxed{-\frac{1}{2}}$$

$$29. \lim_{x \rightarrow 0} \frac{(2+x)^3 - 8}{x} = \lim_{x \rightarrow 0} \frac{(4+4x+x^2)(2+x) - 8}{x} = \lim_{x \rightarrow 0} \frac{\cancel{8} + 8x + 2x^2 + 4x + 4x^2 + x^3 - \cancel{8}}{x}$$

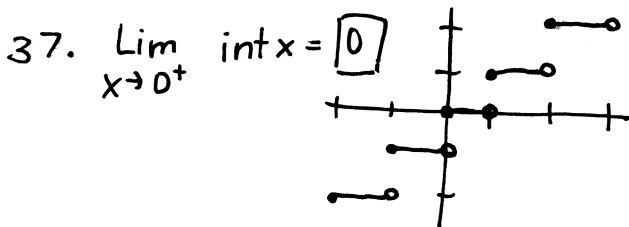
$$\lim_{x \rightarrow 0} \frac{x^3 + 6x^2 + 12x}{x} = \lim_{x \rightarrow 0} x^2 + 6x + 12 = 0^2 + 6 \cdot 0 + 12 = \boxed{12}$$

$$31. \lim_{x \rightarrow 0} \frac{\sin x}{2x^2 - x} = \lim_{x \rightarrow 0} \frac{\sin x}{x(2x-1)} = \lim_{x \rightarrow 0} \frac{\sin x}{x} \cdot \frac{1}{2x-1} = 1 \cdot \frac{1}{2(0)-1} = 1 \cdot (-1) = \boxed{-1}$$

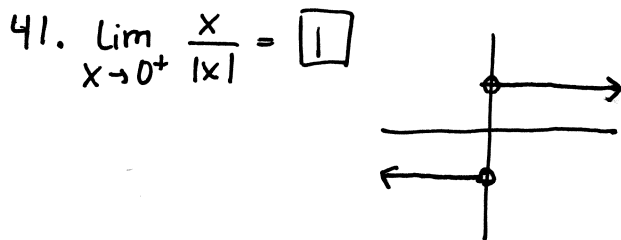
$$33. \lim_{x \rightarrow 0} \frac{\sin^2 x}{x} = \lim_{x \rightarrow 0} \frac{\sin x}{x} \cdot \sin x = 1 \cdot \sin 0 = 1 \cdot 0 = \boxed{0}$$

35. $\lim_{x \rightarrow 1} \frac{x^2 - 4}{x - 1}$ Vertical asymptote at $x = 1$.

$$\lim_{x \rightarrow 1^-} \frac{x^2 - 4}{x - 1} = \infty \quad \text{and} \quad \lim_{x \rightarrow 1^+} \frac{x^2 - 4}{x - 1} = -\infty$$

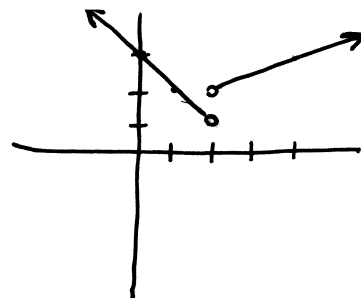


39. $\lim_{x \rightarrow 0.01} \text{int } x = \boxed{0}$



43. a) True
 b) True
 c) False
 d) True
 e) True
 f) True
 g) False
 h) False
 i) False
 j) False

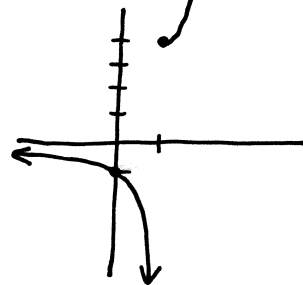
$$57. f(x) = \begin{cases} -x+3, & x < 2 \\ \frac{1}{2}x+1, & x > 2 \end{cases}$$



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

c) No bc $\lim_{x \rightarrow 2^+} f(x) \neq \lim_{x \rightarrow 2^-} f(x)$

$$59. f(x) = \begin{cases} \frac{1}{x-1}, & x < 1 \\ x^3 - 2x + 5, & x \geq 1 \end{cases}$$



b) $\lim_{x \rightarrow 1^+} f(x) = 4$
 $\lim_{x \rightarrow 1^-} f(x) = -\infty$

c) No bc $\lim_{x \rightarrow 1^+} f(x) \neq \lim_{x \rightarrow 1^-} f(x)$

45. a) 3
 b) -2
 c) DNE
 d) 1

47. a) -4
 b) -4
 c) -4
 d) -4

49. a) 4
 b) -3
 c) DNE
 d) 4

51. C

53. D

55. $\lim_{x \rightarrow 4} f(x) = 0$ and $\lim_{x \rightarrow 4} g(x) = 3$

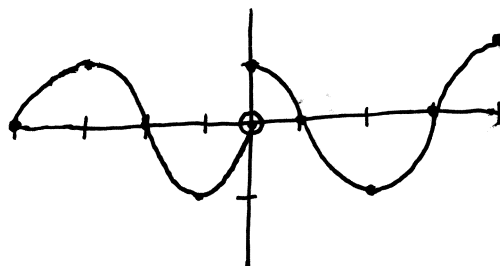
a) $\lim_{x \rightarrow 4} g(x) + 3 = 3 + 3 = \boxed{6}$

b) $\lim_{x \rightarrow 4} x f(x) = 4 \cdot 0 = \boxed{0}$

c) $\lim_{x \rightarrow 4} g^2(x) = 3^2 = \boxed{9}$

d) $\lim_{x \rightarrow 4} \frac{g(x)}{f(x) - 1} = \frac{3}{0 - 1} = \frac{3}{-1} = \boxed{-3}$

$$61. f(x) = \begin{cases} \sin x, & -2\pi \leq x < 0 \\ \cos x, & 0 \leq x \leq 2\pi \end{cases}$$

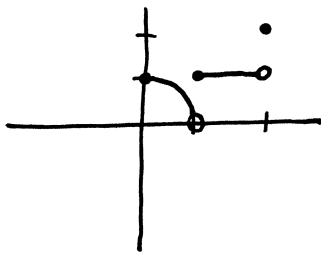


b) $(-2\pi, 0) \cup (0, 2\pi)$

c) 2π

d) -2π

$$63. f(x) = \begin{cases} \sqrt{1-x^2}, & 0 \leq x < 1 \\ 1, & 1 \leq x < 2 \\ 2, & x = 2 \end{cases}$$



b) $(0,1) \cup (1,2)$

c) 2

d) 0

70. $y = gt^2$

20 m in 4 sec

a) $20 = g \cdot 4^2$
 $g = \frac{20}{16} = \frac{5}{4} \rightarrow y = \frac{5}{4}t^2$

b) Avg. speed = $\frac{\Delta y}{\Delta t} = \frac{20 \text{ m}}{4 \text{ s}} = \boxed{5 \text{ m/s}}$

c) Inst. speed at $t = 4, y = \frac{5}{4}t^2$

$$\lim_{h \rightarrow 0} \frac{f(4+h) - f(4)}{h} = \lim_{h \rightarrow 0} \frac{\frac{5}{4}(4+h)^2 - \frac{5}{4}(4)^2}{h} = \lim_{h \rightarrow 0} \frac{\frac{5}{4}[(4+h)^2 - 4^2]}{h}$$

$$\lim_{h \rightarrow 0} \frac{\frac{5}{4}(\cancel{16} + 8h + h^2 - \cancel{16})}{h} = \lim_{h \rightarrow 0} \frac{5}{4}(8+h) = \frac{5}{4}(8+0) = \frac{5}{4} \cdot 8 = \frac{40}{4} = \boxed{10 \text{ m/s}}$$