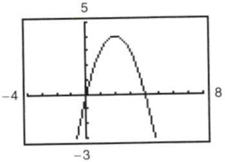
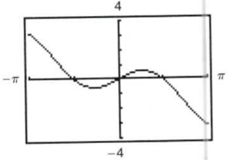
Section 1.3 (page 67)

1.



(a) 0 (b) -5

3.



(a) 0 (b) About 0.52 or $\pi/6$

5. 8 **7.** -1 **9.** 0 **11.** 7 **13.** 2 **15.** 1

17. $1/2$ **19.** $1/5$ **21.** 7 **23.** (a) 4 (b) 64 (c) 64

25. (a) 3 (b) 2 (c) 2 **27.** 1 **29.** $1/2$ **31.** 1

33. $1/2$ **35.** -1 **37.** (a) 10 (b) 5 (c) 6 (d) $3/2$

39. (a) 64 (b) 2 (c) 12 (d) 8

41. (a) -1 (b) -2

$g(x) = \dfrac{x^2 - x}{x}$ and $f(x) = x - 1$ agree except at $x = 0$.

43. (a) 2 (b) 0

$g(x) = \dfrac{x^3 - x}{x - 1}$ and $f(x) = x^2 + x$ agree except at $x = 1$.

45. -2

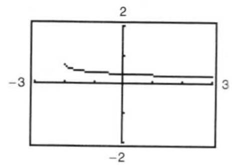
$f(x) = \dfrac{x^2 - 1}{x + 1}$ and $g(x) = x - 1$ agree except at $x = -1$.

47. 12

$f(x) = \dfrac{x^3 - 8}{x - 2}$ and $g(x) = x^2 + 2x + 4$ agree except at $x = 2$.

49. -1 **51.** $1/8$ **53.** $5/6$ **55.** $1/6$ **57.** $\sqrt{5}/10$
59. $-1/9$ **61.** 2 **63.** $2x - 2$
65. $1/5$ **67.** 0 **69.** 0 **71.** 0 **73.** 1 **75.** $3/2$

77.



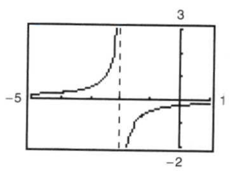
The graph has a hole at $x = 0$.

Answers will vary. Example:

x	-0.1	-0.01	-0.001	0.001	0.01	0.1
$f(x)$	0.358	0.354	0.354	0.354	0.353	0.349

$$\lim_{x\to 0} \frac{\sqrt{x+2} - \sqrt{2}}{x} \approx 0.354 \left(\text{Actual limit is } \frac{1}{2\sqrt{2}} = \frac{\sqrt{2}}{4}.\right)$$

79.



The graph has a hole at $x = 0$.

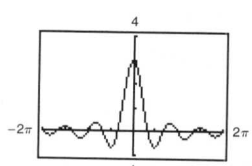
Answers will vary. Example:

x	-0.1	-0.01	-0.001
$f(x)$	-0.263	-0.251	-0.250

x	0.001	0.01	0.1
$f(x)$	-0.250	-0.249	-0.238

$$\lim_{x\to 0} \frac{[1/(2+x)] - (1/2)}{x} \approx -0.250 \left(\text{Actual limit is } -\frac{1}{4}.\right)$$

81.



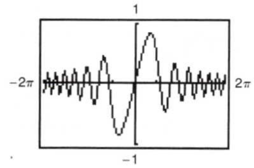
The graph has a hole at $t = 0$.

Answers will vary. Example:

t	-0.1	-0.01	0	0.01	0.1
$f(t)$	2.96	2.9996	?	2.9996	2.96

$$\lim_{t\to 0} \frac{\sin 3t}{t} = 3$$

83.



The graph has a hole at $x = 0$.

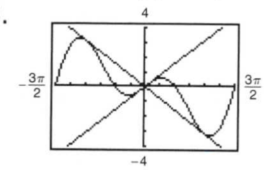
Answers will vary. Example:

x	-0.1	-0.01	-0.001	0	0.001	0.01	0.1
$f(x)$	-0.1	-0.01	-0.001	?	0.001	0.01	0.1

$$\lim_{x\to 0} \frac{\sin x^2}{x} = 0$$

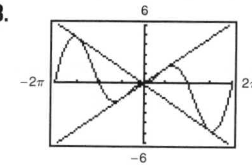
85. 3 **87.** $-1/(x+3)^2$ **89.** 4

91.



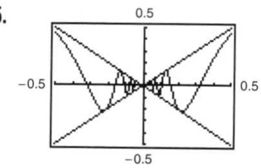
0

93.



0

95.



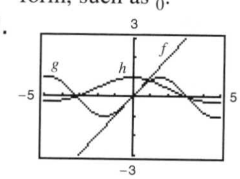
0

The graph has a hole at $x = 0$.

97. f and g agree at all but one point if c is a real number such that $f(x) = g(x)$ for all $x \neq c$.

99. An indeterminate form is obtained when evaluating a limit using direct substitution produces a meaningless fractional form, such as $\frac{0}{0}$.

101.



The magnitudes of $f(x)$ and $g(x)$ are approximately equal when x is close to 0. Therefore, their ratio is approximately 1.

103. -64 ft/sec (speed $= 64$ ft/sec) **105.** -29.4 m/sec

107. Let $f(x) = 1/x$ and $g(x) = -1/x$.

$\lim_{x\to 0} f(x)$ and $\lim_{x\to 0} g(x)$ do not exist. However,

$$\lim_{x\to 0} [f(x) + g(x)] = \lim_{x\to 0} \left[\frac{1}{x} + \left(-\frac{1}{x}\right)\right] = \lim_{x\to 0} 0 = 0$$

and therefore does exist.

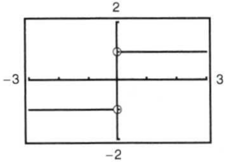
109–113. Proofs

115. Let $f(x) = \begin{cases} 4, & \text{if } x \geq 0 \\ -4, & \text{if } x < 0 \end{cases}$

$\lim_{x\to 0} |f(x)| = \lim_{x\to 0} 4 = 4$

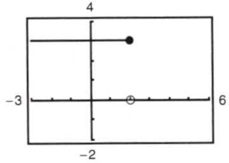
$\lim_{x\to 0} f(x)$ does not exist because for $x < 0$, $f(x) = -4$ and for $x \geq 0$, $f(x) = 4$.

117. False. The limit does not exist because the function approaches 1 from the right side of 0 and approaches -1 from the left side of 0. (See graph below.)



119. True.

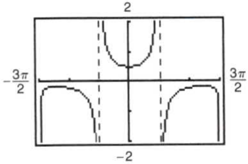
121. False. The limit does not exist because $f(x)$ approaches 3 from the left side of 2 and approaches 0 from the right side of 2. (See graph below.)



123. Proof

125. (a) All $x \neq 0, \dfrac{\pi}{2} + n\pi$

(b)



The domain is not obvious. The hole at $x = 0$ is not apparent from the graph.

(c) $\dfrac{1}{2}$ (d) $\dfrac{1}{2}$

127. The graphing utility was not set in *radian* mode.