EXERCISE SET 2.2

1. (a) -6 (b) 13 (c) -8 (d) 16 (e) 2 (f) $-1/2$
   (g) The limit doesn't exist because the denominator tends to zero but the numerator doesn't.
   (h) The limit doesn't exist because the denominator tends to zero but the numerator doesn't.

2. (a) 0
   (b) The limit doesn't exist because $\lim f$ doesn't exist and $\lim g$ does.
   (c) 0 (d) 3 (e) 0
   (f) The limit doesn't exist because the denominator tends to zero but the numerator doesn't.
   (g) The limit doesn't exist because $\sqrt{f(x)}$ is not defined for $0 \le x < 2$.
   (h) 1

3. 6 **4.** 27 **5.** 3/4 **6.** -3 **7.** -4 **8.** 12

9. -4/5 **10.** 0 **11.** -3 **12.** 1 **13.** 3/2 **14.** 4/3

15. $+\infty$ **16.** $-\infty$ **17.** does not exist **18.** $+\infty$

19. $-\infty$ **20.** does not exist **21.** $+\infty$ **22.** $-\infty$

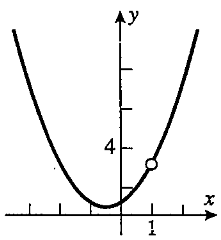
23. does not exist **24.** $-\infty$ **25.** $+\infty$ **26.** does not exist

27. $+\infty$ **28.** $+\infty$ **29.** 6 **30.** 4

31. (a) 2
(b) 2
(c) 2

32. (a) -2
(b) 0
(c) does not exist

33. (a) 3
(b)



34. (a) -6
(b) $F(x) = x - 3$

35. (a) Theorem 2.2.2(a) doesn't apply; moreover one cannot add/subtract infinities.

(b) $\lim_{x\to 0^+}\left(\frac{1}{x}-\frac{1}{x^2}\right) = \lim_{x\to 0^+}\left(\frac{x-1}{x^2}\right) = -\infty$

36. $\lim_{x\to 0^-}\left(\frac{1}{x}+\frac{1}{x^2}\right) = \lim_{x\to 0^-}\frac{x+1}{x^2} = +\infty$

37. $\lim_{x\to 0}\frac{x}{x\left(\sqrt{x+4}+2\right)} = \frac{1}{4}$

38. $\lim_{x\to 0}\frac{x^2}{x\left(\sqrt{x+4}+2\right)} = 0$

39. The left and/or right limits could be plus or minus infinity; or the limit could exist, or equal any preassigned real number. For example, let $q(x) = x - x_0$ and let $p(x) = a(x-x_0)^n$ where n takes on the values $0, 1, 2$.

40. (a) If $x < 0$ then $f(x) = \dfrac{ax+bx-ax+bx}{2x} = b$, so the limit is b.

(b) Similarly if $x > 0$ then $f(x) = a$, so the limit is a.

(c) Since the left limit is a and the right limit is b, the limit can only exist if $a = b$, in which case $f(x) = a$ for all $x \neq 0$ and the limit is a.