

Review Exercises (page 286)

1. Function, domain $\{-1, 2, 4\}$, range $\{0, 3\}$

2. Not a function 3. (a) 2 (b) -2 (c) $-\frac{3x}{x^2-1}$ (d) $-\frac{3x}{x^2-1}$ (e) $\frac{3(x-2)}{x^2-4x+3}$ (f) $\frac{6x}{4x^2-1}$

4. (a) $\frac{4}{3}$ (b) -4 (c) $\frac{x^2}{-x+1}$ (d) $-\frac{x^2}{x+1}$ (e) $\frac{(x-2)^2}{x-1}$ (f) $\frac{4x^2}{2x+1}$

5. (a) 0 (b) 0 (c) $\sqrt{x^2-4}$ (d) $-\sqrt{x^2-4}$ (e) $\sqrt{x^2-4x}$ (f) $2\sqrt{x^2-1}$

6. (a) 0 (b) 0 (c) $|x^2-4|$ (d) $-|x^2-4|$ (e) $|x^2-4x|$ (f) $2|x^2-1|$ 7. (a) 0 (b) 0 (c) $\frac{x^2-4}{x^2-1}$ (d) $-\frac{x^2-4}{x^2-1}$

(a) $\frac{x(x-4)}{(x-2)^2}$ (f) $\frac{x^2-1}{x^2}$ 8. (a) $-\frac{8}{5}$ (b) $\frac{8}{5}$ (c) $-\frac{x^2}{x^2-9}$ (d) $-\frac{x^2}{x^2-9}$ (e) $\frac{(x-2)^2}{x^2-4x-5}$ (f) $\frac{8x^2}{4x^2-9}$ 9. $\{x, x \neq -3, x \neq 3\}$

10. $\{x, x \neq 2\}$ 11. $\{x|x \leq 2\}$ 12. $\{x|x \geq -2\}$ 13. $\{x|x > 0\}$ 14. $\{x|x \neq 0\}$ 15. $\{x, x \neq -3, x \neq 1\}$ 16. $\{x, x \neq -1, x \neq 4\}$

17. $(f + g)(x) = 2x + 3$; Domain: all real numbers

$(f - g)(x) = -4x + 1$; Domain: all real numbers

$(f \cdot g)(x) = -3x^2 + 5x + 2$; Domain: all real numbers

$\left(\frac{f}{g}\right)(x) = \frac{2x-2}{3x+1}$; Domain: $\left\{x \mid x \neq -\frac{1}{3}\right\}$

18. $(f + g)(x) = 4x$; Domain: all real numbers

$(f - g)(x) = -2$; Domain: all real numbers

$(f \cdot g)(x) = 4x^2 - 1$; Domain: all real numbers

$\left(\frac{f}{g}\right)(x) = \frac{2x-1}{2x+1}$; Domain: $\left\{x \mid x \neq -\frac{1}{2}\right\}$

19. $(f + g)(x) = 3x^2 + 4x + 1$; Domain: all real numbers
 $(f - g)(x) = 3x^2 - 2x + 1$; Domain: all real numbers
 $(f \cdot g)(x) = 9x^3 + 3x^2 + 3x$; Domain: all real numbers
 $\left(\frac{f}{g}\right)(x) = \frac{3x^2 + x + 1}{3x}$; Domain: $\{x|x \neq 0\}$

21. $(f + g)(x) = \frac{x^2 + 2x - 1}{x(x - 1)}$; Domain: $\{x|x \neq 0, 1\}$

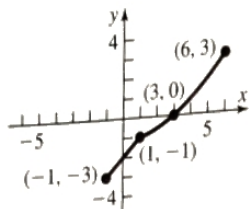
$(f - g)(x) = \frac{x^2 + 1}{x(x - 1)}$; Domain: $\{x|x \neq 0, 1\}$

$(f \cdot g)(x) = \frac{x + 1}{x(x - 1)}$; Domain: $\{x|x \neq 0, 1\}$

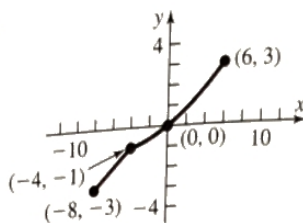
$\left(\frac{f}{g}\right)(x) = \frac{x(x + 1)}{x - 1}$; Domain: $\{x|x \neq 0, 1\}$

23. $-4x + 1 - 2h$ 24. $6x - 2 + 3h$ 25. (a) Domain: $\{x|-4 \leq x \leq 3\}$; Range: $\{y|-3 \leq y \leq 3\}$ (b) (0, 0) (c) -1 (d) -4

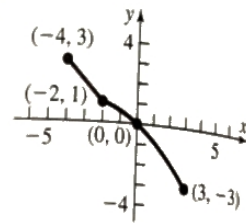
- (e) $\{x|0 < x \leq 3\}$ (f)



(g)

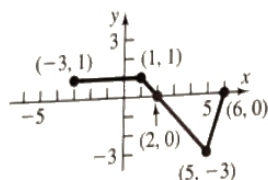


(h)

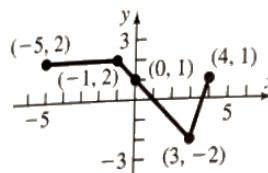


26. (a) Domain: $\{x|-5 \leq x \leq 4\}$; Range: $\{y|-3 \leq y \leq 1\}$

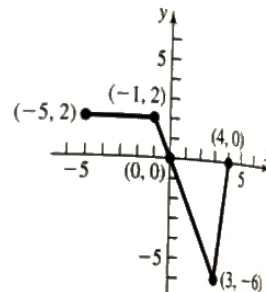
- (e) $\{x|-5 \leq x < 0\}$ (f)



(g)



(h)



27. (a) Domain: $\{x|-4 \leq x \leq 4\}$ or $[-4, 4]$
Range: $\{y|-3 \leq y \leq 1\}$ or $[-3, 1]$

- (b) Increasing on $(-4, -1)$ and $(3, 4)$;
Decreasing on $(-1, 3)$

- (c) Local maximum is 1 and occurs at $x = -1$;
Local minimum is -3 and occurs at $x = 3$

- (d) No symmetry

- (e) Neither

- (f) x-intercepts: -2, 0, 4; y-intercept: 0

28. (a) Domain: all real numbers or $(-\infty, \infty)$
Range: all real numbers or $(-\infty, \infty)$

- (b) Increasing on $(-\infty, -2)$ and $(2, \infty)$;
Decreasing on $(-2, 2)$

- (c) Local maximum is 1 and occurs at $x = -2$;
Local minimum is -1 and occurs at $x = 2$

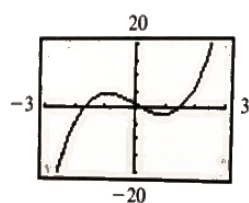
- (d) Origin

- (e) Odd

- (f) x-intercepts: -3, 0, 3; y-intercept: 0

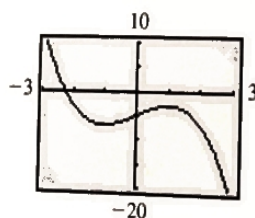
29. Odd 30. Even 31. Even 32. Neither 33. Neither 34. Neither 35. Odd 36. Odd

37.



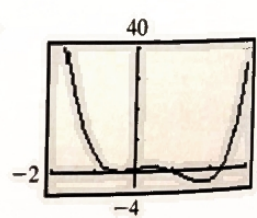
- Local maximum: $(-0.91, 4.04)$
Local minimum: $(0.91, -2.04)$
Increasing: $(-3, -0.91)$; $(0.91, 3)$
Decreasing: $(-0.91, 0.91)$

38.

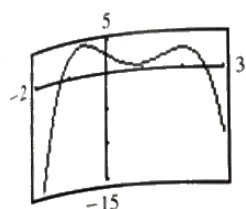


- Local maximum: $(1, -3)$
Local minimum: $(-1, -7)$
Increasing: $(-1, 1)$
Decreasing: $(-3, -1)$; $(1, 3)$

39.



- Local maximum: $(0.41, 1.53)$
Local minimum: $(-0.34, 0.54)$; $(1.80, -3.56)$
Increasing: $(-0.34, 0.41)$; $(1.80, 3)$
Decreasing: $(-2, -0.34)$; $(0.41, 1.80)$



Local maxima: $(-0.59, 4.62)$; $(2, 3)$

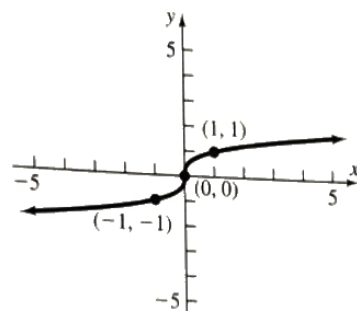
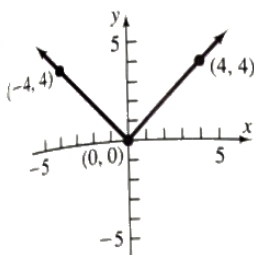
Local minimum: $(0.84, 0.92)$

Increasing: $(-2, -0.59)$; $(0.84, 2)$

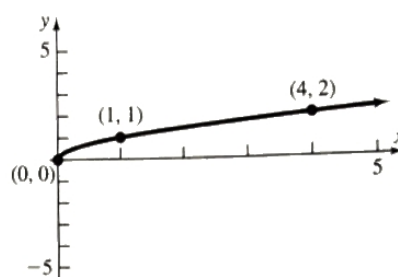
Decreasing: $(-0.59, 0.84)$; $(2, 3)$

41. (a) 23 (b) 7 (c) 47 42. (a) 15 (b) 3 (c) 57 43. -5 44. $2(x+2)$ 45. $-4x-5$
 46. $x-1$ 47. (b), (c), (d)

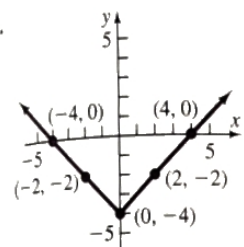
49.



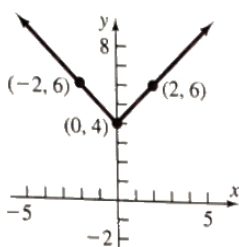
50.



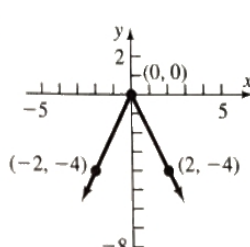
51.



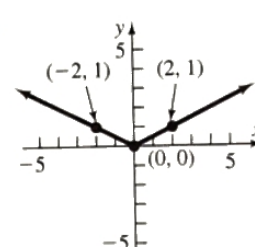
52.



53.



54.



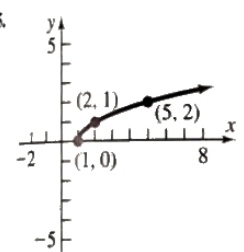
Intercepts: $(-4, 0)$, $(4, 0)$, $(0, -4)$
 Domain: all real numbers
 Range: $\{y|y \geq -4\}$ or $[-4, \infty)$

Intercept: $(0, 4)$
 Domain: all real numbers
 Range: $\{y|y \geq 4\}$ or $[4, \infty)$

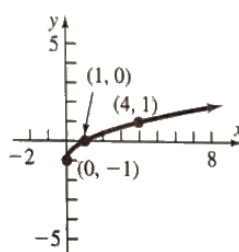
Intercept: $(0, 0)$
 Domain: all real numbers
 Range: $\{y|y \leq 0\}$ or $(-\infty, 0]$

Intercept: $(0, 0)$
 Domain: all real numbers
 Range: $\{y|y \geq 0\}$ or $[0, \infty)$

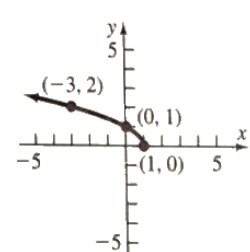
55.



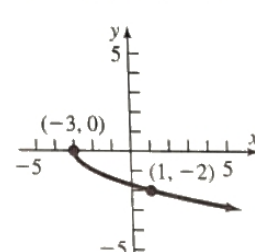
56.



57.



58.



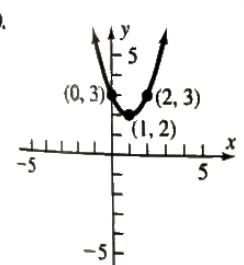
Intercept: $(1, 0)$
 Domain: $\{x|x \geq 1\}$ or $[1, \infty)$
 Range: $\{y|y \geq 0\}$ or $[0, \infty)$

Intercepts: $(0, -1)$, $(1, 0)$
 Domain: $\{x|x \geq 0\}$ or $[0, \infty)$
 Range: $\{y|y \geq -1\}$ or $[-1, \infty)$

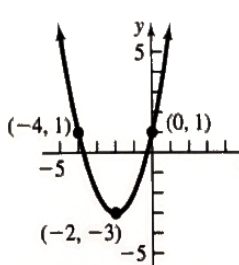
Intercepts: $(0, 1)$, $(1, 0)$
 Domain: $\{x|x \leq 1\}$ or $(-\infty, 1]$
 Range: $\{y|y \geq 0\}$ or $[0, \infty)$

Intercepts: $(-3, 0)$, $(0, -\sqrt{3})$
 Domain: $\{x|x \geq -3\}$ or $[-3, \infty)$
 Range: $\{y|y \leq 0\}$ or $(-\infty, 0]$

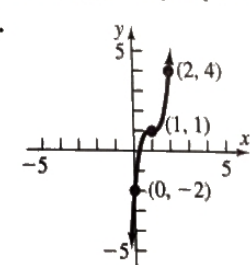
59.



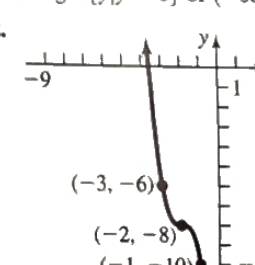
60.



61.



62.



Intercept: $(0, 3)$
 Domain: all real numbers
 Range: $\{y|y \geq 2\}$ or $[2, \infty)$

Intercepts: $(-2 - \sqrt{3}, 0)$,
 $(-2 + \sqrt{3}, 0)$, $(0, 1)$
 Domain: all real numbers
 Range: $\{y|y \geq -3\}$ or $[-3, \infty)$

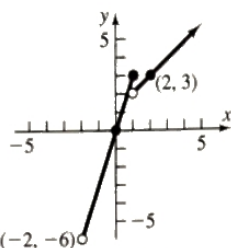
Intercepts: $(0, -2)$,
 $(1 + \frac{\sqrt{3}-9}{3}, 0)$ or about $(0.3, 0)$
 Domain: all real numbers
 Range: all real numbers

Intercepts: $(0, -24)$,
 $(-2 + \sqrt[3]{-4}, 0)$ or about
 $(-3.6, 0)$
 Domain: all real numbers
 Range: all real numbers

63. (a) $\{x|x > -2\}; (-2, \infty)$

(b) $(0, 0)$

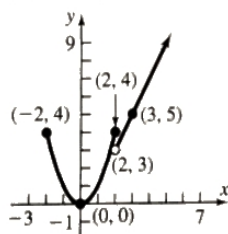
(c)



(d) $\{y|y > -6\}; (-6, \infty)$

66. (a) $\{x|x \geq -2\}; [-2, \infty)$

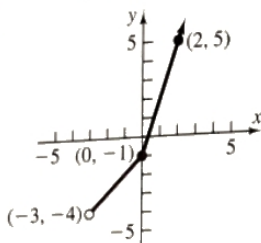
(c)



64. (a) $\{x|x > -3\}; (-3, \infty)$

(b) $(0, -1), (\frac{1}{3}, 0)$

(c)



(d) $\{y|y > -4\}; (-4, \infty)$

(b) $(0, 0)$

(d) $\{y|y \geq 0\}; [0, \infty)$

67. $f(x) = -2x + 3$

68. $g(x) = -4x - 6$

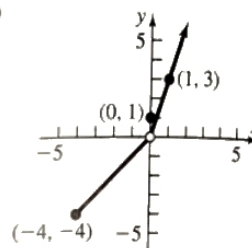
69. $A = 11$

70. $A = 8$

65. (a) $\{x|x \geq -4\}; [-4, \infty)$

(b) $(0, 1)$

(c)



(d) $\{y|y \geq -4\}; [-4, \infty)$

71. $T(h) = -0.0025h + 30, 0 \leq h \leq 10,000$

72. 130 ft/sec; $v(t) = 5t - 20$

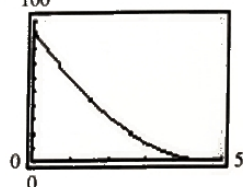
73. $V(S) = \frac{S}{6}\sqrt{\frac{S}{\pi}}$. If the surface area doubles, the volume increases by a factor of $2\sqrt{2}$.

74. (a) $A(x) = (8.5 - 2x)(11 - 2x)$

(b) $0 \leq x \leq 4.25, 0 \leq A \leq 93.5$

(c) $A(1) = 58.5 \text{ in}^2, A(1.2) = 52.46 \text{ in}^2, A(1.5) = 44 \text{ in}^2$

(d) 100



(e) $A(x) \approx 70$ when $x \approx 0.65$ in.;

$A(x) \approx 50$ when $x \approx 1.28$ in.

75. $S(x) = kx(36 - x^2)^{3/2}$; Domain: $\{x|0 < x < 6\}$

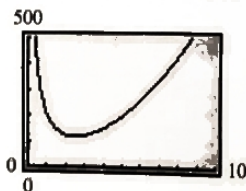
76. (a) $A = 2\pi r^2 + \frac{200}{r}$

(b) 123.22 sq ft

(c) 150.53 sq ft

(d) 197.08 sq ft

(e) A is smallest when $r \approx 2.52$ ft.

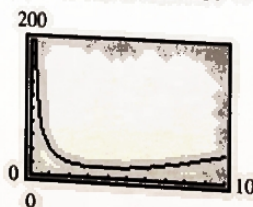


77. (a) $C(r) = 0.12\pi r^2 + \frac{40}{r}$

(b) \$16.03

(c) \$29.13

(d) The cost is least for $r \approx 3.76$ cm.

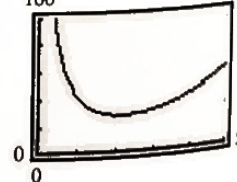


78. (a) $A(x) = 2x^2 + \frac{40}{x}$

(b) 42 ft²

(c) 28 ft²

(d) A is smallest when $x \approx 2.15$ ft.

**Cumulative Review** (page 290)

1. $\{\frac{4}{5}\}$

2. $\{3, 4\}$

3. $\{-\frac{1}{3}, 2\}$

4. $\{-\frac{1}{2}\}$

5. no real solution

6. $\{-7\}$

7. $\{-31\}$

8. $\{\frac{1}{3}, 1\}$

9. $\{\frac{1 - \sqrt{13}i}{4}, \frac{1 + \sqrt{13}i}{4}\}$