

Answers to College Algebra by Rhodes

CHAPTER 1 - Functions

Section 1.1

- 1A. yes, each input has one output B. no, inputs of -2 and -3 have two different outputs
2A. no, fails vertical line test B. yes, passes vertical line test C. no, fails vertical line test
3. yes, each Fahrenheit temperature only corresponds to one Celsius temperature
4. yes, letter weight only corresponds to one postage
5. no, people with the same years of schooling can have many different salaries
6. yes, each value for x only gives one value for y
7. no, for a value of $x = 0$, y is both $\pm\sqrt{12}$
8. no, for a value of $x = 1$, y is both ± 5

- 9A. -23 B. 289 C. $5h^6 - 8h^2 + 1$ D. $5t^3 - 8t - 2$
10A. 3 B. $\frac{n+2}{2n-1}$ C. $\frac{2g+1}{4g-3} + 1 = \frac{6g-2}{4g-3}$ D. $3\left(\frac{a+1}{2a-3}\right) = \frac{3a+3}{2a-3}$
11A. 68 B. 12 C. $3a^2 - 5a - 11$ D. $3x^2 + 6xh - 5x - 5h + 3h^2$
12A. -1 B. 9 C. $t = 2$
13A. -1 B. 3 C. $-1\frac{1}{2}$ D. $x = -2.5$
14A. $7x + 6$ B. $5x - 8$ C. 253 D. $\frac{6x-1}{x+7}$ E. $6x + 41$ F. -6
15A. 22 B. $x^2 - 2x - 7$ C. $2x^3 + 7x^2$ D. $\frac{x^2}{2x+7}$ E. 81 F. $2x^2 + 7$
16A. -3 B. -5.5 C. -18 D. -1.75 E. -4
17A. -6 B. -2 C. 45 D. 1

18A. $S(3) = 4$ Three weeks after release, there are \$4,000 in sales.

B. Between weeks 5 and 11.

C. Week 8, \$12,500

19A. July, 73° , $T(7) = 73$

B. approximately 43; In April, the average high temperature is 43° .

C. January, February, March, November, December

20. $f(x) = \sqrt{x}$, $g(x) = 3x^2 + 4$ 21. $f(x) = x^{5/3}$, $g(x) = 9x - 11$

22. $f(x) = |x|$, $g(x) = 2x - 1$ 23. $f(x) = 2^x$, $g(x) = 4x + 1$

24. $f(x) = \frac{1}{x^2}$, $g(x) = 2x + 3$ 25. $f(x) = \frac{x+1}{x}$, $g(x) = x^2$

26A. $4a + 4h + 7$ B. $4h$ C. 4
27A. $a^2 + 2ah + h^2 + a + h$ B. $2ah + h^2 + h$ C. $2a + h + 1$

28A. $\frac{1}{a+h}$ B. $\frac{-h}{a^2+ah}$ C. $\frac{-1}{a^2+ah}$

29A. $a^3 + 3a^2h + 3ah^2 + h^3 - 1$ B. $3a^2h + 3ah^2 + h^3$ C. $3a^2 + 3ah + h^2$

30. $f \circ g(x) = \frac{1}{\frac{1}{x}-2}$; D: all real numbers except 0 and $1/2$

31. $f \circ g(x) = (\sqrt{x})^3 + 3$; D: $[0, \infty)$

Section 1.2

1. $D = \{0, 1, 2, 3, 4\}$; $R = \{7, 9, 11, 13, 15\}$
2. $D = \{\text{SE US, NE US, MW US, SW US, W US}\}$;
 $R = \{2 \text{ business days, 3 business days, 4 business days}\}$
3. $D = [0, \infty)$; $R = \{\$23, \$39, \$99\}$
4. $D = \{-1, 3, 4, 8, 10\}$; $R = \{-7, -1, 5, 11\}$
5. $D = [0, 10]$; $R = [0, 13.5]$

6. D = [Birth, 8]; R = [20, 55]
7. D = [0, 12]; R = [0, 85]
8. D = [1990, 2009]; R = [3.9, 7.8]
9. D = (-5, 5); R = [-2, 2]
10. D = (0, 1.00); R = {.01, .02, .03, .04, .05}
11. D = $(-\infty, \infty)$; R = [-2, ∞)
12. D = [-2.5, 3]; R = [-4.5, 8]
13. D = [0, 26.2]; R = [10, 460]
14. D = $(-\infty, \infty)$; R = $(-\infty, \infty)$
15. D = $(-\infty, \infty)$; R = [-1, ∞)
16. D = all reals except $x = -3$; R = all reals except 0
17. D = all reals except -2 and 1; R = all reals except 0
18. D = $[-5/2, \infty)$; R = [0, ∞)
19. D = [-5, 5]; R = [0, 5]
20. R = [-117, 28]
21. R = [-1.125, 20]

Section 1.3

- | | | |
|---------|---------------|---------------------|
| 1A. 6.3 | B. -2, 2 | C. -2.7, 2.7 |
| 2A. 0.4 | B. $x = -0.3$ | C. (0, 0.5] |
| 3A. -8 | B. $x = 2$ | C. $(-\infty, 1.5]$ |

4. $y = \sqrt{x}$

5. $y = \frac{1}{x}$

6. $y = \sqrt[3]{x}$

7. $y = x^2$

8. $y = |x|$

9. $y = \frac{1}{x^2}$

10. even

11. neither

12. odd

13. even

14. odd

15. neither

16. even

17. neither

18. neither

19. odd

20. even

21. neither

22. Symmetric to horizontal and vertical axes

23. Symmetric to horizontal axis

24. Symmetric to origin

25. Symmetric to vertical axis

Section 1.4

1. shift 3 left
2. shift down 5
3. shift 1 right, shift 7 down
4. reflect, shift 4 up
5. stretch by 2, shift left 6
6. shrink by $\frac{1}{2}$, shift down 2
7. reflect, stretch by 3, shift 5 right, shift 1 up
8. shrink by 0.3, shift 4 left, shift 8 up
9. $y = 2x + 1$

10. $y = \frac{1}{x+1}$

11. $y = x^2 - 4$

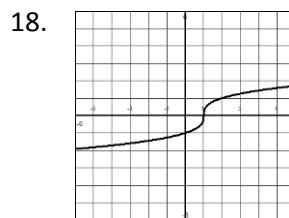
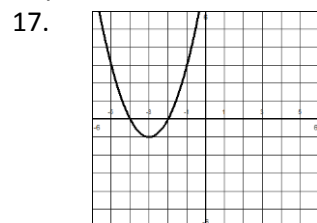
12. $y = -(x - 3)^3$

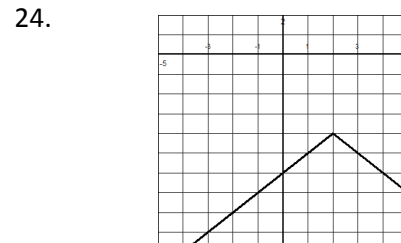
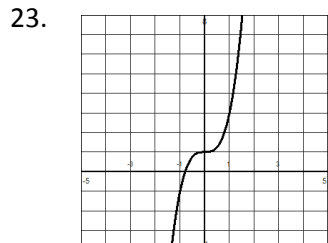
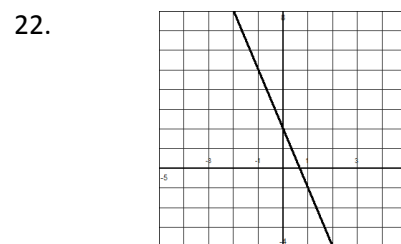
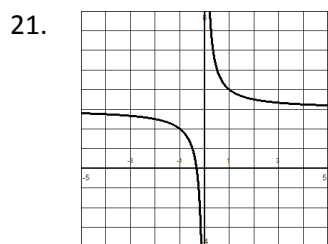
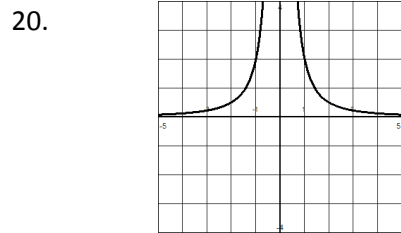
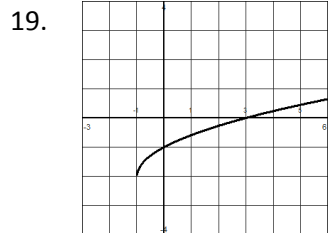
13. $y = 2\sqrt{x}$

14. $y = \frac{1}{(x+2)^2} - 2$

15. $y = -\sqrt{x - 2} + 1$

16. $y = 2\sqrt[3]{x + 2} + 1$





25. shifted up 2, $y = f(x) + 2$

26. Stretched by 2, $y = 2f(x)$

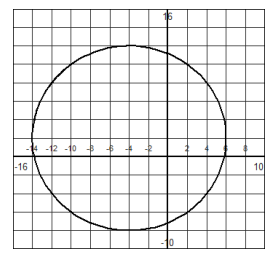
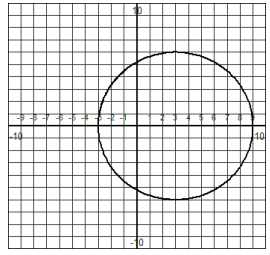
27. Reflected and shifted down 1, $y = -f(x) - 1$

28A. Center (0, 0); radius is 5

B. Center (0, 0); radius is $\sqrt{70}$

29A. Center (3, 0); radius is 6

B. Center (-4, 2); radius is 10



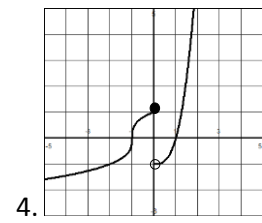
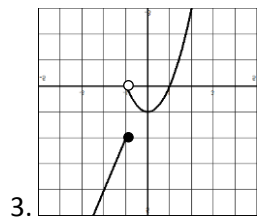
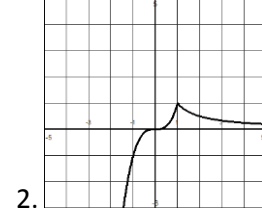
30. $(x - 1)^2 + (y + 2)^2 = 16$

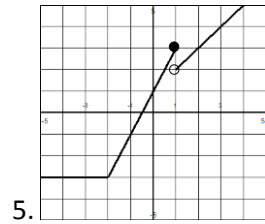
31. $(x + 3)^2 + (y + 1)^2 = 4$

32. $(x - 9)^2 + (y - 2)^2 = 25$

33. $(x + 3)^2 + (y + 5)^2 = 81$

Section 1.5

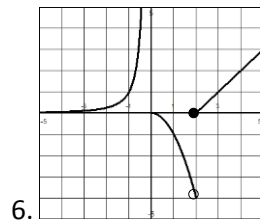




$$7. f(x) = \begin{cases} x^2, & x < 2 \\ -1, & x \geq 2 \end{cases}$$

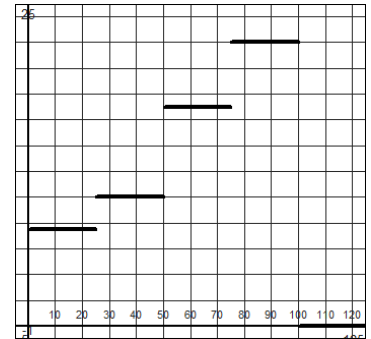
$$9. f(x) = \begin{cases} 39, & 0 < x \leq 1 \\ 41, & 1 < x \leq 2 \\ 43, & 2 < x \leq 3 \\ 45, & 3 < x \leq 4 \\ 46, & 4 < x \leq 5 \\ 48, & 5 < x \leq 6 \end{cases}$$

$$11. S(A) = \begin{cases} 7.50 & 1 \text{ € } A \text{ € } 24.99 \\ 10.00 & 25 \text{ € } A \text{ € } 49.99 \\ 17.00 & 50 \text{ € } A \text{ € } 74.99 \\ 22.00 & 75 \text{ € } A \text{ € } 99.99 \\ 0 & A \geq 100 \end{cases}$$



$$8. f(x) = \begin{cases} x^2, & x < 0 \\ 2, & 0 \leq x \leq 3 \\ 4 - x, & x > 3 \end{cases}$$

$$10. f(x) = \begin{cases} -x - 3, & x < -3 \\ x + 3, & -3 \leq x \leq 0 \\ -2x + 3, & 0 < x < 3 \\ x - 6, & x \geq 3 \end{cases}$$



$$12. P(b) = \begin{cases} 15, & 0 \leq b \leq 500 \\ 0.03b, & b > 500 \end{cases}$$



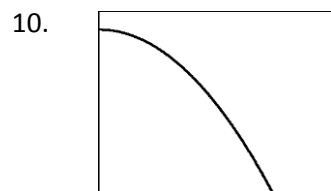
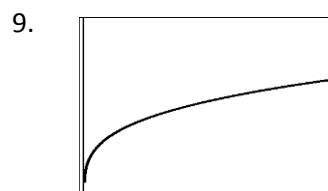
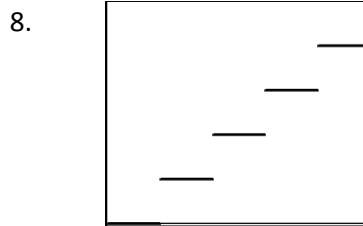
Section 1.6

1. B 2. A

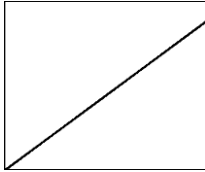
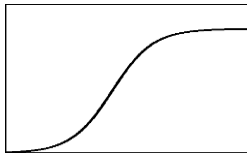
3. A 4. B

5A. II B. I C. IV D. III

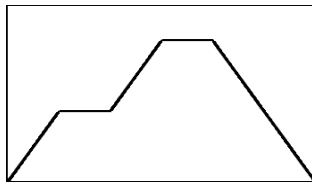
6A. II B. IV C. I D. III



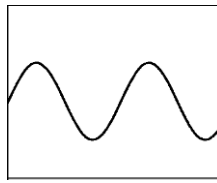
11. 12.



13.



14.



15. -3 16. 0.32 17. 32
 18. 3 19. $-\frac{1}{4}$ 20. $\frac{5}{3}$

21. -2.37, the temperature is falling at an average rate of 2.37 degrees Fahrenheit per hour.
 22A. 20π sq. inches per inch B. 32π sq. inches per inch
 23. -3 feet per second
 24A. 2.9667 million/year B. -1.5 million/year C. 1.34 million/year

Section 1.7

1. neither
2. direct
3. inverse
4. direct
5. neither
6. neither
7. inverse; decreasing and y is undefined at x=0
8. direct; increasing and includes (0,0)
9. neither; increasing, but (0,0) is not included
10. neither; not increasing nor decreasing
11. $y = 150/x^2$; 37.5; 10
12. $y = 3\sqrt{x}$; 3; 100/9 or $11\frac{1}{9}$
13. $y = 28/x$; 14; 11.2
14. $y = 3/4x^3$; 6; 10
15. tax = 0.07(price); \$50,000
16. $V = 1.75W$; 12.25 cups
17. Cost = 0.058(Kwh)
18. $W = 0.787h^3$; 199 pounds
19. $C = 64s$; \$232,960
20. $h = 130/t$
21. $f = 10/L$; $f = 1\frac{2}{3}$ or 1.67 pounds of pressure
22. $v=9.8t$; $v = 78.4$ m/sec
23. $f = 5.625gh^3$; $f = 4860$
24. resistance = 0.225(area)(velocity); $V = 30$ mph
25. $V = \frac{1}{3} hB$; $V = 153$ ft³
26. $E = \frac{55}{144} mv^2$; $E = 154.7$ ergs
27. $a = \frac{972bc}{d^2}$; $a = 1296$
28. $V = \frac{15.33T}{P}$; $V = 138$ cm³
29. $L = \frac{324D^4}{H^2}$; $L = 324$ metric tons
30. $F = \frac{100rm}{t^2}$; $F = 43750$ dynes

Section 2.1

1.

x	y
0	-1
2	3
-2	-5
-1	-3

2.

x	y
0	4
-8	0
-4	2
8	8

3.

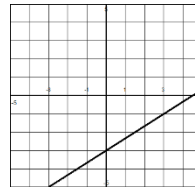
x	y
0	1
1/2	0
4	-7
5	-9

- 4A. Approximately 50 students B. 12 minutes C. at least 25 students
 5A. \$3.90 B. \$2.90 C. 1975 and later
 D. 1990 to 1991 E. about 60 or 70 cents

6A. $y = \frac{2}{3}x - 3$

B. Horizontal intercept or x-intercept: $(\frac{9}{2}, 0)$

Vertical intercept or y – intercept: $(0, -3)$ C. Window: $[-5, 5, 1] \times [-5, 5, 1]$



7. L- intercept: $(45, 0)$; W-intercept: $(0, 30)$; Window: $[0, 45, 4] \times [0, 35, 5]$

8. x-intercept: $(-8, 0)$; y-intercept: $(0, 6)$; Standard Window

9. C-intercept: $(700, 0)$; P-intercept: $(0, 200)$; Window: $[0, 800, 100] \times [0, 250, 50]$

10. x-intercept: $(\frac{1}{10}, 0)$; y-intercept: $(0, \frac{2}{35})$; Window: $[0, 1, 0.1] \times [0, 0.1, 0.01]$

11A. At 4°C , the ant speed is 0.

B. $[0, 30, 5] \times [0, 5, 1]$

x	1	3	7	12	21
y	$-\frac{18}{35} = -.51$	$\frac{2}{35} = .057$	$\frac{6}{5} = 1.2$	$\frac{92}{35} = 2.63$	$\frac{26}{5} = 5.2$

12A.

B. $[0, 22, 5] \times [-2, 7, 1]$

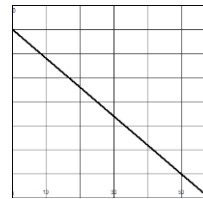
13A. $R = 35 - 0.6w$

B. 29.6 lbs

C. $(58.33, 0)$ After $58 \frac{1}{3}$ weeks, the rice is gone.

D. $(0, 35)$ At 0 weeks, there is 35 pounds of rice.

E. $[0, 60, 10] \times [0, 40, 5]$



14A.

t	0	1	3	4.5	6.25
V	25,000	21,500	14,500	9,250	3,125

B. $[0, 8, 1] \times [0, 25000, 5000]$

15A. 200 chirps/min

B. 51.25°F

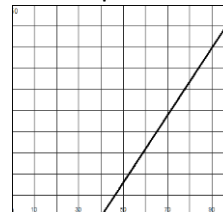
C. Yes. At 60°F , the cricket chirps 80 times per minute.

D. $(40, 0)$ At 40°F , the crickets don't chirp.

E. $(0, -160)$ No, negative chirps is unreasonable.

F. $[0, 100, 10] \times [0, 250, 25]$

G.



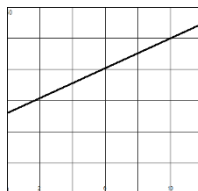
16A.

0	65°
5	95°
8	113°

B. $T = 65 + 6h$

C. $h = 4.167$ hours after 6 am or around 10:10 am

D. Window: $[0, 12, 2] \times [0, 150, 25]$



17. $F = 35 + 54.99m$

(0, 35) Initial fee is \$35 for 0 months.

(-0.64, 0) Not reasonable, negative months.

18. $D = -350 + 15m$

(0, -350) He starts at 350 feet below sea level.

(23.33, 0) After 23.33 minutes, he is at the surface (0 feet below sea level).

19. $B = 50 - 0.75w$

(0, 50) She has 50 pounds at week 0.

(66.67, 0) After approximately 66.67 weeks, the beans are gone.

20. $W = 7.50h$

(0, 0) If he works 0 hours, he makes \$0.

21A. $F = 2.70 + .23(10m-1)$ where m is miles B. $F = \$13.97$

C. $m = 3.7$ miles

D. $m = 11.32$ miles or more

22A. $W = 250 + 0.07s$

B. $W = \$509$

C. $s = \$5000$

23A. $C = 750 + 32y$; $C = 900 + 18y$

B. approximately 10.71 years

24A. $A = P + 0.175P = 1.0175 P$

B. \$7631.25

C. \$982.80

25A.

a	-500	0	1000	2000	3000	4000	5000
B	213	212	210	208	206	204	202

B. $B = 212 - 0.002a$

C. $a > 4000$; $(4000, \infty)$

Section 2.2

1. $y = -7x - 1$

2. $y = \frac{2}{7}x + 2$

3. $y - 1 = -5/2(x - 3)$ or $y = -5/2x + 17/2$

4. $y = 2/5x + 27/5$ or $y - 7 = 2/5(x - 4)$

5. $y = -5/6x + 3$

6. $y = 4$

7. $x = 3$

8. $y = 5$

9. $y = -2x + 1$

10. $y = \frac{1}{2}x + 4$

11. $y - 2 = \frac{3}{4}(x - 1)$ or $y = \frac{3}{4}x + \frac{5}{4}$

12. $y - 3 = -5/2(x - 1)$ or $y = -\frac{5}{2}x + \frac{11}{2}$

13. $m = 20h + 30$

14. $f = -3/2s + 75$

15. $h = -30t + 120$

16. $y = 25x$

17. $y = 2/3x + 12$

18. $P - 21 = -21/26(t - 2002)$ or $P = -\frac{21}{26}t + 1638$

19A. $m = \$8.50$ per pound; Candy costs \$8.50 per pound.

B. (0, 4) It costs \$4 for 0 pounds.

C. $p = 8.50w + 4$

20A. $m = 0.09$ Median age increases by 0.09 years per year.

B. (0, -147.1) Negative years does not make sense.

21A. $m = -1^\circ/200$ ft The temperature decreases by 1° for every 200 ft above sea level.

B. (0, 80) The temperature at sea level is 80° .

C. $T = -1/200 A + 80$

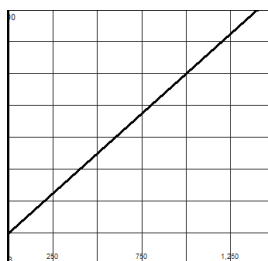
22. Alisa is moving toward the pinball machine at a steady 3 feet per second.

23. C

24A. III B. II C. I D. IV

25A.

200	200
500	350
1000	600

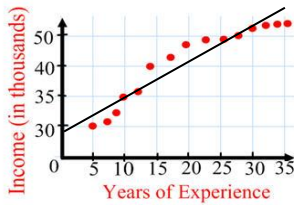


B. $C = 100 + 0.50N$

C. see graph

D. $[0, 1500, 250] \times [0, 800, 100]$

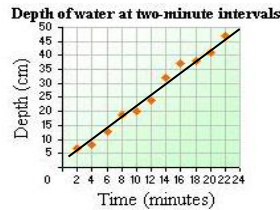
26*.



Points: (10, 35) (25, 48)

$I - 35 = 13/15(E - 10)$

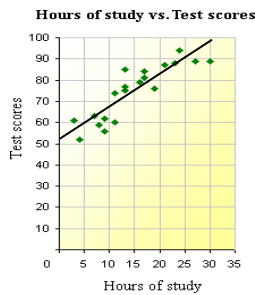
27*.



Points: (4, 10) (14, 30)

$D - 10 = 2(m - 4)$

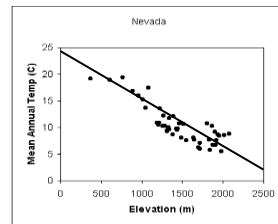
28*.



Points: (5, 60) (25, 90)

$T - 60 = 3/2(H - 5)$

29*.



Points: (0, 24) (2500, 2)

$c = -11/1250m + 24$

*(26 – 29. Answers may vary.)

30A.

C*. (8, 25.5) and (15, 32.8)

D*. $m = 1.04$, Attendance at Disney World parks is increasing by 1.05 million people per year.

E*. $A(t) = 1.04t + 13.8$ where t is years after 1980

F*. $A(27) = 41.88$ million visitors

G. $A = 1.22t + 15.2$

31A.

B. $w = 3.50h - 90.9$

C. $m = 3.50$, a woman's weight increases by 3.50 pounds per inch in height.

D. (0, -90.9); No, negative weights do not make sense.

E. $w(61) = 122.6$ pounds

32A.

B. linear

C. answers will vary; $w = 1.35(\text{year}) - 2622.3$

D. $w(2013) = 95.25\%$ overweight

33A.

B. linear

C. answers will vary; $w = 0.10(\text{year}) - 191.19$

D. $w(2013) = \$10.11$

34A.

B. linear

C. answers will vary; $D = 15290.33(\text{year}) - 29,344,433$

D. $D(2013) = 27,845,001$ Bachelor degrees

35. $K = 15/27F + 2297/9$ or $K = 0.56F + 255.2$

36A.

B. answers will vary (7, 47) and (11, 60)

C. answers will vary; $h = 13/4(\text{length}) + 97/4$ or $\text{height} = 3.25(\text{length}) + 24.25$

Section 2.3

1. $x = -1.6, x = 2.2$

2. $x = 1.8, x = -5.8$

3. $x = 2.61, x = -1.277$

4. $x = 22.808, x = 2.192$

5. $x = 1.338, x = -4.671$

6. $x = 1.766, x = -2.266$

7. $x = -5, x = -4$

8. $x = -2, x = 1$

9. $x = -6, x = 2$

10. $x = 3, x = -3$

11. $x = \pm\sqrt{2}$

12. $x = \pm\frac{\sqrt{14}}{2}$

13. $x = 1, x = -3$

14. $x = \frac{1 \pm \sqrt{10}}{3}$

15. $x = 5/2, x = -1/3$

16. $x = 5, x = -1/3$

17. $x = 5, x = 7$

18. $x = -2/3, x = -7$

19. $x = 8 \pm \sqrt{104}$ or $x = 8 \pm 2\sqrt{26}$

20. $x = \frac{5 \pm \sqrt{35}i}{2}$

21. $x = -3 \pm \frac{\sqrt{23}}{2}$

22. $x = 5/2, x = -1/3$

23. $x = \frac{1 \pm \sqrt{13}}{4}$

24. $x = \frac{5 \pm \sqrt{3}i}{4}$

25. $x = \frac{-7 \pm \sqrt{157}}{6}$

26. $x = \frac{-9 \pm \sqrt{125}}{2}$ or $x = \frac{-9 \pm 5\sqrt{5}}{2}$

27. $x = \frac{-1 \pm \sqrt{2}}{2}$

28. $x = \frac{\pm\sqrt{51}}{3}$

29. $x = 7, x = 1$

30. $x = \frac{1}{2} \pm \frac{\sqrt{15}}{6}i$

31. $x = \pm 3/2$

32. $x = \frac{9 \pm \sqrt{21}}{10}$

33. $x = \pm 2, x = \pm\sqrt{\frac{1}{2}}$

34. $x = \pm\sqrt{\frac{-1 \pm \sqrt{61}}{6}}$

35. $x = \frac{1}{4}, x = 9$

36. $x = \left(\frac{5 \pm \sqrt{33}}{2}\right)^2$

Section 2.4

1. (0, -25), (5, 0), (-5, 0)

2. (0, 28) (-7, 0) (-4, 0)

3. (0, -3), (1, 0), (-3/2, 0)

4. (0, 5), (5/2, 0), (1, 0)

5. (0, 20), (5/3, 0), (1, 0)

6. (0, 40), (-2, 0), (-10, 0)

7. (0, 3), no horizontal intercepts

8. (0, 1), $(\frac{7 \pm \sqrt{41}}{4}, 0)$

9. (0, -11), no horizontal intercepts

10. (0, 22), no horizontal intercepts

11. (-7, -2); $x = -7$

12. (-5, 3); $x = -5$

13. (3, -1); $x = 3$

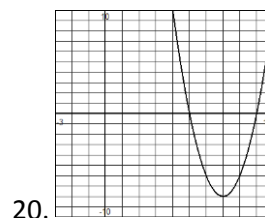
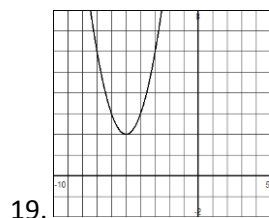
14. (-1, -9); $x = -1$

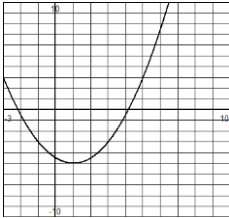
15. (-6, -2); (0, -74); no x-intercepts

16. (-2, -9); (0, 3); $(-2 \pm \sqrt{3}, 0)$

17. (3, -4); (0, -1); $(3 \pm \sqrt{12}, 0)$

18. (-5, -8); (0, -33); no x-intercepts





21.

23. $a > 0, b \neq 0, c < 0$

25. $a > 0, b \neq 0, c < 0$

27. Concave down, y-intercept (0, 11), vertex off y-axis

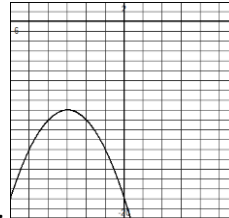
29. concave up, y-intercept (0, -5), vertex off y-axis

31. vertex (0, -5); intercepts (0, -5), $(\pm \frac{\sqrt{5}}{2}, 0)$

32. vertex $(-1/12, -121/24)$, intercepts (0, -5), $(5/6, 0)$, (-1, 0)

33. vertex (-3, -3) intercepts (0, 0), (-6, 0)

34. vertex (2, 7) intercepts (0, 3), $(2 \pm \sqrt{7}, 0)$



22.

24. $a < 0, b \neq 0, c > 0$

26. $a < 0, b = 0, c < 0$

28. concave up, y-intercept (0, 1), vertex on y-axis

30. concave down, y-intercept (0, 3), vertex off y-axis

35.a. (0, 4)

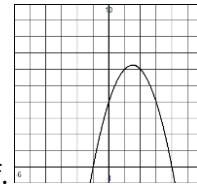
b. (4, 0) (-1, 0)

c. (3/2, 25/4)

d. down

e. standard

f.



36.a. (0, 4)

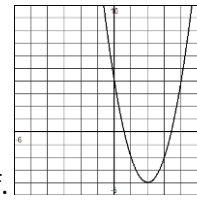
b. $(\frac{4 \pm \sqrt{8}}{2}, 0)$

c. (2, -4)

d. up

e. stretched

f.



37.a. (0, -1)

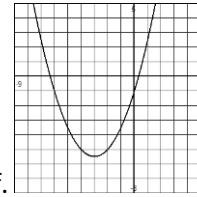
b. $(-3 \pm \sqrt{11}, 0)$

c. (-3, -11/2)

d. up

e. shrunk

f.



38. $f(x) = (x + 6)^2 - 31$

39. $f(x) = (x + 7/2)^2 - 89/4$

40. $f(x) = 3(x - 2)^2 + 5$

41. $f(x) = 2(x + 5)^2 - 61$

Section 2.5

1. $y = x^2 + 2x - 15$; $y = 2(x^2 + 2x - 15)$

3. $y = -(x^2 + 3x - 4)$; $y = -3(x^2 + 3x - 4)$

5. $y = -1/8(x^2 + 3x - 28)$

7. $y = 2/21(x^2 - x - 42)$

9. $y = -2/5(x + 4)(x - 6)$ or $y = -2/5(x^2 - 2x - 24)$

11.

13.

15.

17.

2. $y = x^2 - 7x + 12$; $y = 6(x^2 - 7x + 12)$

4. $y = -(x^2 - 2x - 24)$; $y = -1/2(x^2 - 2x - 24)$

6. $y = 3/10(x^2 + 7x + 10)$

8. $y = 5/49(2x^2 + 5x - 3)$

10. $y = 2(x + 2)(x - 3)$ or $y = 2(x^2 - x - 6)$

12. $C = 0.0035v^2 - 0.295v + 12.2$

14. $h = -1/7500(x - 150)^2 + 38$

16. $h = -4.9(t - 1.5)^2 + 11.025$

18. $h = -0.006(x - 1)^2 + 11.5$

Section 2.6

1. max (7, 5) increasing $(-\infty, 7)$ decreasing $(7, \infty)$

2. min (-11, -8) decreasing $(-\infty, -11)$ increasing $(-11, \infty)$

16A. 500 tennis balls

17. 1100 units

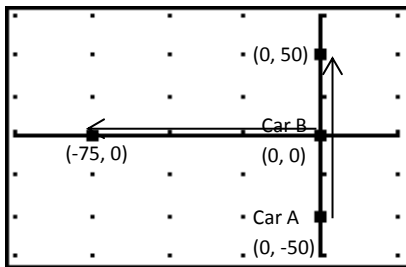
B. less than 1010

3. min $(5/6, 95/12)$ decreasing $(-\infty, 5/6)$ increasing $(5/6, \infty)$
 4. max $(-7/4, 57/8)$ increasing $(-\infty, -7/4)$ decreasing $(-7/4, \infty)$
 5. L = 7.31 ft; W = 12.31 ft
 6. 7.204 hours
 7A. 4.146 sec B. never C. $t \geq 0$
 8A. 2.993 sec B. 3.189 sec C. $t \leq 3.189$ sec
 D. (0.473, 2.588)
 9. $T = 1/2^\circ\text{C}$
 10. $t = 4.33$ sec
 11. $t = 4.9$ seconds to hit the ground;
 maximum height of 186 ft after 1.5 sec
 12A. minimum area = 0 B. 3 x 9 meters
 13. $W = 50/3$ yds; $L = 25$ yds
 14A. 85.73 ft B. 0.857 inch
 15A. $H = 1.569$ B. 625 mph??

18. 40 items 19. 2.367 sec
 20. 72 ft x 160 ft
 21A. $x = 3$ ft; $y = 14$ ft
 B. After he is 7.74 feet horizontally
 22. $W = 20$; $L = 30$ yds
 23. Base = 8 ft; Height = 5 ft
 24. 6 ft by 15 ft
 25A. 50 by 200 or 100 by 100
 B. 11250 ft^2 (75 by 150 ft)
 26A. Not possible
 B. 31250 ft^2 (125 by 250 ft)

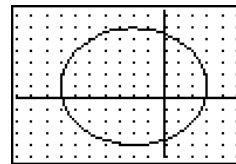
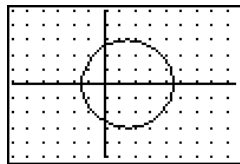
Section 2.7

1. $\sqrt{20} \approx 4.47$ 2. $\sqrt{90} \approx 9.48$
 3. 0.776 4. 6.494
 5. yes
 6. A.



B. 90.14 miles

7. (4, 3) 8. (-4, 2.5)
 9. (1988, 347) In 1988, the average daily jail population was 347 thousand people.
 10. (1988, 2617.5) In 1988, the federal deficit was 2617.5 billion dollars.
 11A. (0, 0) $r = 5$ B. (0, 0) $r = \sqrt{70} \approx 8.37$
 12A. (3, 0) $r = 6$ B. (-4, 2) $r = 10$



- 13A. $(x - 1)^2 + (y + 2)^2 = 16$ B. $(x + 3)^2 + (y + 1)^2 = 4$
 14. $(x - 9)^2 + (y - 2)^2 = 25$ 15. $(x + 3)^2 + (y + 5)^2 = 81$
 16. $(x - 8)^2 + (y + 2)^2 = 149$ 17. $(x + 2)^2 + (y + 2)^2 = 34$

Section 3.1

1.

x	$F^{-1}(x)$
2	-1
5	0
-3	1
7	2
1	3

Yes

*2.

x	y
0	2
-1	4
-2	7
0	9
-1	12

No, note the inverse function notation is not used

3.

Height	Time
3	1
51	2
67	3
51	4

No

4.

t	$g^{-1}(t)$
11	-1
-7	3
1	5
5	8
-1	10

Yes

$$g^{-1}(5) = 8$$

5.

d (cm)	0.5	0.87	1.01	1.24
t (min)	10	30	40	60

6A. $f^{-1}(5) = -3$; $f^{-1}(0) = -2$; $f^{-1}(4) = 0$, $f^{-1}(7) = 2$

B. $f^{-1}(0) = -2$

C. $f^{-1}(7) = 2$

7. $f^{-1}(x) = \frac{x-9}{4}$

8. $g^{-1}(x) = \sqrt[7]{x-5}$

9. $f^{-1}(x) = \sqrt[3]{\frac{x+11}{3}}$

10. $h^{-1}(t) = \frac{t^2-5}{3}$

11. $g^{-1}(m) = 8m + 3$

12. $f^{-1}(d) = \frac{(d-1)^4}{81}$

13. $h^{-1}(x) = \sqrt{\frac{x+5}{6}}$

14. $Y^{-1}(x) = \frac{4x^3+3}{2}$

15A. $C(75) = 23.9$; A temperature of 75°F is about 24°C .

B. 82.4°F

C. $F(C) = 9/5 C + 32$

D. $C^{-1}(28) = 82.4^\circ$

16A. $W(40) \approx 83$ After 40 hours, the bat weighs about 83 grams.

B. $W^{-1}(80) = 46$ Bat weighs 80 grams about 46 hours after its last meal.

17A.

d, skid distance	s. speed
20	22
35	29
80	44

B.

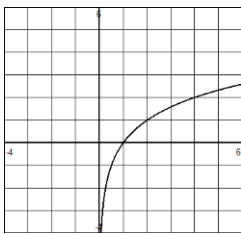
s, speed	d, skid distance
22	20
29	35
44	80

C. $s^{-1}(d) = d^2/24$

D. $s^{-1}(70) = 204$; At 70mph, the skid distance is 204 feet.

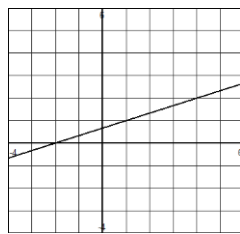
E. $s(70) = 41$; At a skid distance of 70 feet, the car was traveling at 41 mph.

18.

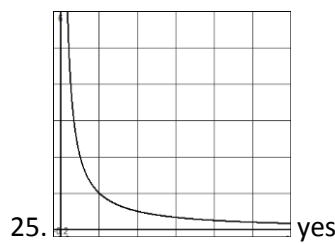
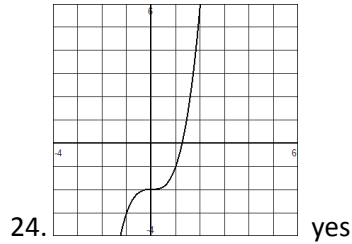
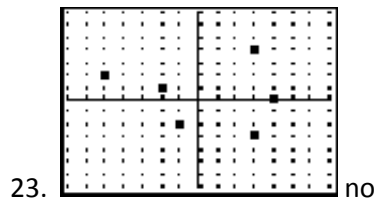
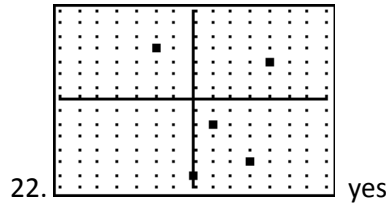
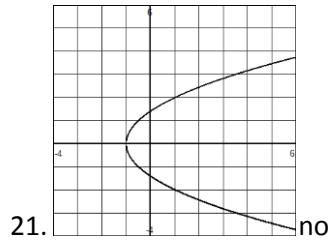
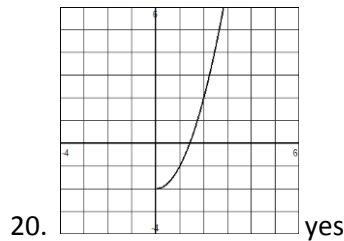


yes

19.



yes



26. 18, 19, 20, 22, 24, 25

27. $f \circ f^{-1}(x) = f(f^{-1}(x)) = \frac{1}{3}(3x+1) - \frac{1}{3} = x$
 $f^{-1} \circ f(x) = f^{-1}(f(x)) = 3(\frac{1}{3}x - \frac{1}{3}) + 1 = x$

28. $f \circ f^{-1}(x) = f(f^{-1}(x)) = 3\sqrt[4]{\frac{(x-1)^4}{81}} + 1 = 3(\frac{x-1}{3}) + 1 = x$
 $f^{-1} \circ f(x) = f^{-1}(f(x)) = \frac{3\sqrt[4]{x+1-1}}{81} = x$

29. $f \circ f^{-1}(x) = f(f^{-1}(x)) = \sqrt[3]{\frac{2(\frac{4x^3+3}{2})-3}{4}} = \sqrt[3]{\frac{4x^3+3-3}{4}} = \sqrt[3]{x^3} = x$
 $f^{-1} \circ f(x) = f^{-1}(f(x)) = \frac{4(\sqrt[3]{\frac{2x-3}{4}})^3+3}{2} = \frac{2x-3+3}{2} = x$

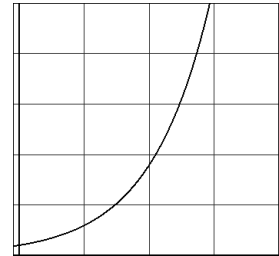
30. $f^{-1}(x) = \sqrt{x-6}$; restrict the domain to $x \geq 6$

31. $f^{-1}(x) = \sqrt{\frac{x}{3}} - 1$; restrict the domain to $x \geq 0$

Section 3.2

0	1	2	3	4
20	60	180	540	1620

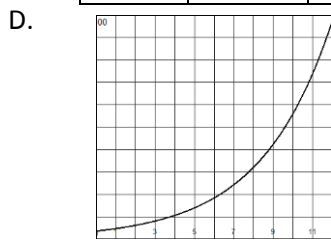
- 1A. B. $P(t) = 20(3)^t$ C.
 D. $P(1.5) = 103.92$ or 104 fruit flies E. $20(3)^t = 1000$; $t = 3.561$ months



2A.

0	5	10	15	20
35	140	560	2240	8960

- B. $P(t) = 35(4)^{t/5}$ C. $P(12) = 975$



E. $t = 3.786$

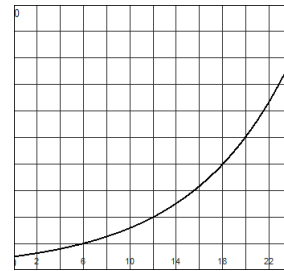
3A.

0	6	12	18	24
1	2	4	8	16

C. $P(t) = 1(2)^{t/6}$
 E. $P(48) = 256$

D. $P(8) = 2.52$

B.



4A. $P(t) = 1(2)^{t/5}$

B. $P(86) = 150562.19$

5A. $T(t) = 125.91(1.14)^t$

B. $T(5) = \$242.43$

C. $t = 6.626$ years

6A. $P(t) = 1000^{t/25}$

B. $P(31) = 5248.07$

7A. $P(t) = 285(1.75)^t$

B. $P(9) = 43871.99$

8A. $P(t) = 5078(2)^{t/5}$

B. $P(13) = 30787.23$

9A. $P(t) = 2.79(1.08)^{t/6}$

B. $P(15) = \$3.38$; $P(24) = \$3.80$

10A. $P(t) = 40000(1.05)^t$

B. $P(30) = \$172877.70$

11. $A(t) = 7000(1.039)^t$; $A(3) = 7851.36$; $A(10) = 10262.51$

12A. $A(t) = 350\left(1 + \frac{.025}{2}\right)^{2t}$

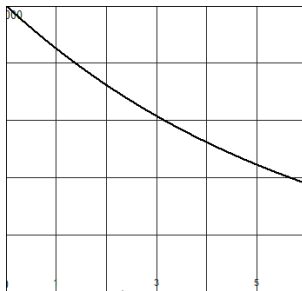
B. $A(5) = 396.29$

13. $A(t) = 2000\left(1 + \frac{.06}{365}\right)^{365t}$; $A(1) = 2123.66$; $A(4) = 2542.45$

0	1	2	3	4
25000	21250	18062.50	15353.13	13050.16

14A. B. $V(t) = 25000(0.85)^t$

C.



D. $V(3.5) = 14154.88$

E. $t = 4.265$

15. $P(t) = 150(1/2)^{t/15}$

16. $P(t) = (1/2)^{t/5730}$; $t = 9952.8$

17A. $P(t) = 70(1/2)^{t/200}$

B. $t = 444.478$

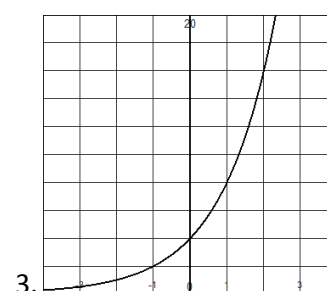
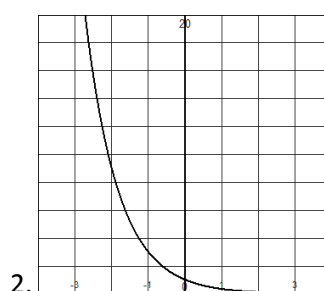
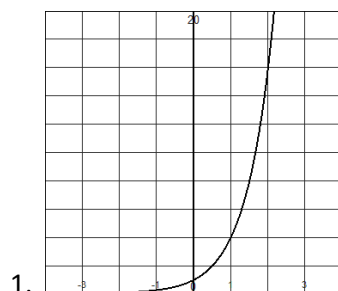
18. $P(t) = (1/2)^{t/7}$; $P(40) = 0.019$

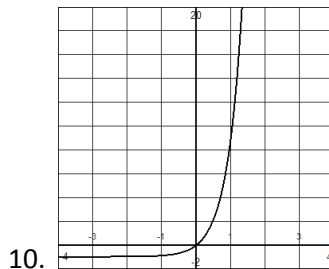
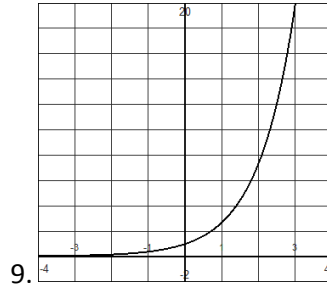
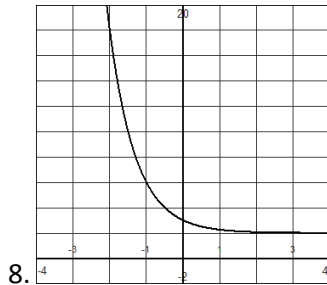
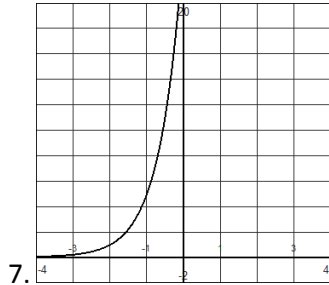
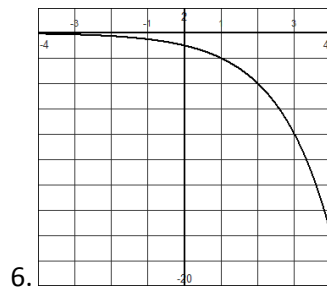
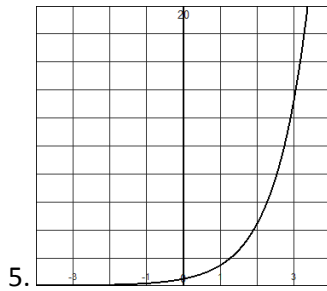
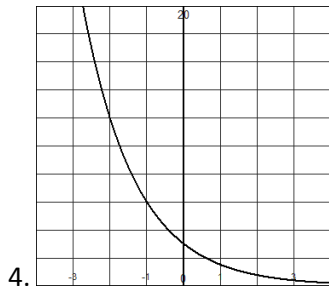
19A. $P(t) = 500(2/3)^{t/2}$

B. $P(4) = 222.22$

C. $t = 12.458$

Section 3.3





11A. $f(x) = 2^x + 3$ B. $f(x) = 3(2)^x$

C. $f(x) = -2^x - 1$ D. $f(x) = 4(2)^x$

12. (0, 6.2) decreasing

13. (0, 2) increasing

14. (0, 2/3) increasing

15. (0, 5/2) decreasing

16. $g(x) = 3(2.5)^x$

17. $f(x) = 32(1/2)^x$

18. $f(x) = 40(3/4)^{x/4}$

19. $g(x) = 100(5)^{x/10}$

20. $f(x) = 3(1/4)^x$

21. $f(x) = 4(1/2)^x$

22. $f(x) = \frac{1}{2}(6)^x$

23. $f(x) = 2(5)^{x/2}$

24A. 1296 B. 210 C. 6^{a+h}

D. $\frac{6^{a+h} - 6^a}{h}$

25A. 65 B. 195 C. $2^{3(a+h)} + 1$

D. $\frac{2^{3(a+h)} + 1 - (2^{3a} - 1)}{h}$

26. neither

Section 3.4

1. $\log_4(16) = 2$

2. $\log_5(125) = 3$

3. $\log_7(1) = 0$

4. $\log_2(1/2) = -1$

9. $2^5 = 32$

10. $5^1 = 5$

11. $b^3 = m$

12. $p^2 = 30$

13. $10^n = t$

14. $e^v = 9$

15. $6^{-4} = 6^{-4}$

16. $100^{1/2} = 10$

17. 1.279

18. 2.477

19. 3.807

20. 4.718

21. 3

22. 2

5. $\log_{36}(6) = \frac{1}{2}$

6. $\log_H(d) = 4$

7. $\log_x(z) = y$

8. $\log_m(3) = 7$

27. 0

28. 4

29. 1

30. 1/3

31. $\frac{\log(22)}{\log(4)} = 2.23$

32. $\frac{\log(121)}{\log(6)} = 2.677$

33. $\frac{\ln(400)}{\ln(12)} = 2.411$

34. $\frac{\ln(18)}{\ln(3)} = 2.631$

35. $\frac{\log(37)}{\log(b)}$

36. $\frac{\ln(g)}{\ln(f)}$

23. 3
24. $\frac{1}{2}$
25. 8
26. 7

37. 2.64
38. 2.367
39. 1.892
40. 4.357

Section 3.5

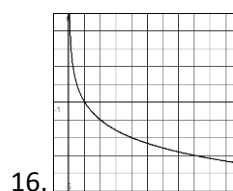
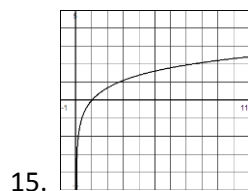
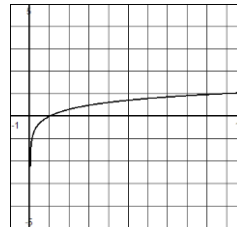
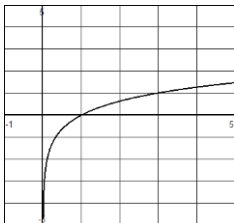
1. $x = 13/3$
2. $x = 7$
3. $x = 4$
4. $x = 1$
5. $x = 17/3$
6. $x = 4$
7. $x = 3$
8. $x = -5$
9. $x = 1.277$
10. $x = 4.358$
11. $x = 1.807$
12. $x = 0.389$
13. $x = -6.276$
14. $x = -1.903$

15. $x = 1.544$
16. $x = -3.145$
17. $x = -0.528$
18. $x = 15.275$
19. $x = 0.999$
20. $x = 30.543$
21. $2^{t/5} = 1000$; $t = 49.829$ minutes
22. $t = 7.8$ or 2015
23. $t = 29.379$ months
24. $t = 9.056$ years
25. $t = 18.12$ years; $t = 28.715$ years
26. $t = 3.802$ years; $t = 11.405$ years
27. $t = 13.887$ years
28. $t = 28.61$ hours

Section 3.6

1. 7
2. 9
3. -2
4. 11
5. t
6. $1/3$
- 13.

7. 12
8. 2
9. 6
10. x
11. 13
12. n
- 14.



17. $\log_3(7) + 6\log_3(x)$
18. $2\log_a(x) + 3\log_a(y)$
19. $2[\ln(m) + \ln(n)]$
20. $4\log_b(x+3) + 5\log_b(y+6)$
21. $\frac{1}{2}\log_6(3) + \frac{1}{2}\log_6(x) - \log_6(y)$
22. $\log_2(4) + \log_2(t) - \log_2(r)$
23. $\frac{1}{3}(\ln(x) - \ln(y))$
24. $\log(g) - 5\log(h)$

28. $\log_3\sqrt{xp}$
29. $\log_b\left(\frac{xd}{w}\right)$
30. $\log_b\left(\frac{x^3y}{z^{1/4}}\right)$ or $\log_b\left(\frac{x^3y}{\sqrt[4]{z}}\right)$
31. $x = 2/15$
32. $x = 501/98$
33. $x = 1$
34. $x = 50/7$

25. $\log_b\left(\frac{z}{w}\right)$
 26. $\log_b\left(\frac{x^2}{y}\right)$
 27. $\log_4(x^2w^3)$

- 35.A. $f(65) = 71.03$ B. 1947 C. 75.3
 36.A. 20.6 decibels B. 89.5 decibels
 37.A. 79.82% B. 73.9 inches

Section 3.7

- 1A. 1050.63 B. 1218.40 C. 22.246
 2A. 5254.73 B. 5256.36
 3. 35526.77
 4. 3194.11
 5. 8.85%; 8.66%
 6. 8.15%; 7.83%
 7. $P = 730(1.051)^t$ or $P = 63911(1.051)^t$
 8. $C = 0.97(1.0528)^t$
 9. \$2529.06
 10. $A = 125(0.7)^t$
 11. a. $T = 150(1.17)^t$, b. 150, c. 721
 12. a. $V = 33457(0.88)^t$, b. 33457, c. 20064

- 13A. $T = 182.4(0.9845)^t$
 C. 182.4°
 D. 35 minutes
 E. 10 minutes

B.



14. (5, 4000), (8, 24000); $f(x) = 202(6)^{x/3}$ or $f(x) = 202(1.817)^x$
 15. (5, 30), (7, 130); $f(t) = 0.767(2.082)^t$

Unit 4

Section 4.1

1. $x + 2/x + 4$
 3. $2x^2 + 20x/3 + 4$
 5. $x + 4 - 10/(x + 2)$
 7. $4x - 14 + 45/(x + 3)$
 9. $x^2 - 4x + 2 + 1/(x + 1)$
 10. $x + 3 - 4/(x + 2)$
 11. $x^2 - 2x + 3 + 5/(x - 1)$
 13. $3x + 7 + 5/(x - 2)$
 15. -19
 17. -144

Section 4.2

- 1.A. 5 B. 1
 3. 1.1
 5. $-13/5$
 7. -2 or 6
 9. -16
 11. $\pm \frac{\sqrt{165}}{5}$
 13. $13 \frac{1}{3}$ days
 15. 20 liters
 17. 42.5 hours
 19. 2,448,371 deaths
 21. 1.5 inch/hour
 23. 4 women
 25. 14.2 lbs
 27. 2.4 hours
 29. 20.6 days
 31. $6 \frac{2}{3}$ hours
 33. 30.6 minutes
 35. 2.7 hours
 37. $16 \frac{2}{3}$ miles
 39. 44 and 60 mph

Section 4.3

1.

A. V. A.: $x = 0$, $x = \frac{1}{2}$, no holes

B. H.A.: $y = 0$

C. x-int: $(-4,0)$, no y-int

3.

A. V.A.: $x = 4$, hole at $x = -4$

B. H.A.: $y = 0$

C. x-int: none, y-int: $(0, -1/4)$

5.

A. V.A.: $x = 3$, no holes

B. H.A.: none, Slant asymptote: $y = x + 3$

C. X-int: none, y-int: $(0, -4/3)$

7.

A. V.A.: $x = -2$, no holes

B. H.A.: $y = 1$

C. x-int: $(-4,0)$, y-int: $(0,2)$

9.

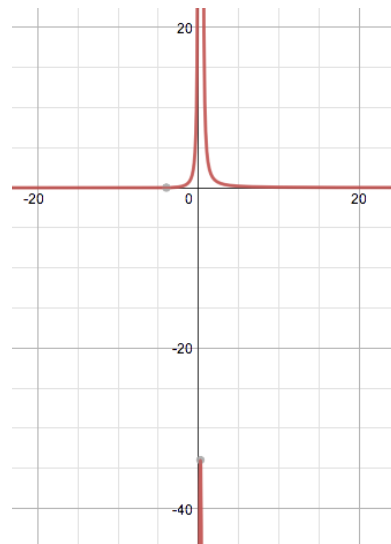
A. Average Cost = $\frac{750 + 92x}{x}$

D. V.A.: $x = 0$, H.A.: $y = 92$

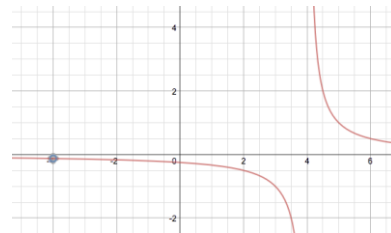
E. The average annual cost for the refrigerator approaches \$92 as the length of ownership increases

F. No

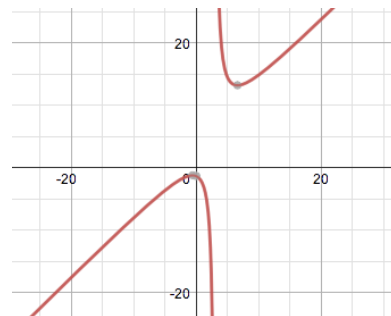
D.



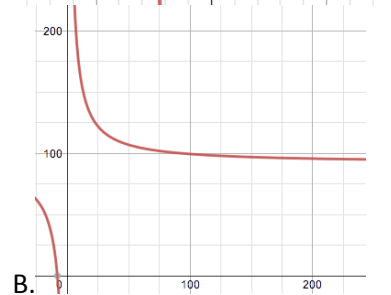
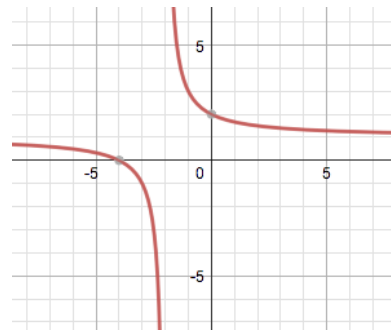
D.



D.



D.



B.

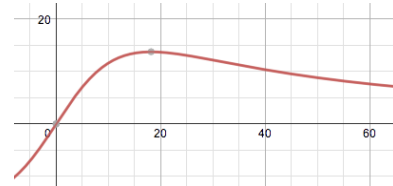
11.

B. 18.2 minutes, 13.8 micrograms per mL

C. Drug concentration increases until its maximum and then slowly decreases as it is absorbed by the body.

D. V.A.: none, H.A.: $C(t) = 0$, Drug concentration approaches zero as time elapses.

A.



13.

A. Average Cost = $\frac{80 + 6x}{x}$

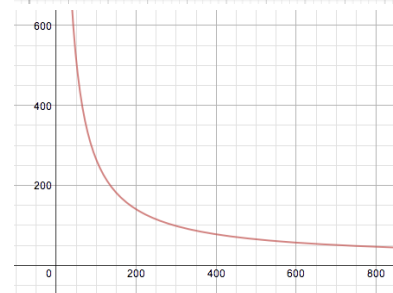
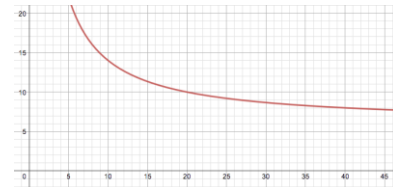
B. Average cost of each t-shirt approaches \$6 the more t-shirts are produced.

15.

A. Average Cost = $\frac{25000 + 15n}{n}$

C. 3571 calculators

D. H.A.: $y = 15$. As more calculator are produced, the average cost of the calculators approaches \$15.



Section 4.4

1. Degree = 5, Leading Coefficient = -11

3. Degree = 4, Leading Coefficient = -8

5. Degree = 4, Leading Coefficient = -2

7.

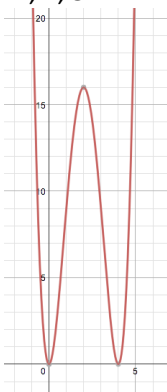
9.

11.

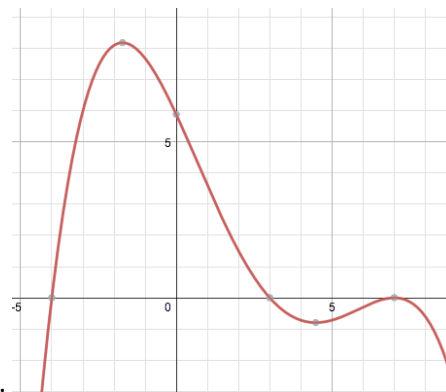
13. -5, 4, 8

15. -1, 2, 5

17.



19.



21.

23. $P(x) = (x + 2)^2(x - 4)$

25. $P(x) = -x(x + 3)(x + 1)(x - 3)$

27. $P(x) = x(x + 3)(x + 1)^2$

29. $P(x) = (x - 3)(x - 2)(x - 1)^2(x + 3)$

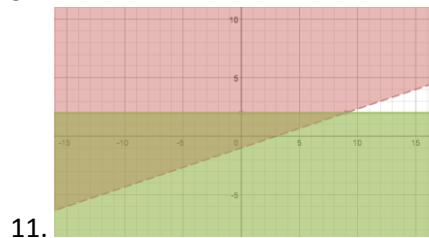
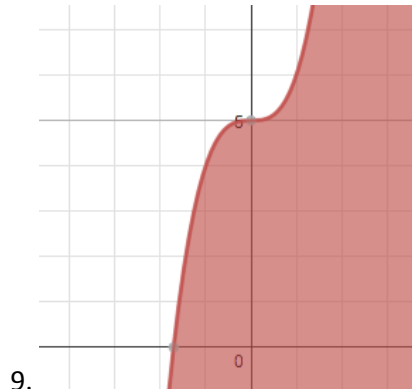
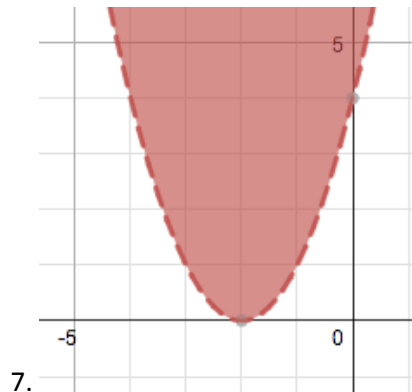
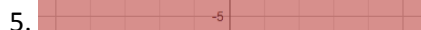
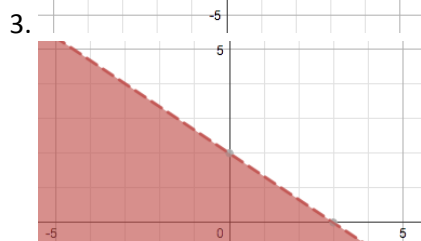
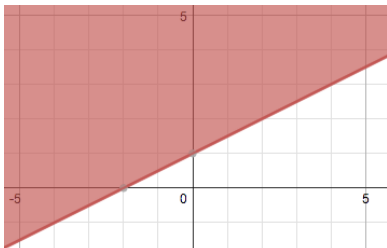
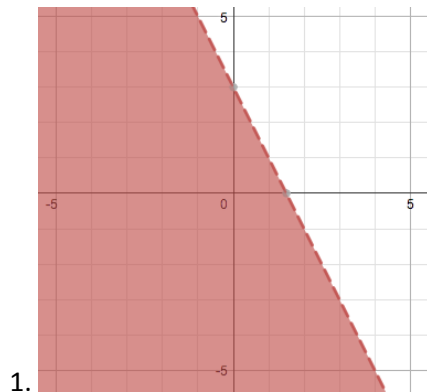
31. $P(x) = (x - 5)(x - 2)(x + 4)$

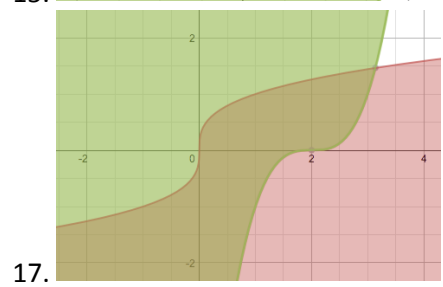
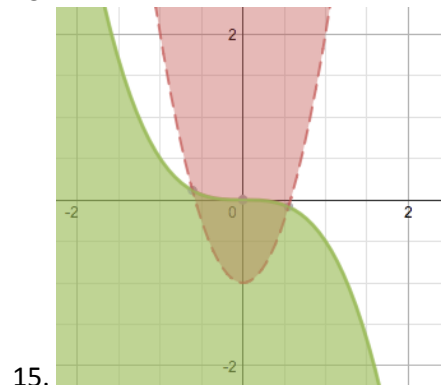
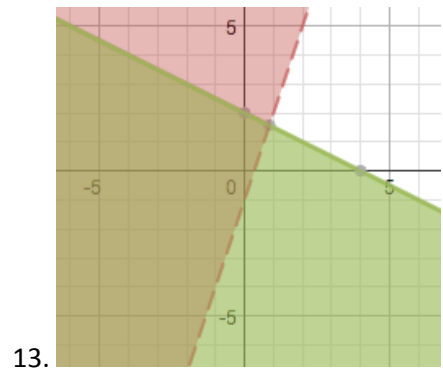
33. $P(x) = 6(x + 1)(x + 5/2)(x - 2/3)$

Section 4.5

- | | | |
|--------------------------------------|--|---|
| 1. A. $x = -4$ | B. $(-4, 0)$ | C. $(0, \infty)$ |
| 3. A. $x = -1$ | B. $(-\infty, -2) \cup (-1, 1)$ | C. $(-2, -1) \cup (1, \infty)$ |
| 5. A. $x = -2, 0, 1, 3$ | B. $(-2, 0) \cup (1, 3)$ | C. $(-\infty, -2) \cup (0, 1) \cup (3, \infty)$ |
| 7. A. $x = -1, 4$ | B. $(-1, 4)$ | C. $(-\infty, -1) \cup (4, \infty)$ |
| 9. A. $x = 3, 5$ | B. $(3, 5)$ | C. $(-\infty, 3) \cup (5, \infty)$ |
| 11. $(1, 6)$ | 25. $(-3, 0) \cup (1, \infty)$ | |
| 13. $[1/2, 2]$ | 27. $(-5/2, 2/3)$ | |
| 15. $(-\infty, -1) \cup (0, 1)$ | 29. $(-\infty, -25/2] \cup [-5/2, \infty)$ | |
| 17. $[-2, 1)$ | 31. $(-8, -6)$ | |
| 19. $(-2, -2/3)$ | 33. Between 0 and 2.17 seconds | |
| 21. $(-12, 20)$ | 35. Never | |
| 23. $(-\infty, -2) \cup (2, \infty)$ | 37. More than 7.7 feet | |
| | 39. A. $ x - 37500 \leq 2570$ | B. $[\$34,930, \$40,070]$ |

Section 4.6





19. (1,-1)

21. $0.75x + 0.60y \geq 25, x \geq 0, y \geq 0$

23. 1991

25. \$7500 in sales.