

1. a. 20 e. $3\sqrt{3} - 2\sqrt{5}$
b. 9 f. $\frac{5\sqrt{2}}{3}$
c. 40 g. $\sqrt{6}$
d. $\sqrt{2}$ h. $9\sqrt{2} + 5\sqrt{6}$
2. a. $x = \pm 3$ d. $x = \pm 2$
b. $x = \pm 3$ e. $x = \pm 5\sqrt{3}$
c. $x = \pm 10$ f. $x = \pm 2\sqrt{7}$
3. a. $x = 5, x = 2$ d. no real solutions
b. $x = -5, x = 2$ e. $x = \frac{1}{3}$
c. $x = \frac{3}{2}, x = -\frac{2}{3}$ f. $x = \frac{3 \pm \sqrt{5}}{4}$
4. a. 70 feet
b. 103 feet
c. 5.123 seconds
5. a. There are two times when the ball is six feet above the ground. The first is immediately after the ball is kicked, and occurs at 0.047 seconds. The second is farther downfield and while the ball is heading back toward ground; this occurs at 4.640 seconds.
b. 4.721 seconds
c. 90.390 or 90.391 feet

6. Interval notation is used in the chart below, but inequality notation is acceptable as are precise words such as “All real numbers greater than or equal to 3.”

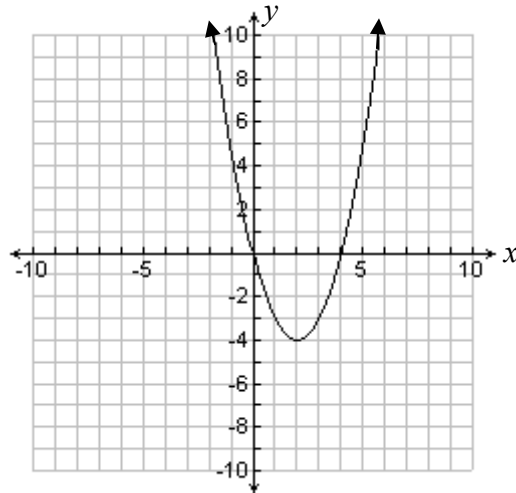
	Domain	Range	Axis of Symmetry	Vertex min. or max.	Transformation(s) from $f(x) = x^2$	Equation
I	$(-\infty, \infty)$	$[3, \infty)$	$x = 5$	$(5, 3)$ min.	Right 5 units Up 3 units	$f(x) = (x - 5)^2 + 3$
II	$(-\infty, \infty)$	$(-\infty, -4]$	$x = -6$	$(-6, -4)$ max.	Reflect over x -axis Left 6 units Down 4 units	$f(x) = -(x + 6)^2 - 4$
III	$(-\infty, \infty)$	$(-\infty, 6]$	$x = -2$	$(-2, 6)$ max.	Reflect over x -axis Left 2 units Up 6 units	$f(x) = -(x + 2)^2 + 6$
IV	$(-\infty, \infty)$	$[-5, \infty)$	$x = 4$	$(4, -5)$ min.	Right 4 units Down 5 units	$f(x) = (x - 4)^2 - 5$

7. **D**

8. a. Right 2 units and down 4 units

b. $(2, -4)$

c.

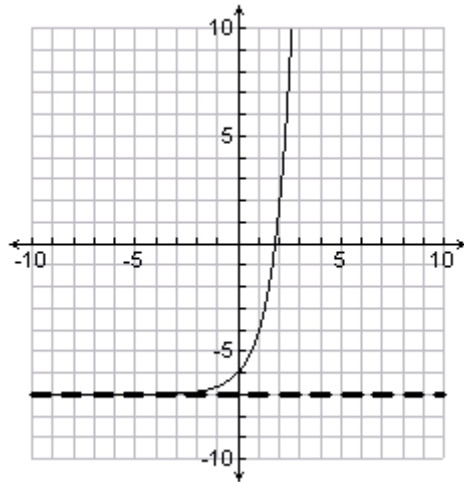


d. 0 and 4. Can also be written as $(0, 0)$ and $(4, 0)$.

e. 0. Can also be written as $(0, 0)$.

9. a. Dilation, or vertical stretch, by a factor of 5.
 b. Dilation, or vertical shrink, by a factor of $\frac{1}{2}$, then up 3 units.
 c. Reflection over x -axis and dilation, or vertical stretch, by a factor of 2.
10. a. $y = 2.5x^2 - 17.5x + 50$
 b. 50 miles per hour
 c. The vertex is $(3.5, 19.375)$. At time period 3.5, which corresponds to 5:15 P.M., the average speed is 19.375 miles per hour. Because this vertex is a minimum, it indicates the time at which the average speed is the slowest.
11. a. $y = -20x^2 + 140x + 1200$
 b. \$1440.
 Explanations: $y = -20(4)^2 + 140(4) + 1200$
 OR
 I replaced x with 4.00 in the function and obtained 1440.
 c. \$1445 .
 Explanations: The vertex of the parabola gives the maximum value for the revenue. The vertex (found by graphing) is at $(3.5, 1445)$.
 OR
 The vertex of the parabola gives the maximum value for the revenue and is on the axis of symmetry. The axis of symmetry is $x = \frac{-b}{2a} = \frac{-140}{-40} = 3.5$
 So, the x value of the vertex is 3.5. Substituting 3.5 for x into the equation I determined in part a gives the maximum value of y which is 1445.
 d. \$3.00
 Justifications: The amount of revenue when the price is reduced by \$3.00 is \$1440. The amount of revenue when the price is reduced by \$5.00 is \$1400. Therefore, more revenue is obtained when the price is reduced by \$3.00 rather than \$5.00.
 OR
 $y = -20(3)^2 + 140(3) + 1200$
 $y = 1440$
 $y = -20(5)^2 + 140(5) + 1200$
 $y = 1400$
 OR
 I looked on the graph and saw that \$3.00 is closer to the axis of symmetry, which contains the maximum, than \$5.00, so the y -value is higher when x is \$3.00 than when x is \$5.00.

12. a.



- b. $y = -7$
- c. exponential growth
- d. All real numbers
- e. No. Sample justification: There is an asymptote at $y = -7$. Since the graph will never touch the asymptote, $f(x)$ will never be -7 .

13.

x	$f(x) = 3(4)^{x+2}$
0	48
1	192
2	768
3	3072

x	$f(x) = 3\left(\frac{1}{4}\right)^x + 10$
0	13
1	$10\frac{3}{4}$
2	$10\frac{3}{16}$
3	$10\frac{3}{64}$

14. **B**

- 15. a. Dilation or vertical stretch by a factor of 3
- b. horizontal asymptote, growth factor, domain, range
- 16. a. Vertical translation up 7 units
- b. growth factor, domain
- 17. a. exponential growth
- b. exponential decay
- c. exponential decay
- d. exponential growth
- e. exponential growth
- f. exponential decay

18. a.

Number of Months after Purchase, m	Value of Gift Card, v
0	100.00
1	95.00
2	90.25
3	85.74
4	81.45
5	77.38

b. $v = 100(.95)^m$

19. a. $y = 820.019(1.08)^x$

b. $820.019(1.08)^9 = 1639$ or 1640 boats

c. 2008.

Justifications: I graphed the equations $y = 820.019(1.08)^x$ and $y = 1500$ into my calculator and determined that the x -value of the point of intersection was between 7 and 8. $2000 + 7 = 2007$ and $2000 + 8 = 2008$. The value of x is a whole number: so, The 1500th boat will visit the harbor during 2008.

OR

I tried different values of x and found that when $x = 7$, $y < 1500$, but when $x = 8$, $y > 1500$. So, the 1500th boat visits the harbor when x is 8. $2000 + 8 = 2008$. So, the 1500th boat will visit the harbor during 2008.

d. Approximately 8 % per year.

20. a. Colony I: $y = 1.5(2)^x$

Colony II: $y = 2048(.5)^x$

b. Colony I: The number of bacteria is doubling every day.
Colony II: The number of bacteria is halving every day.

c. On day 11

21. C

22. B

23. a. \$1600
 b. Yes or No depending on justification.
 No because the x -axis is an asymptote and so the y -value will never mathematically be zero. OR Yes because eventually the value will be less than \$.01 which is economically equivalent to 0.
 c. 13. The value of the boat decreases by 13% each year.
24. a. $k = 32,000$ $sp = k$
 $8(4000) = k$
 $k = 32,000$
- b. The total number of square feet in the park that will be available to those who attend the concert.
- c. $s = \frac{32,000}{p}$ OR $sp = 32,000$
- d. 3.2
25. a. $k = \frac{1}{7}$ $D = ks$
 $3 = k(21)$
 $k = \frac{1}{7}$
- b. k is the ratio of the depth of the water to the distance from shore. Every foot farther into the water corresponds to an increase in water depth of $\frac{1}{7}$ of a foot.
- c. 28 feet $D = ks$
 $4 = \frac{1}{7}s$
 $s = 28$ feet
- d. 5.5 feet $D = ks$
 $D = \left(\frac{1}{7}\right)38.5$
 $D = 5.5$
- e. $D = \frac{1}{7}s$

26. a. $k = 12$ $y = kx$
 $480 = k40$
 $k = 12$
- b. The number of dollars Amon earns each hour
- c. \$216 $y = kx$
 $y = 12(18) = 216$
- d. 30 $y = kx$
 $360 = 12x$
 $x = 30$
- e. $y = 12x$
27. a. linear
 b. linear
 c. exponential
 d. quadratic
 e. exponential
 f. exponential

28.

		6	4
	/	/	
	.	.	.
	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	●
5	5	5	5
6	6	●	6
7	7	7	7
8	8	8	8
9	9	9	9

29.

		3	0
	/	/	
	.	.	.
	0	0	●
1	1	1	1
2	2	2	2
3	3	●	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

30.

		1	5
	/	/	
	.	.	.
	0	0	0
1	1	●	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	●
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9