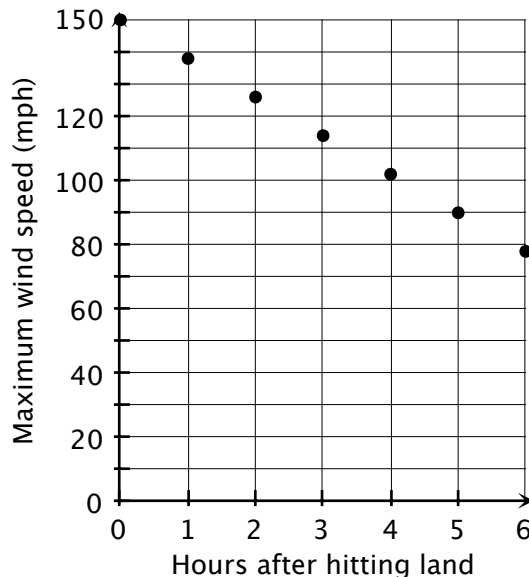


Review Questions for Unit 1 *Answer Key*

1. Hurricanes are powerful storms that can cause widespread damage to large areas. Hurricanes typically retain strength or gain strength when they travel over water and lose strength when they travel over land. The following data show the maximum wind speed of a hurricane six hours after it hits land.

Hours after Hitting Land	0	1	2	3	4	5	6
Maximum Wind Speed (mph)	150	138	126	114	102	90	78

- Write a recursive rule for this pattern:
Start with 150 mph and subtract 12 mph for each hour.
- Write an explicit rule for this pattern:
 $W = 150 - 12h$ where W is the wind speed and h is the number of hours after landing.
- Is this an arithmetic or geometric sequence? *Arithmetic.*
- If this pattern continues, what will the maximum wind speed of the hurricane be 10 hours after it hits land? *30 mph.*
- Use the data to make a graph. Label and scale the axes.



2. A manufacturer of designer watches decides to build new warehouses to produce a larger quantity of watches. Due to new technology and more efficient use of resources, the manufacturer finds that operating more warehouses leads to a significant increase in watch production. The table below shows the relationship between the number of warehouses in use and the quantity of watches produced each month

Warehouses	1	2	3	4
Watches Produced each Month	40	60	90	135

- a. Write a recursive rule to describe this pattern. *Start with 40 watches for the first warehouse and multiply by $\frac{3}{2}$ to find the number of watches with an additional warehouse.*
- b. Write an explicit rule to describe this pattern. $y = 40 \cdot \left(\frac{3}{2}\right)^{n-1}$ where y is the number of watches produced each month and n is the number of warehouses. *Some students may write $y = 40 \cdot \left(\frac{3}{2}\right)^n$ in which case n represents the number of additional warehouses beyond the first one.*
- c. Is this an arithmetic or geometric sequence? *Geometric.*
- d. If this pattern continues, how many watches per month will the company produce if it operates 5 warehouses? *About 202. Actually the sequence gives 202.5.*

Review Questions for Unit 2 *Answer Key*

1. Stephanie is a software developer who develops Apps (mobile device programs) for smart phones and tablet computers. Stephanie is very creative and very efficient so her services are in high demand. She is offered two new job opportunities and is considering which opportunity to select.

Opportunity 1 – She earns a fixed monthly salary of \$4000 and a payment of \$900 for each App she develops during the month.

Opportunity 2 – She earns a fixed monthly salary of \$6000 and a payment of \$450 for each App she develops during the month.

- a. Identify a variable for the number of Apps she develops each month. *Answers will vary. For example let x represent the number of Apps developed each month.*
 - b. Write an expression for Opportunity 1. $4000 + 900x$.
 - c. Write an expression for Opportunity 2. $6000 + 450x$.
 - d. Write an equation to find the number of Apps Stephanie would develop to earn the same amount with both opportunities. $4000 + 900x = 6000 + 450x$
 - e. Solve the equation in (d). Round your answer to the nearest 0.01. $x = 4.44$.
 - f. Interpret your answer in the context of this problem.
If she develops 4 or fewer Apps per month, Opportunity 2 is the better deal. But if she develops 5 or more Apps per month she will earn more with Opportunity 1.
2. a. Solve the equation $3(x - 6) = 6x + 24$. Show all of your work and explain which property of equality you use in each step.

$$3(x - 6) = 6x + 24.$$

$$3x - 18 = 6x + 24.$$

$$\underline{-3x} \quad \underline{-3x}$$

$$-18 = 3x + 24.$$

$$\underline{-24} = \underline{-24}$$

$$\frac{-42}{3} = \frac{3}{3}x.$$

$$-14 = x$$

Apply the distributive property on the left side.

Add $-3x$ (or subtract $3x$) on both sides.

Add -24 (or subtract 24) on both sides.

Divide by 3 (or multiply by $\frac{1}{3}$) on both sides.

- b. Identify two factors on the left side of the equation in 2(a). **3 and $x - 6$.**

- c. Identify a coefficient on the right side of the equation in 2(a). **6.**

3. Solve the equation $\frac{2}{3}x + 2\frac{1}{6} = \frac{1}{2}x$ and check your solution. Do not change the common fractions to decimals.

Many students will solve by "clearing the fractions" to get $4x + 13 = 3x$ so $x = 13$.

4. The area of a trapezoid is given by the formula:

$$A = \frac{1}{2}(a + b)h.$$

A is the area of the trapezoid, a and b are the bases of the trapezoid, and h is the altitude (height) of the trapezoid.

a. Solve the equation for b . *Answer: $b = \frac{2A}{h} - a$*

- b. If a , b and h are all measured in inches, what units would A be measured in?
Square inches or in^2 .

5. Solve for x and graph the solution on the number line.

$$2x + 5 \leq 6x - 3 - 2x$$

Answer: $4 \leq x$ or $x \geq 4$



Review Questions for Unit 3 *Answer Key*

1. Consider the following relationship represented as a set of ordered pairs.

{(New Haven, CT), (Danbury, CT), (New Britain, CT), (Hartford, CT), (Stamford, NY), (New Haven, KY), (Hartford, AR)}

- a. Represent the relation using a table.

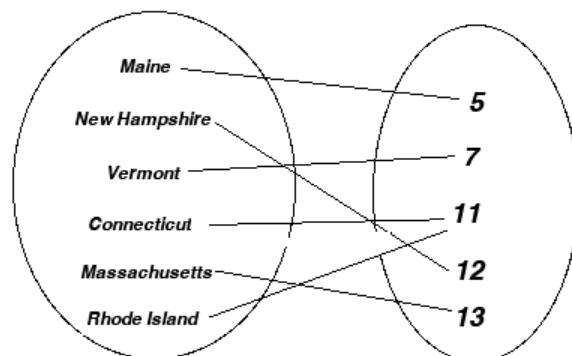
<i>New Haven</i>	<i>Danbury</i>	<i>New Britain</i>	<i>Hartford</i>	<i>Stamford</i>	<i>New Haven</i>	<i>Hartford</i>
<i>CT</i>	<i>CT</i>	<i>CT</i>	<i>CT</i>	<i>NY</i>	<i>KY</i>	<i>AR</i>

By the way, did you know that Hartford, Arkansas, has less than 700 residents? Or that New Haven, Kentucky, thrived on the liquor trade until prohibition put the distilleries out of business? Or that the village of Stamford, New York, is known as the “Queen of the Catskills”?

- b. Is this relation a function? **No. Why or why not? For some inputs (e.g. Hartford and New Haven) there is more than one output.**
- c. What is the domain? **{New Haven, Danbury, New Britain, Hartford, Stamford}**
- d. What is the range? **{CT, NY, KY, AR}**
2. Consider the relationship between the New England states and the number of letters in the name of each state as shown in the table.

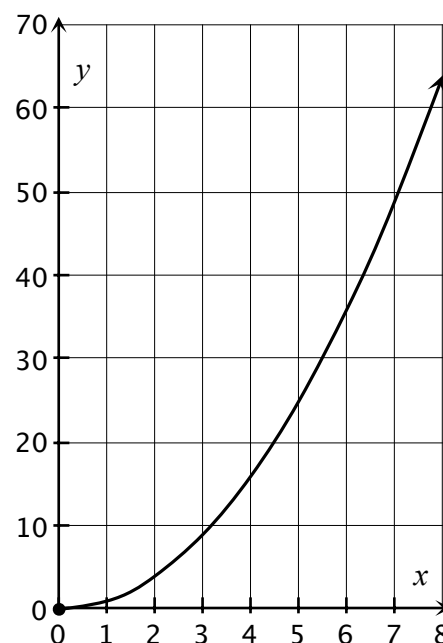
State	Number of letters
Maine	5
New Hampshire	12
Vermont	7
Connecticut	11
Massachusetts	13
Rhode Island	11

- a. Represent this relation using mapping diagram.
See below.
- b. Represent this relation using a set of ordered pairs.
{(Maine, 5), (New Hampshire, 12), (Vermont, 7), (Connecticut, 11), (Massachusetts, 13), Rhode Island, 11)}
- c. Is this relation a function? **Yes** Why or why not?
For each state there is only one number.
- d. What is the domain? **The set of New England States.**
- e. What is the range? **{5, 7, 11, 12, 13}**



3. Consider the relationship between a real number and its square.

- Express this relation using an equation. $y = x^2$
- Graph this relation using an equation. Label and scale the axes. *See graph at right.*
- Is this relation a function? *Yes*
Why or why not? *Every real number has exactly one square.*
- What is the domain? *The set of real numbers.*
- What is the range? *The set of non-negative real numbers.*



4. A compact disc is read at 44.1 kHz (kilohertz). This means that a CD player scans 44,100 samples of sound per second on a CD to produce the sound you hear. The function $S(t) = 44.1t$ describes the number of samples of sound, $S(t)$, in thousands, that are scanned in t seconds.
- How many samples of sound are scanned after 30 seconds? *1,323 thousand or 1,323,000.*
 - How many samples of sound are scanned after 2 minutes? *Note 2 minutes = 120 seconds, so the number of samples scanned is 5,292 thousand or 5,292,000.*
 - How long would it take the CD player to scan 1,764,000 samples of sound? *40 seconds.*
 - Would negative numbers be in the domain of this function? *No.* Explain. *You can't scan the CD for a negative number of seconds? That does not make sense.*
 - Find t so that $S(t) = 882$ and explain what this means in the context of this problem.
 $t = 20$, In this context it means that you can scan 882,000 samples in 20 seconds.

5. According to an FBI Fact sheet, IAFIS (Integrated Automated Fingerprint Identification System) searches fingerprints of over 74 million subjects in the National Criminal History Record File. In 2012, IAFIS processed 58 million fingerprint submissions. Express IDAFIS software can compare 85 million fingerprints per second. The capability of fingerprint software varies in each state. Suppose a state has a fingerprint identification system that compares 90,000 fingerprints per second.

The function $F(s) = 90s$ describes the number of fingerprints (**in thousands**) that can be compared in s seconds.

- a. How many fingerprints can be compared in 15 seconds? ***1,350 thousand or 1,350,000 fingerprints.***
- b. How long would it take the fingerprint identification system to compare 1,500,000 fingerprints? ***$16\frac{2}{3}$ seconds.***
- c. Find $F(9)$ and explain what it means in the context of this problem. ***$F(9) = 810$. This means that in 9 seconds the system can compare 810 thousand or 810,000 fingerprints.***
- d. Find s so that $F(s) = 1920$ and explain what it means in the context of this problem.
 $s = 21\frac{1}{3}$ The system can compare 1920 thousand fingerprints (1,920,000) in $21\frac{1}{3}$ seconds.
- e. Suppose we need to compare all 74 million fingerprints in the National Criminal History File. How long would it take to process this request? Express your answer in minutes and round to the nearest 0.1 minute. ***13.7 minutes.***

Review Questions for Unit 4 *Answer Key*

1. Determine which of these tables could represent a linear function. Explain your reasoning. (There may be more than one correct answer) *(c) only. In (a) x is always increasing by 3, but the change y is not constant. In (b) the changes in y are constant but the changes in x are not. In (c) as x increases by 2, y decreases by 6.*

a.

x	y
-3	-4
0	-1
3	1
6	2
9	2

b.

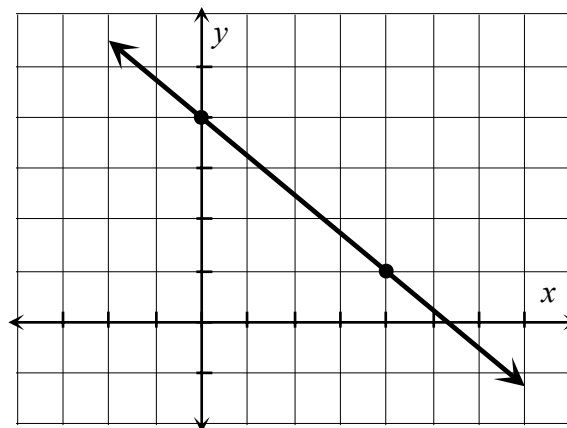
x	y
-5	10
0	8
1	6
2	4
3	2

c.

x	y
-4	15
-2	9
0	3
1	0
2	-3

2. Find the slope of the line from the graph.

Answer $-\frac{3}{4}$



3. Determine the slope and y-intercept for each equation:

a. $-x + 5y = 20$ *Answer: slope = 1/5; y-intercept is (0,4)*

b. $y + 3 = 4(x + 5)$ *Answer: slope = 4; y-intercept is (0,17)*

4. Find the equation of the line that is parallel to $2x + 4y = 9$ and goes through $(6, -2)$.

Answer: $y = -\frac{1}{2}x + 1$ or $2x + 4y = 4$ or $x + 2y = 2$

5. Find the equation of the line that is perpendicular to $2x - y = 8$ and goes through $(3,5)$.

Answer: $y - 5 = \frac{1}{2}(x - 3)$ or $y = \frac{1}{2}x + 3\frac{1}{2}$

6. Find the slope of the line that contains the points $(-1,9)$ and $(-3,4)$. Then write the equation of the line in slope-intercept form.

Answer: $\text{slope} = \frac{5}{2}$; $y = \frac{5}{2}x + \frac{23}{2}$

7. A florist is planning to spend \$400 on table decorations for a wedding. She plans to use roses and orchids. Rose centerpieces cost \$20. Orchid centerpieces cost \$15.

Let x represent the number of rose centerpieces and let y represent the number of orchid centerpieces.

- a. Write an equation in standard form showing how the \$400 can be spent.

Answer: $20x + 15y = 400$

- b. Rewrite the equation in slope-intercept form.

Answer: $y = \frac{4}{3}x + 26\frac{2}{3}$

8. The Aqua Fun Company determined that when it priced a new pool toy at \$4 each it sold 20,000 toys per day during the summer. When it increased the price to \$6 each, the sales dropped to 15,000 toys per day. Use ordered pairs of the form (sale price, number of pool toys sold) to answer the following questions.

- a. Assume that the relationship between the price and the number of pool toys sold is linear and write an equation that describes the relationship. **Answer:** $y = -2500p + 30000$

- b. What are the daily sales of pool toys if they are priced at \$4.50 each? **Answer:** 18,750 pool toys

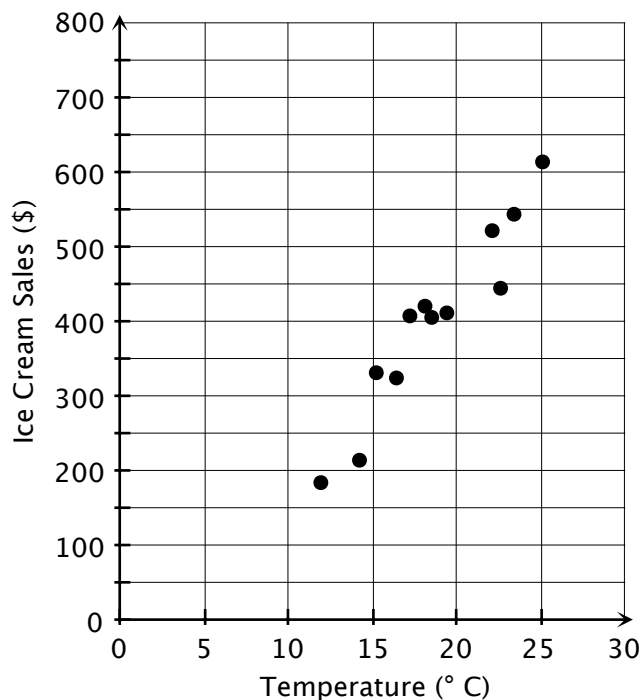
- c. Identify and interpret the slope in the context of the problem. **Answer:** $-2,500$ toys per dollar; the rate at which the number sold decreases with an increase in price.

- d. Identify and interpret the y -intercept in the context of the problem. **Answer:** 30,000; the number of toys sold if the price is zero, i.e. they are given away.

Review Questions for Unit 5 *Answer Key*

1. A local ice cream shop keeps track of how much ice cream they sell versus the temperature on that day. The following table shows the temperature and ice cream sales for 12 days. Make scatterplot of the data and then draw a trend line that you feel best fits the data points. Label and scale the axes appropriately.

Temperature (° C)	Ice Cream Sales (\$)
14.2	215
16.4	325
11.9	185
15.2	332
18.5	406
22.1	522
19.4	412
25.1	614
23.4	544
18.1	421
22.6	445
17.2	408



- What is the independent variable in the problem? *Temperature.*
- What is the dependent variable in the problem? *Ice cream sales.*
- Find an equation for the trend line. You may use the regression feature on your calculator if you choose. Round the parameters to the nearest 0.1

Answers will vary: The regression line is $y = 30.1x - 159.5$

- What is the slope of the trend line? What does the slope represent in the context of the problem? ***30.1, based on equation in (d). For every 1°C rise in temperature, sales will increase by about \$30***
- What is the y-intercept of the trend line? What does the y-intercept represent in the context of the problem? ***-159.5, based on equation in (d). In the context of the problem this is meaningless. When the temperature is 0°C, freezing, no one buys ice cream.***

- f.* Describe the strength and direction of the correlation in the scatterplot. **Positive and moderately strong correlation.**
- g.* Use your equation to predict the total ice cream sales when the temperature is 21.3°C . Is this an example of interpolation or extrapolation? Explain. **About 481 based on equation in (d); interpolation since 21.3°C lies within the range of given temperatures.**
- h.* Use your equation to determine the temperature if the sales were \$450. **$20.3^{\circ}\text{C}$, based on equation in (d)**
2. The following data represent the number of text messages sent in one day by a group of students:
- [3, 5, 7, 12, 13, 14, 21, 23, 23, 23, 23, 29, 39, 40, 56]
- a.* To the nearest 0.1 what is the mean number of text messages sent by the students? **22.1**
- b.* What is the mode number of text messages sent by the students? **23**
- c.* What is the median number of text messages sent by the students? **23**
- d.* What is the range in the number of text messages sent by the students? **53**
- e.* What is the interquartile range (IQR) for the number of text messages sent by the students? **17**
- f.* Which number text messages appears to be an outlier? Use the $1.5 \cdot \text{IQR}$ rule to check to see if there are any outliers. **56**
- g.* If the outlier is eliminated which statistic will change more, the mean or median? Explain. **The mean will change more since the extreme value pulls it up. The median stays about the same since the middle of the distribution is not affected as much by dropping one data point.**

3. The local summer fair charges \$10 per person. If a person buys more than 25 tickets at once, the person is only charged \$7.50 a person.
- a. Complete the table below to indicate the total cost based on the number of people entering the summer fair.

Number of People	5	10	15	20	25	30	35	40	45	50
Total Cost	<i>50</i>	<i>100</i>	<i>150</i>	<i>200</i>	<i>250</i>	<i>225</i>	<i>262.50</i>	<i>300</i>	<i>337.5</i>	<i>375</i>

- b. Create a piecewise function to describe the relationship in the cost per person and the number of people attending the summer fair.

$$f(x) = \begin{cases} 10x & \text{when } x \leq 25 \\ 7.5x & \text{when } x > 25 \end{cases}$$

Review Questions for Unit 6 *Answer Key*

Solve problems 1–3 algebraically using either substitution or elimination.

1. Meryl Streep is the most nominated performer of all time with numerous nominations for Best Actress and Best Supporting Actress. Kathryn Hepburn has been nominated for Best Actress almost as many times as Meryl Streep. Meryl Streep has $\frac{7}{6}$ the number of Best Actress nominations that Kathryn Hepburn has. Together they have 26 nominations for Best Actress.

How many times have Meryl Streep & Kathryn Hepburn been nominated for Best Actress?

Let x represent the number of nominations for Streep, and y represent the number of nominations for Hepburn. Then the system of equations is (1) $x + y = 26$ and (2) $x = \frac{7}{6}y$. Substituting (2) in equation (1) we get $\frac{13}{6}y = 26$ from which it follows that $y = 12$ and $x = 14$. So Streep had 14 nominations and Hepburn had 12 nominations.

2. Each summer households that heat with oil need to decide if they should buy the oil they think they will need for the coming winter season or whether they should just pay for each delivery they get it in the fall, winter and early spring. (In the winter, oil prices usually go up quite a bit.).

In the summer of 2012, the Baldwins contacted two oil companies. Both required that a customer have a burner protection plan (pays for the annual furnace cleaning and service calls) if they plan to pre-buy oil. Meyer Oil Company charges \$287 for a burner protection plan and \$3.499 per gallon for pre-bought oil. Emerald Oil Company charges \$275 for a burner protection plan and \$3.519 per gallon for pre-bought oil.

- a. How many gallons of pre-bought oil would the Baldwin's need to purchase in order to have both plans cost the same amount of money?

Let y represent the total cost for each company and x the number of gallons purchased. The there are two equations: Meyer: $y = 3.499x + 287$ and Emerald: $y = 3.519x + 275$. The solution to this system is $x = 600$ and $y = \$2,386.40$. So both plans cost the same amount of money when they purchase 600 gallons.

- b. In April 2013, the Baldwin's realized they had used all 815 gallons they had pre-purchased in July 2012. They had decided to go with the Meyer Oil Company. Had they made the correct decision that July? Explain. *Yes. Since they use more than the 600 gallons where the two companies charge the same amount, they are better off with Meyer, which has a lower cost for each gallon beyond 600.*

3. Together a 20-ounce Pepsi and a 20-ounce Coke have 134 grams of sugar. A 20-ounce Coke has 4 fewer grams of sugar than a 20-ounce Pepsi. How many grams of sugar are in a 20-ounce Pepsi? How many grams of sugar are in a 20-ounce Coke?

Let x represent the number of grams of sugar in a 20-ounce Coke and y represent the number of grams of sugar in a 20-ounce Pepsi. Then we have two equations:

(1) $x + y = 134$ and

(2) $x = y - 4$.

The solution to this system is $x = 65$ and $y = 69$. So there are 65 grams of sugar in a 20-ounce Coke.

4. Now return to problem 2 and solve it graphically (either by hand or using technology). When you graph, you should have 2 intersecting lines. What are the coordinates of the point of intersection? What is the significance of the x -coordinate of the intersection point in terms of the context of this problem? What is the meaning of the y -coordinate of the intersection point in this context?

Point of intersection is (600,2386.40). The x coordinate indicates that 600 gallons are consumed when the two companies charge the same amount. The y -coordinate indicates that the common amount charged is \$2,386.40.

5. Now return to problem 3 and solve it graphically. Technology should be used here. Explain the meaning of the x - and y - coordinates of the intersection point in the context of this problem.

Point of intersection is (65, 69); the x -coordinate represents the numbers of grams of sugar in a 20-ounce Coke and the y -coordinate represents the number of grams of sugar in a 20-ounce Pepsi.

Review Questions for Unit 7 *Answer Key*

1. Identify which table could represent a linear function, which table and exponential function, and which table neither. Explain your reasoning.

a.

x	y
0	20
3	13
6	6
9	-1

b.

x	y
0	0
2	2
4	6
6	12

c.

x	y
0	40
1	20
2	10
3	5

a. **Linear:** As x increases by 3, y has a constant decrease of 7.

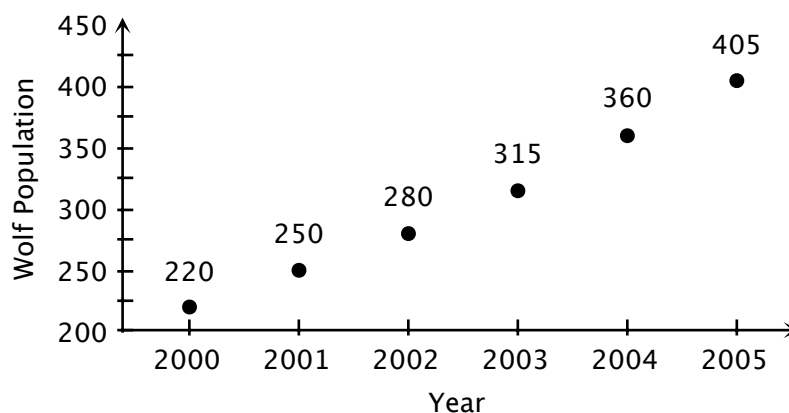
b. **Neither:** As x increases by 2, the y -values have neither a constant increase/decrease nor a constant ratio.

c. **Exponential.** As x increases by 1, the value of y is halved (divided by 2).

2. In the last century western gray wolves were placed on the endangered species list. But after a few years the population began to grow again. Biologists believe that the population fits an exponential model of the form $P = ab^t$ where P is the population of wolves and t is the number of years since 2000.

- a. Use the data in the table below (which gives the wolf population in the state of Michigan) and the graph to estimate values of the parameters a and b . You may use a graphing calculator if you choose.

Year	Wolf Population
2000	220
2001	250
2002	280
2003	315
2004	360
2005	405



Answers will vary. Using the exponential regression feature of the calculator we have $a \approx 220$ and $b \approx 1.13$

- b. Use your model to predict the wolf population in the year 2010.

Answers will vary. Using the parameters above we get approximately 745 wolves in the year 2010.

3. Lamar's uncle gave him \$500 and told him to save it to buy a car when he is old enough to drive. He put the money in a savings account that pays 4% interest compounded annually. He wanted to know how much interest he would earn after 3 years. So he found the value by calculating $500 \cdot (0.04)^3 = 0.032$. He was amazed that he would earn only slightly more than 3 cents! What went wrong? Explain his error and calculate the amount of interest correctly.
He forgot to add the interest rate to 1 to obtain the growth factor. The correct calculation is $500 \cdot (1.04)^3 = 562.43$. This means he has earned \$62.43 in interest over the three years.
4. From approximately 1947 to 1977, General Electric Company (GE) discharged PCBs from its capacitor manufacturing plants at Hudson Falls and Fort Edward into the Hudson River. It was only many years later that the Environmental Protection Agency (EPA) reached an agreement with GE to start cleaning up the river. In the meantime, the EPA monitored fish in the river to determine the level of PCBs. The concentration (in mg/kg) of PCBs in brown bullheads was found to be modeled by the function $y = 62 \cdot 0.927^x$ where x is the number of years since 1980.
- What does 62 represent in the context of this problem?
62 is the initial amount, 62 mg/kg of PCBs.
 - What does 0.927 represent in the context of this problem?
0.927 is the decay factor.
 - By approximately what percent did the concentration of PCBs decay each year?
 $1.000 - 0.927 = 0.072$. The percent concentration is decaying at a rate of 7.2% per year.
 - What was the concentration of PCBs in 2002 when the cleanup began?
About 11.7 mg/kg ($t = 22$)
 - If they had never started cleaning up the river, what would the concentration of PCBs be in 2013?
About 5.08 mg/kg ($t = 33$)
5. The value of a government bond, in dollars, is given by the function $y = 1000 \cdot 1.06^x$ where x is the number of years the bond has been held.
- How much was the bond originally worth?
\$1000. This is the initial value.
 - What is the annual rate of interest?
 $0.06 = 6\%$ annual rate of interest.
 - Approximately how many years will it take the original investment to double in value?
Use a graph or guess and check. When $x = 12$, $y = \$2012.20$. The doubling period is about 12 years. (The rule of 72 gives this as $72 \div 6 = 12$)

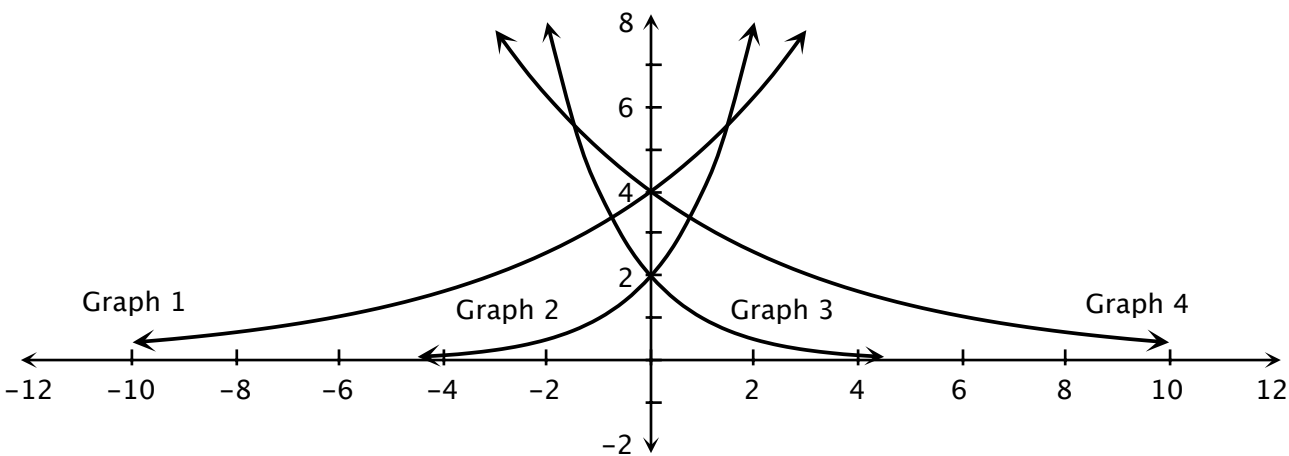
6. A business discovered that their kitchen has been infested with fruit flies! The owner keeps a record of the number of flies and finds they are growing exponentially, doubling every week. Here are the data he has collected.

Number of weeks since flies were discovered	Number of fruit flies in the kitchen
0	10
1	20
2	40
3	80

The owner wonders how many flies there will be after 3.5 weeks. His daughter Melissa, who is studying algebra in school, tells him, “Just take the number of flies in week 3 and multiply by the square root of 2.” Is Melissa correct? Explain.

Yes, she is correct. An exponential model for the fruit fly population is $y = 10 \cdot 2^x$. After $3\frac{1}{2}$ weeks we have $y = 10 \cdot 2^{3\frac{1}{2}} = 10 \cdot 2^3 \cdot 2^{\frac{1}{2}} = 80 \cdot \sqrt{2} \approx 113$.

7. Identifying Graphs



In the graph above, each curve represents a function of the form $y = a \cdot b^x$.

The parameter a takes on one of these values: 2 or 4.

The parameter b takes on one of these values: 0.5, 0.8, 1.25, or 2.

For each graph, identify the values of a and b :

Graph #1 $a = 4$ $b = 1.25$

Graph #2 $a = 2$ $b = 2$

Graph #3 $a = 2$ $b = 0.5$

Graph #4 $a = 4$ $b = 0.8$

8. Operations with Radicals

- a. When given the expression $16^{\frac{1}{4}}$, Shonda says “This is equivalent to 4 because 16 divided by 4 is 4.” Do you agree? If not, what is the value of $16^{\frac{1}{4}}$?

No. Shonda is confusing multiplication with exponentiation. $16^{\frac{1}{4}} = 2$ because $2^4 = 16$.

- b. Rewrite $\sqrt[3]{x}$ with an exponent instead of a radical.

Answer: $x^{\frac{1}{3}}$

- c. Write $49^{-\frac{1}{2}}$ as a fraction.

Answer $\frac{1}{49^{\frac{1}{2}}} = \frac{1}{\sqrt{49}} = \frac{1}{7}$

- b. Find the value of $5^{\frac{1}{3}} \cdot 5^{\frac{2}{3}}$ without using a calculator.

Answer $5^{\frac{1}{3}} \cdot 5^{\frac{2}{3}} = 5^1 = 5$

- c. If you know that $6^5 = 7776$, then you can conclude that 7776 raised to what power gives you 6? **Answer: $\frac{1}{5}$**

9. Geometric Sequences

For each sequence (1) find the next term, (2) state a recursive rule, and (3) state an explicit rule.

- a. 5, 15, 45, 135, ...

405. Recursive rule: Start with 5. Multiply each term by 3 to get the next term. Explicit rule: n th term = $5 \cdot 3^{n-1}$. (If you call the first term the “0” term, you can use $5 \cdot 3^n$)

- b. 1200, 300, 75, 18.75, ...

4.6875. Recursive rule: Start with 1200. Multiply each term by $\frac{1}{4}$ to get the next term.

Explicit rule n th term = $1200 \cdot (\frac{1}{4})^{n-1}$. (If you call the first term the “0” term, you can use $1200 \cdot (\frac{1}{4})^n$)

Review Questions for Unit 8 *Answer Key*

For these questions you may use the quadratic formula.

Quadratic Formula

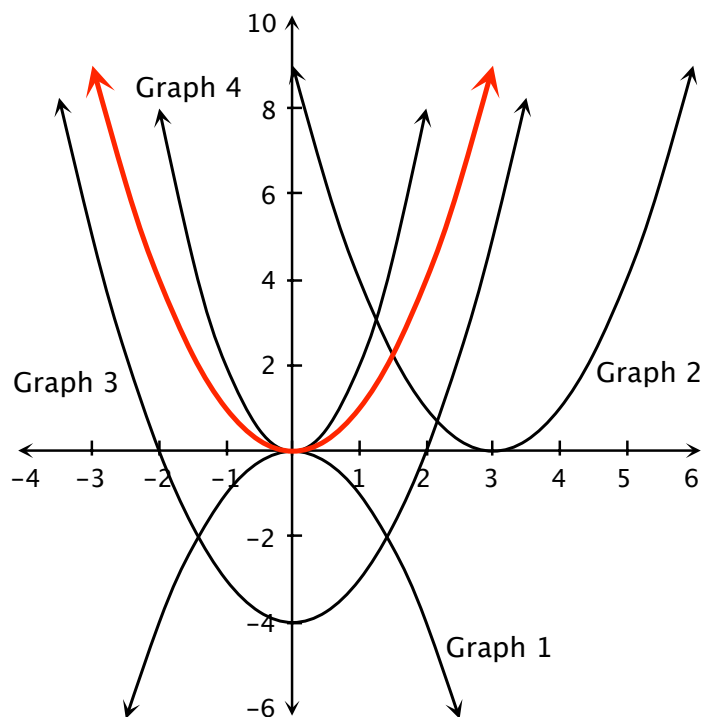
Solutions to the equation $ax^2 + bx + c = 0$ are given by the formula: $x = -\frac{b}{2a} \pm \frac{\sqrt{b^2 - 4ac}}{2a}$.

1. Consider the function $f(x) = -0.5(x + 6)^2 + 4$. Without drawing its graph, indicate which quadrant the vertex lies in. Explain your reasoning. Again, without drawing its graph, indicate whether the parabola opens up or down. Explain your reasoning.
 $h = -6$; $k = 4$; so the vertex is $(-6, 4)$, which lies in the second quadrant. Since $a < 0$, the parabola opens down.

2. The graph of $y = x^2$ is shown as the thicker curve.

Match each of the other graphs (#1 – #4) with its function rule.

- a. $y = x^2 - 4$ **Graph #3**
 b. $y = 2x^2$ **Graph #4**
 c. $y = -x^2$ **Graph #1**
 d. $y = (x - 3)^2$ **Graph #2**



3. Find the x - and y -intercepts of the graph of $y = (2x - 3)(x + 7)$.

x -intercepts are solutions to the equations $2x - 3 = 0$ and $x + 7 = 0$; that is, $(1.5, 0)$ and $(-7, 0)$.

y -intercept is found by setting $x = 0$ or expanding $(2x - 3)(x + 7) = 2x^2 + 11x - 21$; that is, $(0, -21)$.

4. Write each function in factored form:

a. $f(x) = x^2 - 5x - 24$ $f(x) = (x - 8)(x + 3)$

b. $f(x) = x^2 - 9x + 20$ $f(x) = (x - 4)(x - 5)$

5. Write each function in vertex form:

a. $f(x) = x^2 - 6x + 3$ $f(x) = (x - 3)^2 - 6$

b. $f(x) = 2x^2 + 12x + 10$ $f(x) = 2(x + 3)^2 - 8$

6. Write each function in standard form:

a. $f(x) = -(x + 1)^2 + 5$ $f(x) = -x^2 - 2x + 4$

b. $f(x) = \frac{1}{2}(x - 4)^2 - 8$ $f(x) = \frac{1}{2}x^2 - 4x$

c. $f(x) = (x + 3)(x - 3)$ $f(x) = x^2 - 9$

d. $f(x) = (3x - 1)(x + 3)$ $f(x) = 3x^2 + 8x - 3$

7. A quarterback throws a football down field to a receiver. The path of the football is given by the equation $h = -0.05x^2 + x + 6$ where h is the height of the ball and x is the distance from where the ball is thrown. Both h and x are measured in feet.

a. What is the maximum height of the ball?

11 feet (the y-coordinate of the vertex)

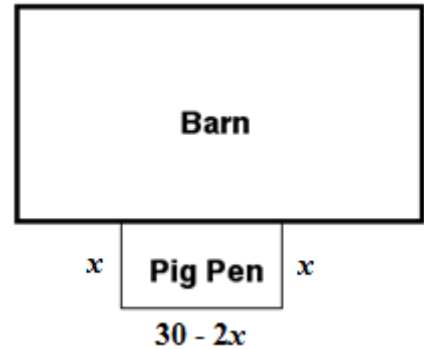
b. How high was the ball when it was thrown?

6 feet (the y-intercept).

c. If no one catches the ball how far away will it be when it hits the ground?

About 24.8 feet (positive x-intercept, from a graph or using the quadratic formula).

8. A farmer is building a rectangular pig pen along the side of a barn. She has 30 feet of fence and will use it to build three sides of the rectangle measuring x feet, x feet and $30 - 2x$ feet, as shown in the diagram. Find the value of x that will give the maximum area for the pigs.



$$\text{Area} = x(30 - 2x) = -2x^2 + 30x$$

$$x\text{-coordinate of the vertex is } -\frac{b}{2a} = -\frac{30}{-4} = 7.5$$

Since $a < 0$, the parabola opens down so the vertex gives the maximum.

9. A company manufacturing computer components discovers that the cost of producing a certain type of chip is given by the function $c(x) = .006x^2 - 2.4x + 290$, where $c(x)$ is the cost in dollars and x is the number of chips produced in one hour. They are interested in finding the vertex of the parabola that is the graph of this function.

- a. Will the vertex give them the maximum cost or the minimum cost? How can you tell without actually graphing the function?

Minimum cost. Because a is positive, the parabola opens up, so the vertex is a minimum.

- b. Find the vertex. What does its x -coordinate tell you in the context of this problem?

(200,50). The minimum cost occurs when 200 chips are produced each hour.

- c. What does the y -coordinate of the vertex tell you?

The minimum cost is \$50 per hour.