SUPPLEMENTAL MATERIALS PROJECT DIRECTORS

Terry Souhrada

TECHNICAL EDITOR

Peter Fong

Printed in the United States of America.

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Contents

Level 1

About these materials

This supplement to *Integrated Mathematics*: *A Modeling Approach Using Technology* was created in response to the requests of teachers who use SIMMS IM materials. Some asked for extra problems to help students solidify their knowledge of the mathematics skills in the curriculum. Some wanted more problems that illustrate applications of mathematical content. Others desired additional assessment tools that could be used in conjunction with those already included in each module.

The materials in this copy of *Additional Review and Periodic Assessment* have been written specifically for Level 1. The review pages offer a selection of straightforward skill problems, along with one or two context problems, for each activity in each of the 15 modules. The periodic assessments each consist of four or five problems and are intended to be completed in less than one class period.

A principal feature of the SIMMS IM curriculum is the depth and breadth of the mathematics covered. All modules are designed to help students understand concepts and learn the specific skills necessary to become effective problem-solvers. The problems included here are not intended to replace the work students do in Explorations, Discussions, and Assignments. They can be used, however, to provide extra practice for certain students, groups of students, or entire classes.

Thank you for selecting the SIMMS IM curriculum for your school—and for your commitment to making a positive impact on the mathematics education of each student. Thanks also to the fine teachers who helped prepare these materials: Clay Burkett, Terri Dahl, Peggy Lynn, Sue Moore, Mike Trudnowski, and Lisa Wood.

– Terry Souhrada –

Supplemental Materials
Project Director

Level 1: Volume 1—Reflect On This

Additional Review—for use with Activity 1

1.1. Determine the measure of the central angle for a regular polygon with:

a. 4 sides **b.** 6 sides **c.** 9 sides

d. 15 sides **e.** 30 sides **f.** 45 sides

1.2. Find the number of sides in a regular polygon whose central angles measure:

a. 45° **b.** 36°

c. 90° **d.** $32\frac{8}{11}°$

1.3. A carpenter wishes to make a tabletop in the shape of a regular hexagon. The edge of the table consists of six pieces like those shown below.

Edge Piece
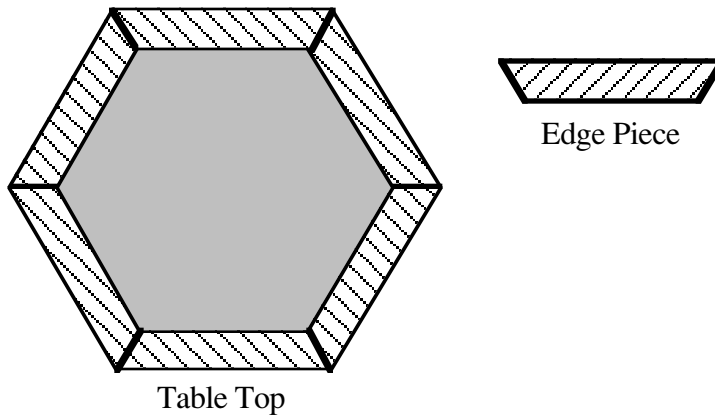
Table Top

a. Determine the measure of each interior angle in an edge piece.

b. Identify the type of polygon represented by an edge piece. Is it a regular polygon? Explain.

c. If the tabletop was a regular octagon, how would the measures of the angles in the edge pieces change? Explain.

Additional Review—for use with Activity 2

2.1. Identify each set of angle measures as supplementary, complementary, or neither. Justify your answers.

    a. $42°, 48°$ **b.** $63°, 127°$ **c.** $36°, 144°$

    d. $97°, 83°$ **e.** $55°, 45°$ **f.** $120°, 40°, 20°$

2.2. Determine the supplement and complement of each angle below:

    a. $40°$ **b.** $36°$

    c. $42\frac{5}{8}°$ **d.** $m°$, where $m < 90$

2.3. To determine the proper angle for cutting a board, carpenters often use a tool called a carpenter's square. As shown below, a carpenter's square forms a right angle and has dimension markings on each of its legs.

Carpenter's Square   Close-up View
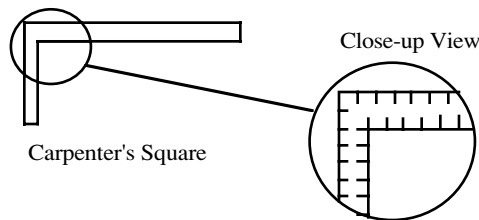
In the following diagram, a carpenter's square has been placed on a board. Use this diagram to answer Parts **a** and **b**.
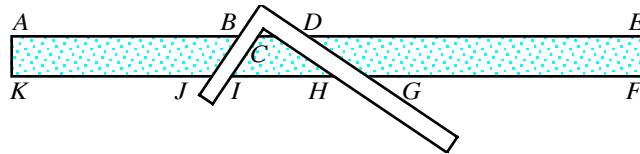
    a. Identify all the pairs of complementary angles.

    b. Identify all the pairs of supplementary angles.

    c. In the diagram above, $\angle CHI$ measures $36°$. The board was cut along $\overline{BJ}$. The two resulting pieces were placed as shown below. What regular polygon could be created using $\angle KJE$? Explain your answer.

2
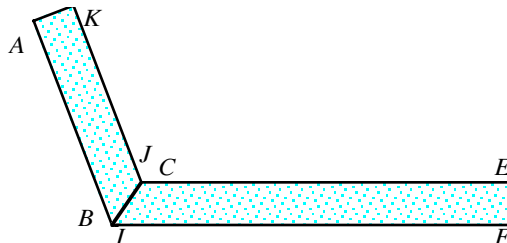
Periodic Assessment 1—for use after Activity 2

1. Determine the measure of the central angle for a regular polygon with:

   a. 3 sides   **b.** 7 sides   **c.** p sides

2. Find the number of sides in a regular polygon whose central angles measure:

   a. $45°$ **b.** $51\frac{3}{7}°$ **c.** $m°$, where $m < 360$

3. Identify each set of angle measures below as supplementary, complementary, or neither. Justify your answers.

   a. $52°, 38°$ **b.** $30°, 24°, 36°$ **c.** $66°, 114°$

4. Determine the supplement and complement of each angle:

   a. $67°$ **b.** $112°$ **c.** $v°$, where $v < 90$

5. The sum of the measures of the interior angles of a triangle is $180°$. Is it possible to have a pair of supplementary angles in one triangle? Explain your answer.

3

Additional Review—for use with Activity 3

3.1   Determine the coordinates of the image of each point when reflected in the *x*-axis.

   a. (4,7)   **b.** (–3,6)   **c.** (–8,2)   **d.** (*a,b*)

3.2   Determine the coordinates of the image of each point when reflected in the *y*-axis.

   a. (10,6)   **b.** (3,–7)   **c.** (–11,–4)   **d.** (*a,b*)

3.3   A segment connects a preimage point *P* with its image *P'*. Describe the relationship between $\overline{PP'}$ and the line of reflection.

3.4   On the coordinate grid below, draw the shortest path from point *A*(2,4) to point *B*(7,2) that touches the *x*-axis.
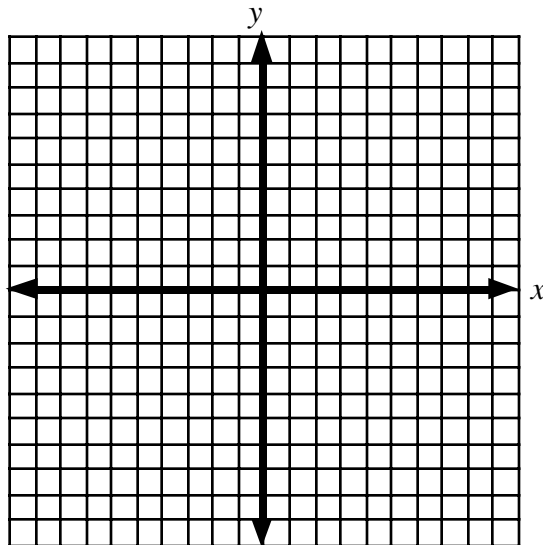
3.5   Draw a path from the golf ball to the hole that uses a single bank (reflection).
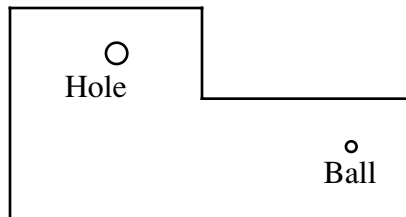
Additional Review—for use with Activity 4

4.1 For each point P below, determine the coordinates of P', a reflection of P in the x-axis, and the coordinates of P'', a reflection of P' in the y-axis.

a. (2,–5) **b.** (4,6) **c.** (–3,1)

d. (–7,–3) **e.** (a,b)

4.2 Use the coordinate grid below to draw the shortest path from A (3,–2) to B (2,–6) that touches both the x- and y-axes.
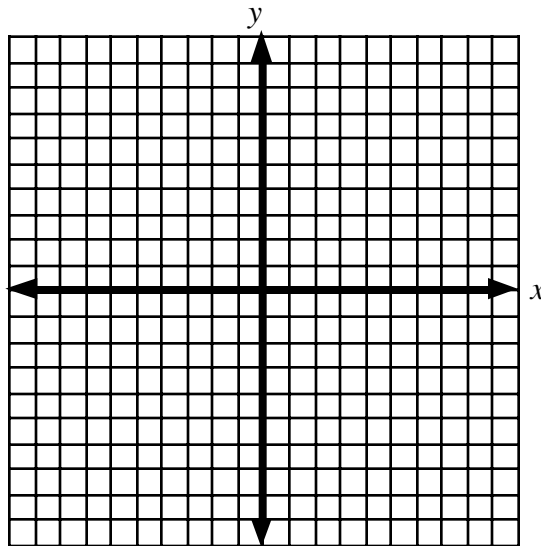
4.3 Determine the measures of the incoming and outgoing angles on the graph that you drew in Problem **4.2**. Describe the relationship among the angles.

4.4 Draw a path from the golf ball to the hole that uses two banks (reflections).

Ball

Hole
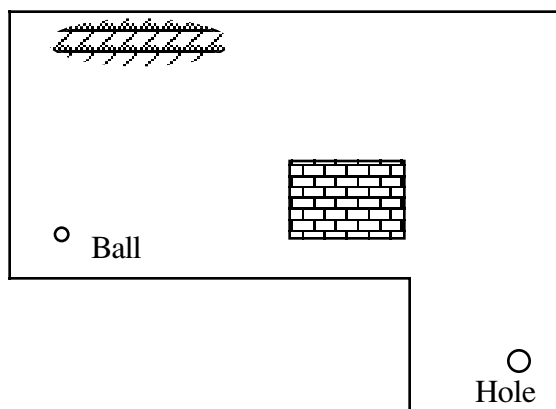
Periodic Assessment 2—for use after Activity 4

1.   Plot the points $A(-5,9)$ and $B(6,-2)$ on the coordinate grid below. Plot the reflection of point A in the y-axis and the reflection of point B in the x-axis. Label the points and their reflections. Identify the coordinates of the images.
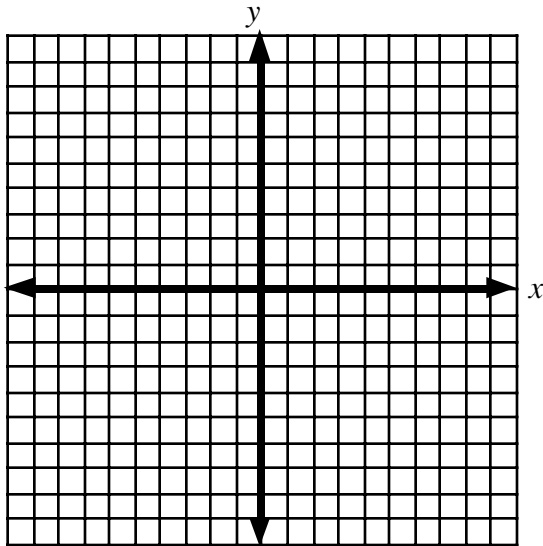
2. Sketch the reflection in the line m of the figure below.
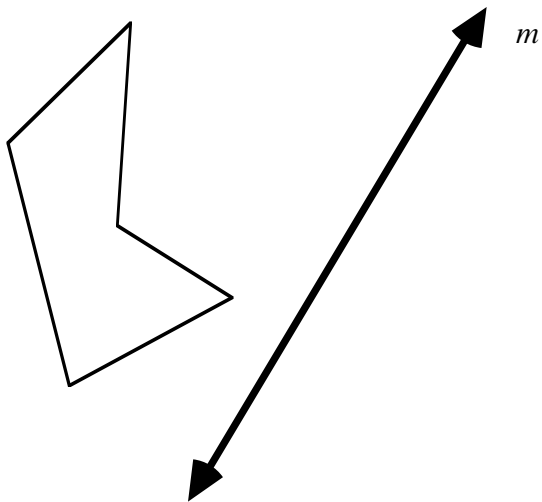
3. The Martin and Rodriguez families are planning to build their new homes on adjacent parcels. Each family must build a driveway from their house to the county road. Because they are good friends, they want the driving distance between their homes to be as short as possible. To keep costs down, however, they do not want to build any new bridges. Where would you recommend that they locate the driveways? Justify your recommendation.
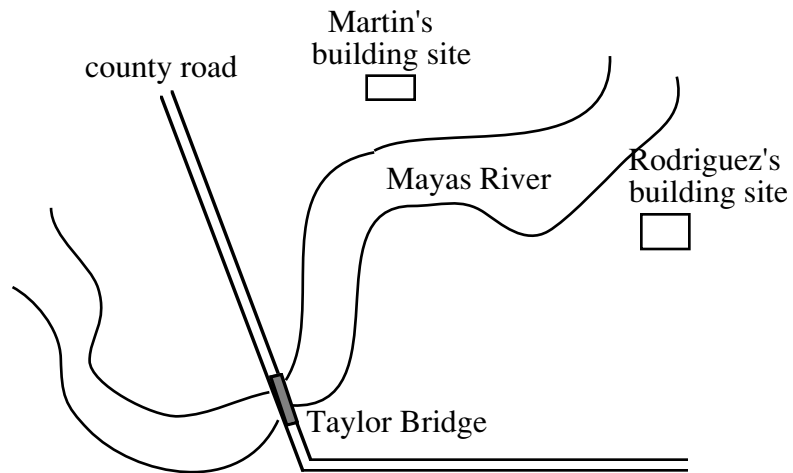
Level 1: Volume 1—So You Want to Buy a Car

Additional Review—for use with Activity 1

1.1. Every ten years, the U.S. government conducts a national census. Many different types of information are collected. The following table shows U.S. water usage (in billions of liters) during the census years from 1940 to 1990. "Irrigation" includes water for agriculture. "Public supply" includes water for domestic and commercial use, but excludes water used to generate hydroelectric power. "Other" includes water used for purposes other than irrigation or public supply.

Year	Irrigation $(1 \bullet 10^9$ L)	Public Supply $(1 \bullet 10^9$ L)	Other $(1 \bullet 10^9$ L)
1940	269	38	223
1950	337	53	291
1960	416	79	527
1970	492	102	807
1980	568	129	969
1990	519	155	870

From *Statistical Abstract of the United States*. 115th Annual Edition. Washington, DC: U.S. Bureau of the Census, 1995, p. 232.

a. Enter the data from the table in a spreadsheet.

b. Create graphs that show the change in water usage versus time in each category below.

    1. irrigation

    2. public supply

    3. other

1.2 Use the spreadsheet to determine the total water usage for each census year from 1940 to 1990.

a. Create a graph that shows the change in total water usage versus time.

b. Describe any trends you observe in water usage from 1940 to 1990.

Additional Review—for use with Activity 2

2.1   The following table shows U.S. public water usage (in billions of liters), along with the U.S. population, for the census years from 1940 to 1990.

Year	Public Supply $(1 \cdot 10^9 \text{ L})$	Population
1940	38	133,333,000
1950	53	96,552,000
1960	79	139,073,000
1970	102	162,651,000
1980	129	185,792,000
1990	155	210,256,000

From *Statistical Abstract of the United States*. 115th Annual Edition. Washington, DC: U.S. Bureau of the Census, 1995, p. 231.

   a. Use a spreadsheet to display the per capita water usage (amount of water used per person each year) for each census year.

   b. Create a bar graph that shows per capita water usage for the census years from 1940 to 1990.

2.2.   Classify each of the following as an objective or subjective type of information. Justify your responses.

   a. best brand name for stereo equipment

   b. best fast-food restaurant

   c. cost of one can of cola

   d. cost of one compact disc

   e. grade in first quarter of academic year

Periodic Assessment 1—for use after Activity 2

1. The following table lists the catch of fish (in millions of kilograms) and its value (in millions of dollars) for Gloucester, MA. To answer the questions below, enter this data in a spreadsheet .

Year	Catch $(1 \cdot 10^6$ kg$)$	Value $(\$1 \cdot 10^6)$
1990	56.8	40.5
1991	48.2	40.0
1992	45.8	34.1
1993	30.4	31.3

From *Statistical Abstract of the United States*. 115th Annual Edition. Washington, DC: U.S. Bureau of the Census, 1995, p. 703.

   a. Create a graph that displays the change in the catch for the years from 1990 to 1993.

   b. Create a graph that displays the change in the catch's value from 1990 to 1993.

   c. Use the spreadsheet to determine the average value of a kilogram of fish for each year from 1990 to 1993. Create a graph that displays this information.

2. Classify each of the following as an objective or subjective type of information. Justify your responses.

   a. price per kilogram of apples

   b. the best basketball player

   c. favorite brand of jeans

Additional Review—for use with Activity 3

3.1. The following table shows media usage (in hours per person) from 1985 to 1994.

Year	Daily Newspapers (hours)	Pay Cable (hours)	Recorded Music (hours)
1985	185	90	185
1986	184	72	173
1987	180	84	200
1988	178	94	215
1989	175	95	220
1990	175	90	235
1991	169	90	219
1992	172	80	233
1993	170	78	248
1994	168	78	261

From *Statistical Abstract of the United States*. 115th Annual Edition. Washington, DC: U.S. Bureau of the Census, 1995, p. 572.

Use a graphing utility to create a scatterplot of media usage versus time for each of the following categories.

a. daily newspapers

b. pay cable

c. recorded music

3.2. Determine the type of association represented by each of the graphs you created in Problem **3.1**.

Additional Review—for use with Activity 4

4.1 Write each percentage below as a decimal.

    a. 56%   **b.** 3%   **c.** 130%

4.2 Write each decimal below as a percentage.

    a. 1.17   **b.** 0.09   **c.** 0.35

4.3 Parts **a–c** below list both the original price and the new price of a particular item. Find the percent increase or decrease in each case.

    a. original price $35; new price $50

    b. original price $425; new price $237

    c. original price $112; new price $145

4.4 The student population at Archimedes High School is 2695. Last year the population was 2610. What is the percent change in the school population from last year to this year?

4.5 At a year-end clothing sale, shirts regularly priced at $24 were on sale for $16. What was the percent decrease in the price of the shirts?

Periodic Assessment 2—for use after Activity 4

1. The U.S. government uses the Producer Price Index (PPI) to compare prices from one time period to another. The following table shows the PPI for home electronic equipment and sporting and athletic goods for the years from 1970 to 1994. This data uses 1982 as the base year and assigns it a value of 100. Values greater than 100 indicate that comparable goods cost more than in 1982. Values less than 100 indicate that comparable goods cost less than in 1982.

Year	Home Electronic Equipment	Sporting and Athletic Goods
1970	106.0	52.7
1980	103.8	90.6
1985	90.8	99.7
1990	82.7	112.6
1991	83.2	115.3
1992	82.0	118.2
1993	80.2	118.6
1994	80.2	120.1

From *Statistical Abstract of the United States*. 115th Annual Edition. Washington, DC: U.S. Bureau of the Census, 1995, p. 501.

Use a graphing utility to create a scatterplot that shows the PPI versus time for each of the following categories.

   a. home electronic equipment

   b. sporting and athletic goods

2. Determine the type of association represented by each of the graphs you created in Problem **1**.

3. Classify each of the following as a negative association, a positive association, or no association. Justify your responses.

   a. grams of fat eaten and calories consumed

   b. compact discs bought and dollars remaining

   c. sunny days and interest rates

4. The original price of a new stereo is $985. If the price is reduced to $690, what is its percent decrease?

5. The city council has voted for an increase in bus fares. The former price was 45 cents; the new price is 50 cents. What is the percent increase?

Level 1: Volume 1
Yesterday's Food is Walking and Talking Today

Additional Review—for use with Activity 1

1.1 Use dimensional analysis to complete each of the following.

    a. _____ hr = 50 min = _____ sec

    b. 121 km = _____ m = _____ cm = _____ mm

    d. 60 mi/hr = _____ km/hr = _____ km/sec = _____ m/sec

    c. 2.4 L/hr = _____ ml/min

1.2 Solve each equation for the indicated variable.

    a. $4x = 12$ **b.** $-3y = -15$ **c.** $-100 = 25x$

    d. $y + 4 = -10$ **e.** $y - 3 = -20$ **f.** $y/-4 = -10$

1.3 Find the slope of a line that satisfies each of the following conditions.

    a. rise = 6; run = 4   **b.** rise = –4; run = –2

1.4 Find the slope of the line through each of the following pairs of points.

    a. (4,6) and (3,9)   **b.** (–3,9) and (5,–8)   **c.** (4,–6) and (3,–6)

    d. (5,–8) and (5,–7)   **e.** (*a*,*b*) and (*c*,*d*)

1.5 List the domain and range for each relation below. Describe whether or not each relation is also a function.

    a. $\{(2,3),(-3,6),(4,7),(1,6)\}$ **b.** $\{(-1,12),(3,4),(-1,3),(2,6)\}$

1.6 What is the slope of the line with the equation $y = -2$?

1.7 What is the slope of the line with the equation $x = 4$?

Periodic Assessment 1—for use after Activity 1

1. **a.** 154 min = _____ hr

    b. _____ kg = 3.6 g = _____ mg

2. Solve each equation for the indicated variable.

    a. $3y = -18$ **b.** $x + 4 = -12$ **c.** $-9x = 4$

3. Find the slope of the line that passes through each of the following pairs of points.

    a. (3,2) and (9,4)   **b.** (4,7) and (1,7)   **c.** (–4,8) and (8, –2)

4. **a.** List the domain and range of the relation below:

$$\{(-3,12),(3,4),(-1,2),(3,6)\}$$

    b. Is this relation a function? Explain your answer.

5. Playing the drums burns energy at approximately 0.066 kcal/(min • kg). Jesse has a mass of 58 kg. If he plays the drums for 3 hr, approximately how many kilocalories will he burn?

6. Weightlifting burns energy at approximately 0.116 kcal/(min • kg). Jaya ate a breakfast containing 310 kcal. Her mass is 72 kg. How long will it take Jaya to burn off this breakfast while lifting weights?

Additional Review—for use with Activity 2

2.1 Identify the slope and *y*-intercept of each of the following lines.

    a. $y = 3x + 1$ **b.** $y = -2x + 5$

    c. $y = (2/3)x - 5$ **d.** $y = -1x - 3$

2.2 Write an equation in slope-intercept form for each of the following:

    a. the line with a slope of 7 and *y*-intercept of –3

    b. the line that crosses the *y*-axis at (0,–5) and has a slope of 1/4

    c. the line with a slope of $-2/5$ and *y*-intercept of 7

2.3 Solve each equation below in terms of *y*.

    a. $y + 3x = 7x$ **b.** $y - 2x = -3x$ **c.** $y + 12 = 4x$

    d. $8y = 32x$ **e.** $-12y = 6x$ **f.** $3y = -6x - 9$

    g. $y/5 = -2x$ **h.** $y + 2x = 9x - 3$ **i.** $ay - c = bx$

2.4 Write an equation in point-slope form for each of the following:

    a. the line that passes through (3,1) and has a slope of –7

    b. the line that passes through (0,9) and has a slope of 3/5

    c. the line that passes through (2,–3) and (4,–7)

2.5 Identify each of the following pairs of lines as parallel or not parallel. Justify your responses.

    a. $y = 3x - 5$ and $y = 3x + 2$

    b. $y = 0.25x + 1$ and $y = 0.75x + 1$

    c. $2y = -4x + 6$ and $4y = -8x + 20$

2.6 Both the Wood family and the Green family are driving to New York City. From the Wood's home, the distance is 809 miles. The Green's home is located 60 miles closer to New York. Both families left home at 2:00 p.m. and traveled at 65 mph.

    a. Using the same coordinate system, create graphs that model this situation.

    b. Describe the relationship between the two graphs. Why does this relationship exist?

    c. What function could be used to model the Wood's trip? the Green's trip?

    d. What do the slopes and *y*-intercepts of the functions in Part **c** represent?

    e. Identify the domain and range of the function that models the Wood's trip.

    f. Identify the domain and range of the function that models the Green's trip.

Additional Review—for use with Activity 3

3.1. Use the distributive property to expand each of the following expressions.

    a. $3(x-2)$ **b.** $0.5(x+7)$ **c.** $-2(x-5)$

    d. $-\dfrac{5}{7}\left(x-\dfrac{2}{5}\right)$ **e.** $1.6(x+5.1)$ **f.** $r(s-t)$

3.2 Use the distributive property to determine if the expressions $4(x+3)$ and $2(2x+6)$ are equivalent.

3.3 Identify the slope and y-intercept of each of the following lines.

    a. $y=(4/3)(x+2)$ **b.** $y=-0.2(x-1.9)$ **c.** $y+7=2(x-6)$

    d. $y-4=0.2(x+10)$ **e.** $y-r=s(x-t)$

3.4   **a.** Write the equation of the line that passes through the points $(-2,1)$ and $(5,3)$ in point-slope form.

    b. Write the equation of the line in Part **a** in slope-intercept form.

    c. Are your equations in Parts **a** and **b** equivalent? Justify your answer.

3.5 Find the coordinates of the points of intersection for each of the following pairs of equations. Check your solutions.

    a. $\begin{cases} y=x+4 \\ y=-4(x-3) \end{cases}$ **b.** $\begin{cases} y=(2/3)(x+6) \\ y=(-1/3)(x-6) \end{cases}$ **c.** $\begin{cases} y+6=1.2(x-3) \\ y-9=2.4(x-2) \end{cases}$

3.6. The following graph describes the distance traveled over time by two objects, where time is in seconds and distance is in meters.
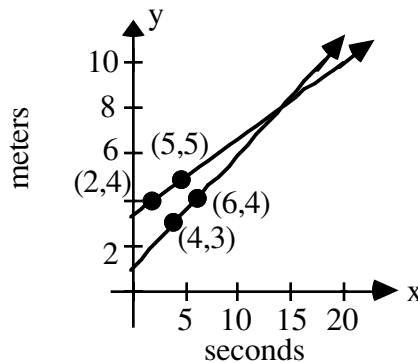
    a. Write an equation that describes the motion of each object.

    b. Identify the time when the objects have traveled the same distance.

Periodic Assessment 2—for use after Activity 3

1. Identify the slope and y-intercept of each line below.

   a. $y = (2/3)x - 4$ **b.** $y = -3x + 6$

2. Write an equation in slope-intercept form for each of the following:

   a. the line with a slope of $-2/5$ and y-intercept of -5

   b. the line that crosses the y-axis at $(0,3)$ and has a slope of -2

3. Solve each equation below in terms of y.

   a. $y - 3x = 4x$ **b.** $y + 3 = -4x$ **c.** $4y = 8x - 12$

4. Write an equation in point-slope form for each of the following:

   a. the line that passes through $(0,4)$ and has a slope of -2

   b. the line that passes through $(-2,6)$ and has a slope of $-1/4$

5. Write each of the following equations in slope-intercept form.

   a. $y - 2 = -3(x - 0)$ **b.** $y + 1 = 1.5(x + 1)$

6. Find the coordinates of the points of intersection for each of the following pairs of equations.

   a. $\begin{cases} y = 2x + 1 \\ y = 3x - 2 \end{cases}$ **b.** $\begin{cases} y = -2(x + 7) \\ y + 4 = 0.5(x - 6) \end{cases}$

7. Determine the equation of the line that passes through the points $(-2,3)$ and $(2,1)$.
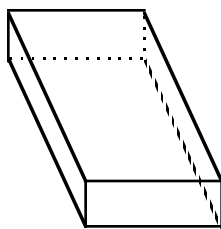
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Level 1: Volume 1—A New Look at Boxing

Additional Review—for use with Activity 1

1.1 Identify which of the following objects are prisms. If it is a prism, identify its type. If it is not a prism, explain your reasoning.
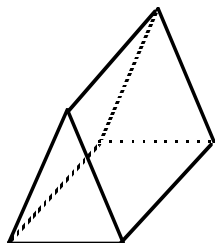
a. **b.** **c.**
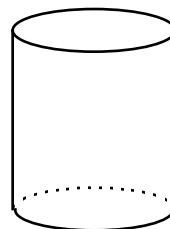
1.2 Find the area of each shape below.

a.

15 cm

17 cm

b.

17 cm

45 cm

c.

3 cm

6 cm
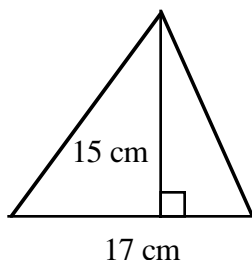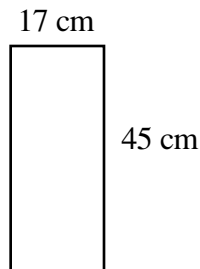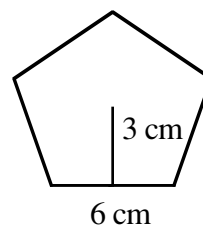
1.3 **a.** Find the surface area of each prism.

1.

0.5 cm

2.0 m

1.4 m

2.

1.6 cm

1 cm

1.2 cm

3 cm
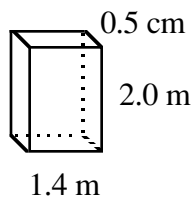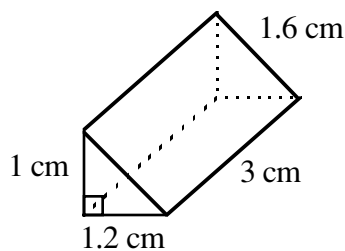
b. Make a scale drawing of a net for each prism in Part **a.**

c. Describe the dimensions of the smallest rectangle that would enclose each net in Part **b**.

d. Find the area of each rectangle in Part **c**.

e. Suppose you used a rectangular sheet of cardboard to construct each prism. For each one, what percentage of cardboard would be wasted?

Periodic Assessment 1—for use after Activity 1

1. Which of the following nets, if any, could be used to create the hexagonal prism below?
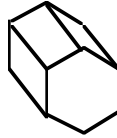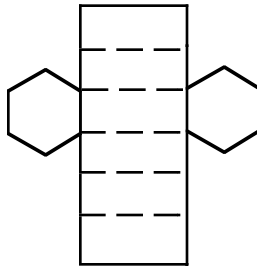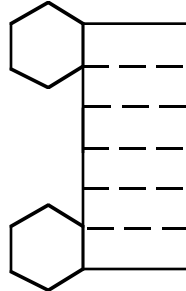
   a.   **b.**   **c.**
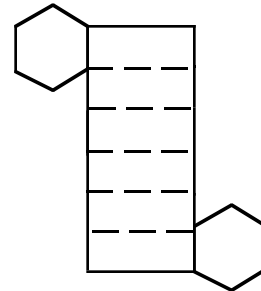
2. Indicate whether each of the following statements is true or false. If false, explain your response.

   a. Prisms have exactly two lateral faces.

   b. Prisms have exactly two bases.

   c. Prisms have bases that are polygons.

   d. Prisms have faces that are not polygons.

3. A tent manufacturer is designing a new tent in the shape of a triangular prism. Determine the surface area of the tent including the floor.

   1.4 m

   1.2 m

   2.5 m

   1.6 m
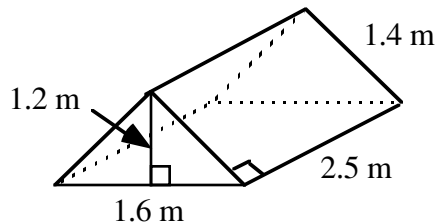
4. A packaging company has received a contract to make cardboard crates for refrigerators. The crates are rectangular prisms that measure 1.7 m by 0.8 m by 0.8 m. Since the company pays 22 cents per square meter of cardboard, it wants to minimize the amount of waste. Imagine that you work as an engineer for this company. Write a design plan that includes:

   a. the shape of the net (drawn to scale)

   b. the dimensions of the rectangle that will enclose the net

   c. the percentage of waste cardboard for each crate produced

   d. the cost of the wasted cardboard

Additional Review—for use with Activity 2

2.1 Determine the sum of the measures of the exterior angles for a regular polygon with:

    a. 3 sides   **b.** 6 sides   **c.** n sides

2.2 Determine the measure of one exterior angle for a regular polygon with:

    a. 5 sides   **b.** 9 sides   **c.** n sides

2.3 Determine the measure of one interior angle for a regular polygon with:

    a. 5 sides   **b.** 9 sides   **c.** n sides

2.4 An artist is designing a sculpture that includes a polygon with 60 sides. Find the measure of one interior angle of the polygon.

2.5 Given that the measure of one interior angle of a polygon is 150°, find the following:

    a. the measure of one exterior angle of the polygon

    b. the number of sides in the polygon

2.6 A landscaper wants to create a flower garden that resembles tessellated regular octagons . Is it possible to create a design that tessellates octagons? Explain your response.

Additional Review—for use with Activity 3

3.1   Draw an appropriately labeled diagram for each of the following.

    a. $\overline{AB}$ **b.** ray RS **c.** line r

    d. $\angle TAL$ **e.** obtuse $\angle FUN$ **f.** acute $\angle SUN$

3.2   **a.** Name the sides of $\angle SUN$ from Part **f** of Problem **3.1**.

    b. Name the vertex of $\angle SUN$

    c. List two other ways of naming $\angle SUN$.

3.3   Determine the measure of the central angle for a regular polygon with:

    a. 5 sides   **b.** 9 sides   **c.** n sides

3.4   What is the geometric relationship between the apothem and a side of a regular polygon?

3.5   Determine the perimeter of a regular polygon with a side length of 12 cm and each of the following numbers of sides:

    a. 7   **b.** 12   **c.** n

3.6   The formula for the area A of a regular polygon is:

$$A = \frac{1}{2}a \bullet s \bullet n$$

What does the expression $s \bullet n$ represent?

3.7   Find the surface area of the pentagonal prism below.

8 m   5.5 m

10 m
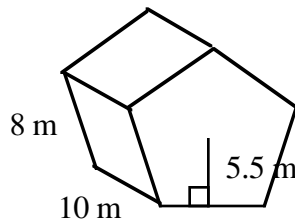
3.8   The cupcake box shown below is an hexagonal prism. Find its surface area.

8 cm   4.3 cm

5 cm
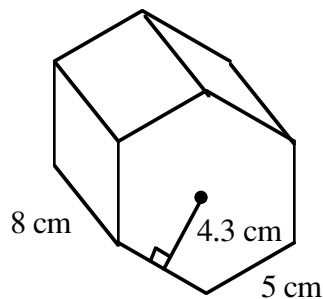
Periodic Assessment 2—for use after Activity 3

1. Complete Parts **a–c** for a regular polygon with 10 sides.

   a. Determine the sum of the measures of the exterior angles.

   b. Find the measure of one exterior angle.

   c. Identify the measure of one interior angle.

2. Find the measure of one interior angle of a regular octagon.

3. Name the regular polygons that will tessellate the plane and explain why each one works.

4. The Petersons are remodeling their home. The kitchen floor will be done in tiles in the shape of regular hexagons. A sample tile is shown below.

19.6 cm

16 cm
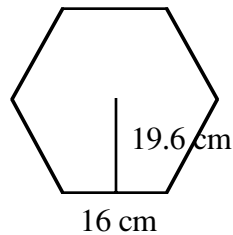
   a. What is the area of one tile?

   b. The dimensions of the kitchen floor are 4 meters by 5 meters. Approximately how many tiles will they need to complete the floor?

Level 1: Volume 1
What Will We Do When the Well Runs Dry?

Additional Review—for use with Activity 1

1.1. Convert each of the following measurements:

    a. $2 \text{ L} = \underline{\hphantom{00}} \text{ cm}^3$ **b.** $500 \text{ cm}^3 = \underline{\hphantom{00}} \text{ dm}^3$ **c.** $257 \text{ dm}^3 = \underline{\hphantom{00}} \text{ L}$

    d. $75 \text{ cm}^3 = \underline{\hphantom{00}} \text{ L}$ **e.** $4.5 \text{ L} = \underline{\hphantom{00}} \text{ dm}^3$ **f.** $x \text{ dm}^3 = \underline{\hphantom{00}} \text{ cm}^3$

1.2 Use the pentagonal prism in the following diagram to identify these parts:

    a. the bases   **b.** a lateral face   **c.** a lateral edge
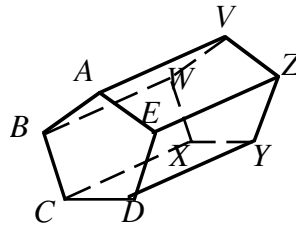
1.3 Determine the number of each of the following in a hexagonal prism:

    a. bases   **b.** lateral faces

    c. lateral edges   **d.** total edges

1.4 Sketch each of the following prisms and determine its volume:

    a. a right triangular prism with bases whose sides measure 6 cm, 8 cm, and 10 cm, and a height of 15 cm

    b. a regular octagonal prism with bases whose sides measure 3 cm (apothem 3.6 cm) and a height of 5 cm

1.5. Lake Michigan is one of the largest bodies of fresh water in the world. In 1995, American farmers used $5.07 \cdot 10^{11}$ L of irrigation water per day. At this rate, about how many days would it take to drain Lake Michigan?

    The average depth of Lake Michigan is approximately 85 m. Use this fact and the map below to help you solve this problem.
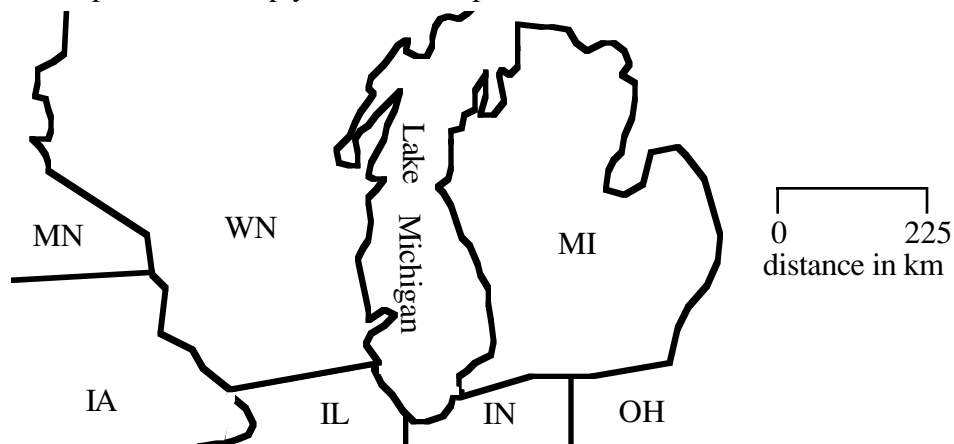
Periodic Assessment 1—for use after Activity 1

1. Which faces of a prism are always parallel?

2. How many cubic centimeters are there in 3.5 L?

3. How many faces does an octagonal prism have? How many edges?

4. Find the volume, in liters, of the prism in the diagram below. All measurements are in centimeters.
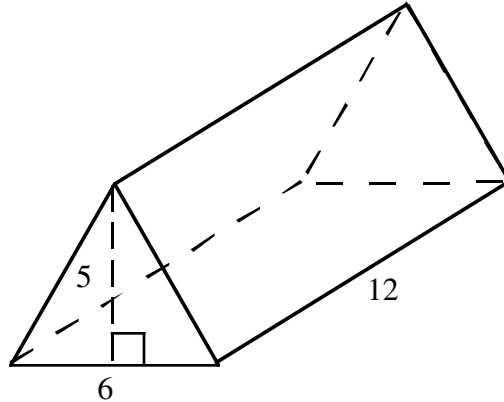
5. Lise wants to build a concrete sidewalk from her house to her garage. To help her plan this project, she made the scale drawing shown below. Each square on the grid represents 1 square foot. If the sidewalk will be 4 inches thick, how many cubic yards of concrete will she need to order?
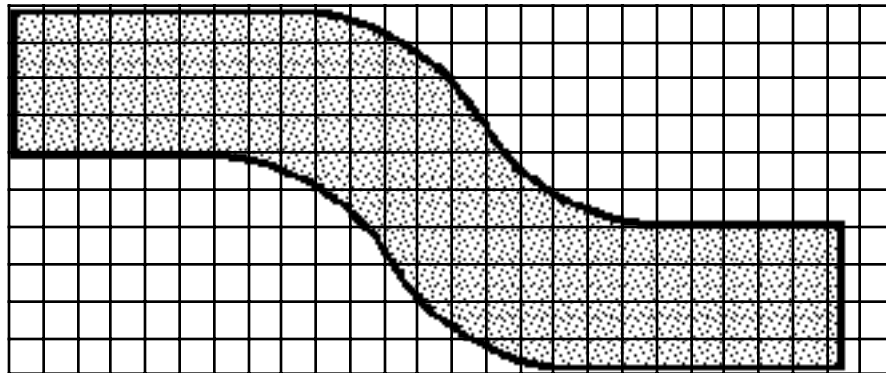
Additional Review—for use with Activity 2

2.1 Find the slope of the line that contains each of the following pairs of points:

    a. $(5,2)$ and $(7,8)$ **b.** $(10,8)$ and $(-3,13)$

    c. $(-2,5)$ and $(6,5)$ **d.** $(-1,-4)$ and $(-1,5)$

2.2 Create a graph of the line $y = (2/3)x - 7$. Identify its slope and y-intercept.

2.3 Graph a line with a slope of $-6/5$ and a y-intercept of 2. Write its equation in the form $y = mx + b$.

2.4 Write the equation of each line shown below:
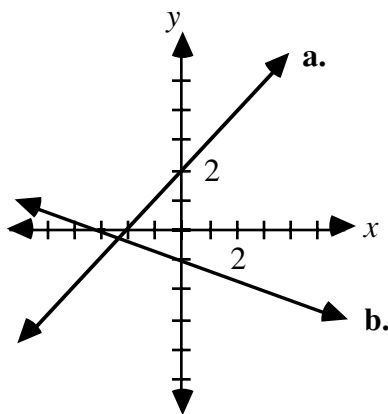
2.5 Write the equation of each line described below in the form $y = mx + b$.

    a. the line with slope –6 that passes through the point $(3,-2)$

    b. the line with slope $1/7$ that passes through the point $(-5,-4)$

    c. the line that passes through the points $(-6,4)$ and $(3,10)$

    d. the line that passes through the points $(7,11)$ and $(-2,23)$

    e. the line that passes through the points $(0,6)$ and $(1,1)$

    f. the horizontal line passing through the point $(2,-4)$

2.6 Dave and Peg plan to build a new home in the mountains. To satisfy local building regulations, their well must produce at least 35 gallons of water per minute. Their well takes 1.4 sec to fill a 1-gallon container and 7.1 sec to fill a 5-gallon container. Does this meet the requirement? Justify your response.

Additional Review—for use with Activity 3

3.1 Use the coordinate grid below to complete Parts **a–c**.

    a. Plot the points A (1,4), B (6,6), and C (8,9).

    b. One line that approximates these points is $y = 0.7x + 3$. Graph this line.

    c. Determine the residuals for A, B, and C.
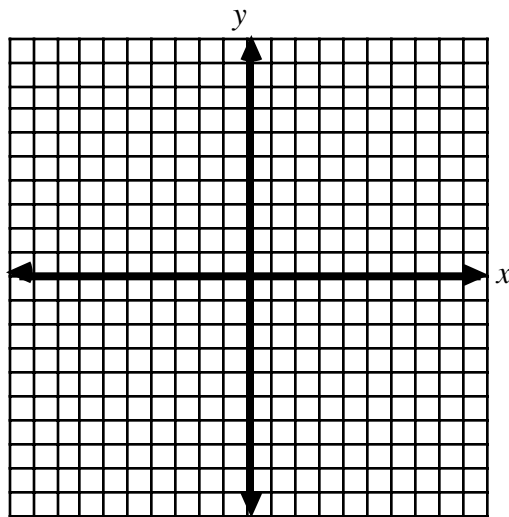
3.2 Using the information in Problem **3.1**, calculate the percent error for points A, B, and C.

3.3 The following table shows the number of public high school graduates in Rhode Island, in thousands, for the given years.

Year	Graduates (in thousands)
1980	10.9
1985	9.2
1987	8.8
1988	8.9
1989	8.6
1990	7.8
1991	7.7
1992	7.9

Source: *Statistical Abstract of the United States*. Washington, DC: U.S. Bureau of the Census, 1995. p.177.

    a. Make a scatterplot of the Rhode Island graduation data.

    b. Draw a line that closely approximates the data and determine its equation.

    c. Find the sum of the absolute values of the residuals.

    d. Use your model to predict the number of graduates in 1998. Use an appropriate reference to check your prediction.

Periodic Assessment 1—for use after Activity 3

1. Write the equation of the line shown below in the form $y = mx + b$. (Each square on the grid represents 1 unit.)
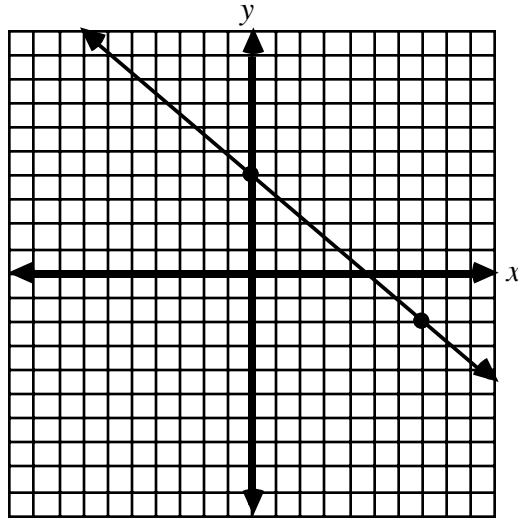
2. Identify the slope and y-intercept of the line $y = (2/3)x - 9$.

3. Write the equation of the line with slope $-7/5$ that passes through the point $(15, -6)$.

4. Determine the equation of the line that passes through the points $(0, 32)$ and $(100, 212)$.

5. In most Olympic swimming events, the winning time has decreased steadily over the years. For example, the winning times in the women's 400-meter freestyle can be modeled by the line $y = -0.03x + 6.1$, where x represents the number of years after 1920 and y represents the time in minutes. In 1996, Michelle Smith of Ireland won the event with a time of 4.12 minutes. Determine the residual and the percent error for this data point.

Level 1: Volume 2
Skeeters Are Overrunning the World

Additional Review—for use with Activity 1

1.1. Determine the percent increase in each of the following populations:

    a. initial population = 250; current population = 325

    b. initial population = 25,000; current population = 40,000

1.2. Write each the following using exponential notation.

    a. $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$ **b.** $7 \cdot 7 \cdot 7$ **c.** $15 \cdot 15 \cdot 15 \cdot 15$

1.3. Write each of the following in expanded form.

    a. 5^2 **b.** 2^5 **c.** 11^3

1.4.   **a.** Complete the table below for a population that grows by a factor of 4 with each generation.

Generation Number (x)	Total Population (y)
0	1
1	
2	
3	
4	
5	

    b. Write an equation for finding the total population given the generation number.

    c. Determine the generation number that yields a population of 16,384.

    d. Which quantity represents the dependent variable? Which quantity represents the independent variable?

Additional Review—for use with Activity 2

2.1. For each annual growth rate below, determine the value of b in the corresponding equation of the form $y = a \cdot b^x$.

    a. 20%   **b.** 50%   **c.** 3%

    d. 100%   **e.** 125%   **f.** 10.5%

2.2. For each of the following values of b in an equation of the form $y = a \cdot b^x$, determine the growth rate per time period.

    a. 1.2   **b.** 2.4   **c.** 1.07

    d. $1 + 0.33$ **e.** 1.259   **f.** 1.002

2.3. Given the initial values and annual growth rates below, determine the values for each of the next five years. Round all values to the nearest tenth.

    a. initial value = 10; growth rate = 20%

    b. initial value = 3000; growth rate = 5%

2.4. Herb and Alyssa bought a house for $124,000. Over the next 6 years, the house's value increased at an average rate of 6% per year.

    a. Determine the value of the house in each of those 6 years. Round values to the nearest dollar.

    b. Make a scatterplot of the house values from Part **a**.

2.5. Olivia bought an antique car for $20,000 in 1998. Assuming that the car increases in value at an average rate of 4% per year, determine the car's value in each of the next 7 years. Round values to the nearest dollar.

Periodic Assessment 1—for use after Activity 2

1. Last year, the population of Boomtown grew from 1250 people to 1275 people. What was the annual growth rate in percentage terms?

2. Complete the following table.

Expanded Notation	Exponential Notation
$9 \cdot 9 \cdot 9 \cdot 9$	
	17^3
$8 \cdot 8 \cdot 8 \cdot 8 \cdot 8 \cdot 8$	
	10^5

3. The following table shows annual growth rates and values for b in the corresponding equation of the form $y = a \cdot b^x$. Complete the table.

Growth Rate	Value of b
25%	
	1.072
8%	
	2.21

4. Julissa invested $1200 in an account that promised 5.1% growth per year.

a. Using an equation of the form $y = a \cdot b^x$ to model this situation, what is the value of b?

b. Predict the value of Julissa's account in each of the next 5 years. Round each value to the nearest cent.

Additional Review—for use with Activity 3

3.1. Given the following equations in the form $y = a \cdot b^x$, identify the initial value and the growth rate.

    a. $y = 4 \cdot 3^x$ **b.** $y = 100(1.23)^x$ **c.** $y = 1500(1.008)^x$

3.2. Given the following initial values and annual growth rates, write an exponential equation to describe the pattern of growth.

    a. initial value = 5; growth rate = 100%

    b. initial value = 4000; growth rate = 5.15%

    c. initial value = 25; growth rate = 40%

3.3. Two siblings, Jana and Shamus, received $2 and $3, respectively, on their birthdays this year. Their grandfather told them he would double the previous year's gift for their next 5 birthdays.

    a. To determine the amounts they will receive each year, complete the table below.

Year (x)	Jana (j)	Shamus (s)
0	$2	$3
1		
2		
3		
4		
5		

    b. For each sibling, write an equation to model the growth in the birthday gift.

    c. Identify the domain and range for each relation.

    d. Are the relations in Part **b** functions? Explain your response.

3.4. The following table shows the value of an antique coin over a period of five years.

Year (t)	Coin Value (y)
1995	$150.00
1996	$180.00
1997	$216.00
1998	$259.30
1999	$311.04

    a. Determine the annual rate of growth in the coin's value.

    b. Write an equation of the form $y = a \cdot b^x$ to model the coin's value.

    c. If the coin's value continues to increase at the rate same annual rate, what will it be worth in 2004?

Additional Review—for use with Activity 4

4.1. As part of a population study, the State Department of Fish and Wildlife counts the fish in one section of Coyle Creek each fall. In 1994, the fish count was 75. From 1994 to 1998, the average annual growth rate was 15%. Use this information to predict the approximate fish count in 1999.

4.2. Jurek invested $10,000 in an account that promised 17% annual growth. If the company's predictions are true, what would the value of this investment be in 10 years?

4.3. In 1998, Marissa bought a new car for $14,000. In the past, the value of this car has decreased at an average rate of 21% per year. If this trend continues, what will her car be worth in 7 years?

4.4. Every spring, the National Collegiate Athletic Association (NCAA) holds both men's and women's basketball tournaments. The following table shows the relationship between each round of the tournament and the number of teams remaining.

Round Completed	Number of Teams Remaining
0	64
1	32
2	16

a. Determine the rate of change in the number of teams, per round.

b. Write an equation of the form $y = a \cdot b^x$ to model this situation.

c. How many rounds are required to determine a winner?

Periodic Assessment 2—for use after Activity 4

1.   **a.** Given an initial value of 9 and a growth rate of 40% per time period, write an equation that models the pattern of growth.

     b. What would the value be after 5 time periods? Round your answer to the nearest tenth.

2.   The following table shows the change in the population of a town over time.

Year (x)	Population (y)
0	8000
1	8800
2	9680
3	10,648

     a. Determine the annual growth rate.

     b. Write an equation of the form $y = a \cdot b^x$ to model this situation.

     c. Assuming that the growth rate remains unchanged, what would the population be after year 7?

3.   The Department of Fish and Wildlife has been monitoring the elk population in a wilderness area. Using a helicopter, they counted 510 elk in the area in 1995. The counts over the next three years revealed an average annual growth rate of 11%. If this rate of growth continues, what will the population be in 2001?

Level 1: Volume 2—Oil: Black Gold

Additional Review—for use with Activity 1

1.1   Find the area of each of the following figures and describe how you determined your response.

a.

3 cm   3 cm

3 cm   2.1 cm   3 cm

3 cm

b.

$\square = 1 \text{ mm}^2$

c.

9.2 m

10.2 m   9.0 m   3.7 m

9.9 m
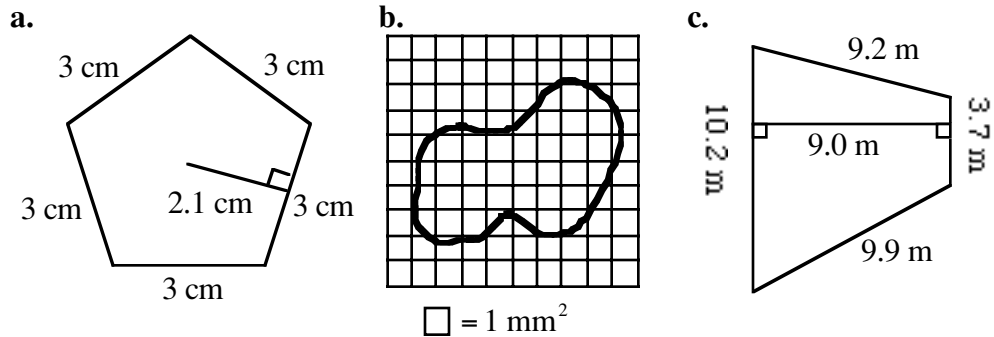
1.2   Write an equation for the volume of each of the figures below, including the correct formula for the area of the base, then calculate the volume.

a.

5 cm

15 cm

13 cm

13 cm   13 cm

b.

4.7 mm

2.3 mm

c.

4.5 m

2.5 m   2.0 m
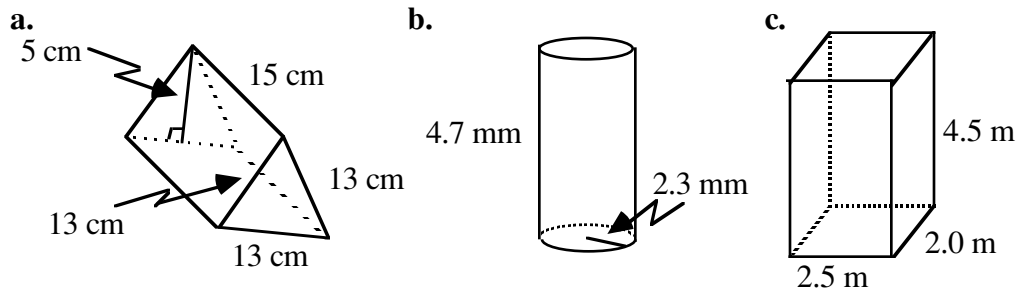
1.3   Sarah bought a 2-L bottle of cola that she wants to share with her friends. The cups she found have a roughly cylindrical shape, but they are wider at the top than at the base. The diameter at the top of each cup is 5 cm; the diameter at the base is 4 cm. The height of each cup is 6 cm. How many cups will Sarah be able to fill with her bottle of cola?

Periodic Assessment 1—for use after Activity 1

1. Find the area of each of the following figures:

a.

4 m   4 m

2 m

4 m $2\sqrt{3}$ m   2 m

4 m   4 m

b.

$\square$ = 1 mm^2
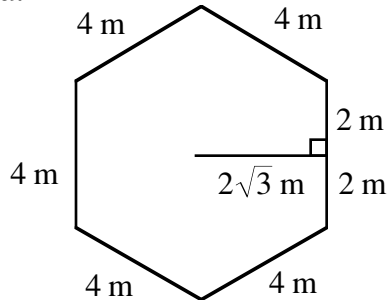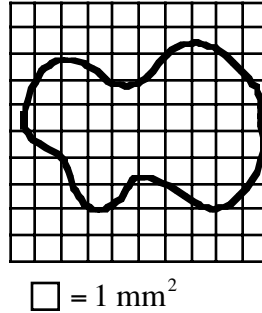
2. Find the volume of each of the following:

a.

6 m   6 m

6 m   8.1 m

7.2 m

6 m

6 m

b.

0.6 m

0.2 m
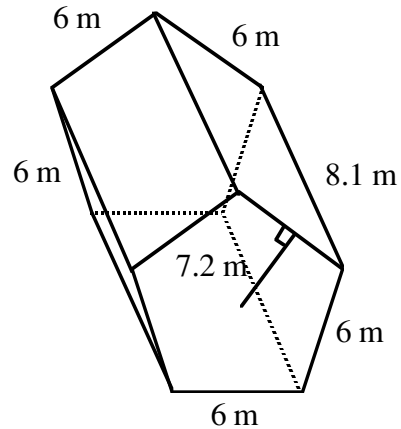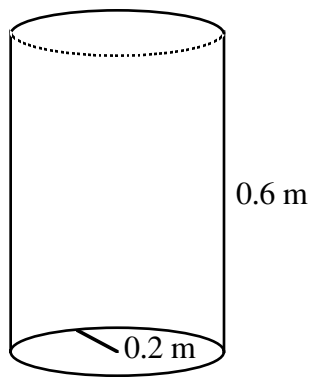
3. Six 12-oz cans of soda cost $2.79. A 2-L bottle of soda costs $1.19. Which is the better buy? Justify your response.

Additional Review—for use with Activity 2

2.1 Determine which of the following graphs, if any, depict a direct proportion.

a.
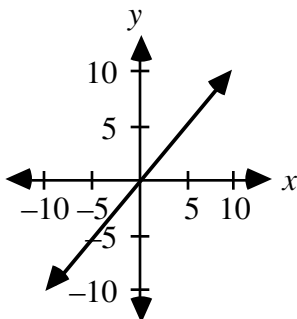
b.
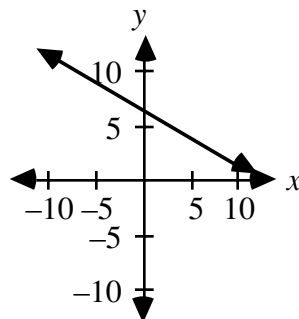
c.
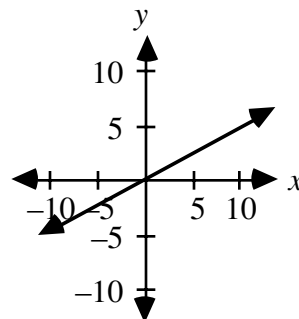
2.2 Determine which of the following relations, if any, are direct proportions. If a relation represents a direct proportion, identify the constant of proportion.

a.

x	12	−8	3	16	−20
y	1/3	−1/2	4/3	1/4	−1/5

b.

x	8	−2	13	−5	30
y	4	−1	6.5	−2.5	15

c.

x	7	−2	6	−9	11
y	25	−2	22	−23	35

d.

x	2	−3	5	9	−4
y	18	−27	45	81	−36

2.3 Determine which of the following equations, if any, are direct proportions. If an equation represents a direct proportion, identify the constant of proportion..

a. $y = 0.75x$ **b.** $y = 4x - 7$ **c.** $y = 10x$

d. $y = -(3/2)x$ **e.** $y = x^2$ **f.** $y = 2/x$

2.4 The table below shows data for mean annual income in 1998, depending on total years of education. Is this data directly proportional? Why or why not?

Education (in years)	12	14	16	18
Annual Income ($)	22,895	29,872	40,478	51,183

Source: *Statistical Abstract of the United States*. Washington, DC: U.S. Bureau of the Census, 1999.

Additional Review—for use with Activity 3

3.1 Identify each of the following data sets as directly proportional, inversely proportional, or neither.

a.

x	3	−10	−2	2.5	20
y	1.67	−0.5	−2.5	0.2	0.25

b.

x	−3	6	15	−21	12
y	−2	4	10	−14	8

c.

x	8	-12	−2	−3	4
y	−1/2	−4/3	−1	−7/3	0

d.

x	6	12	4	−3	24
y	2	1	3	−4	0.5

3.2 Identify each of the following situations as involving a direct proportion, an inverse proportion, or neither.

a. the number of children at a party and the average amount each will receive from a piñata full of treats

b. the number of people at a barbecue and the kilograms of hamburger needed

c. the number of miles hiked and the number of calories expended

d. the number of people in a family and the number of slices each receives from one pizza shared equally

e. the number of raffle tickets sold and the probability of winning the grand prize

3.3 Brooke has $50 to buy party favors for her birthday celebration. She knows that the more friends she invites, the less she can spend per person. Make a data table that relates the number of guests to the amount spent per guest, then write an equation that models this situation.

Periodic Assessment 2—for use after Activity 3

1. In an inverse variation, what value remains constant?

2. In a direct variation, what value remains constant?

3. Graph the following data set and determine what kind of proportion it represents.

x	10.1	99	55	35.5	3
y	13.9	1.3	2.45	3.8	46

4. What type of proportion is represented by the equation $y = 2.5x$? Justify your response and identify the constant of proportionality.

5. What type of proportion is represented by the equation $y = 7/x$? What is the constant of proportionality?

6. Because sound travels more slowly than light, it may take a few seconds to hear the thunder produced by a lightning strike. Imagine that you witness a lightning strike 9.9 km away. About 30 sec later, you hear the thunder. Use this information to find a constant of proportionality and write an equation that models this situation.

Level 1: Volume 2—I'm Not So Sure Any More

Additional Review—for use with Activity 1

1.1 Complete the following table, expressing all fractions in their simplest form.

Percentage	Decimal	Fraction
		1/4
	0.12	
8%		
	1.5	
0.3%		
		5/8

1.2 Describe the differences between experimental probability and theoretical probability. Give an example of each.

1.3 Toss two coins 10 times and use the results to determine the experimental probability of each outcome below.

    a. two heads

    b. one head and one tail

    c. two tails

1.4   **a.** What is the sample space for tossing two coins?

    b. Determine the theoretical probability of obtaining each of the following outcomes when tossing two coins:

        1. two heads

        2. one head and one tail

        3. two tails

    c. What is the sum of probabilities in Part **b**?

1.5 A bag contains 20 red marbles, 16 green marbles, and 12 blue marbles. If you select one marble at random from the bag, what is the probability that the marble is:

    a. red?

    b. green?

1.6 A cooler contains 12 cans of soda, 7 cans of fruit juice, and 5 bottles of water. If you select one drink at random from the cooler, what is the probability that the drink is:

    a. water?

    b. fruit juice or soda?

Additional Review—for use with Activity 2

2.1   **a.**   What is the sample space for rolling a fair six-sided die.

b.   What is the theoretical probability of rolling each of the following?

1. a three

2. a six

3. an even number

4. an even or an odd number

5. an even and an odd number

2.2   **a.**   What is the sample space for rolling a pair of six-sided dice?

b.   What is the theoretical probability of each of the following?

1. a three and a three

2. a four and a six

3. a sum of 7

4. a sum of 9 or greater

2.3   After analyzing its customer records, a rental car company found that approximately 2% of its customers were involved in accidents. What is the probability that a customer chosen at random was not involved in an accident?

Additional Review—for use with Activity 3

3.1   **a.** What number is 72% of 3010?

      b. Sixteen percent of what number is 240?

      c. Fifteen is 300% of what number?

      d. Four-fifths of what number is 60?

      e. What number is 7/8 of 88?

3.2   The following table shows the probabilities of all the possible outcomes of an event. Use this information to calculate the expected value in this situation.

Outcome (x)	Probability $P(x)$
10	1/6
4	1/3
2	1/2

3.3   The table below shows the probabilities of all the possible outcomes of an event. Use this information to calculate the expected value.

Outcome (x)	Probability $P(x)$
1	1/6
2	2/3
3	1/6

3.4   The theoretical probability of success in a certain event is 30%. Predict how many successes will occur in each of the following:

      a. 10 trials

      b. 40 trials

      c. n trials

3.5.   A student organization is working to raise money for co-curricular activities. To help with their efforts, a local business has promised to donate the grand prize for a raffle. The students hope to sell 20,000 tickets for the raffle, at $10 each. What value should the prize have to make this a fair game?

Periodic Assessment—for use after Activity 3

1. The following table includes information about a music collection installed in a CD player which can play individual discs at random.

Type of Music	Number of Compact Discs
rap	10
country	3
alternative	8

    a. What is the theoretical probability of randomly picking a rap CD?

    b. What is the theoretical probability of randomly picking a country CD?

    c. What is the theoretical probability of randomly picking an alternative CD?

2. What is the sum of the theoretical probabilities of all the outcomes in a given sample space?

3.   **a.** List all the outcomes for tossing a fair coin and rolling a fair six-sided die.

    b. How many outcomes are there in the sample space?

    c. What is the theoretical probability of obtaining a four on the die?

    d. What is the theoretical probability of obtaining an odd number on the die?

4. The following table shows the probabilities of all the possible outcomes of an event. Use this information to calculate the expected value.

Outcome (x)	Probability $P(x)$
5	1/4
1	1/2
–6	1/4

Level 1: Volume 2—Are You Just a Small Giant?

Additional Review—for use with Activity 1

1.1   Solve each of the following proportions for x.

    a. $\dfrac{3}{8} = \dfrac{x}{56}$ **b.** $\dfrac{4}{7} = \dfrac{47}{x}$

    c. $\dfrac{x}{9} = \dfrac{13}{79}$ **d.** $\dfrac{1}{x} = \dfrac{22}{37}$

1.2   Which of the following equation(s) do not have the same solution as the one below?

$$\frac{14}{x} = \frac{84}{45}$$

    a. $\dfrac{14}{x} = \dfrac{45}{84}$

    b. $\dfrac{84}{14} = \dfrac{45}{x}$

    c. $\dfrac{x}{45} = \dfrac{14}{84}$

1.3   Steen loves to build model ships. According to the instructions for his new kit, the scale factor of the model to the actual ship is 1:56.6.

    a. The length of the model is 75 cm. What is the length of the original ship?

    b. The height of the mast of the original ship is 21.3 m. What is the height of the mast on the model?

1.4   A soft-drink manufacturer plans to build a concession stand that looks like a soda can laying on its side. An ordinary can has a diameter of 5.4 cm and a height of 12.4 cm. To allow workers to stand comfortably inside, the concession stand will have a diameter of 200 cm.

    a. Set up a proportion to illustrate the relationship between the measurements of the soda can and the concession stand.

    b. Solve the proportion to find the length of the concession stand.

Additional Review—for use with Activity 2

2.1 Calculate a real-number value for each square root below. Round non-integer values to the nearest hundredth.

    a. $\sqrt{121}$ **b.** $\sqrt{56}$ **c.** $\sqrt{-32}$

2.2 Polygons A, B, C, D, E, F, G, and H are all similar polygons. Use this information to complete the following table.

Polygons	Ratio of Side Lengths	Ratio of Areas
A and B	1:6	
C and D		9/16
E and F	$m{:}n$	
G and H		s/t

2.3 If the lengths of the sides of a square are tripled, by what factor is the area increased?

2.4 If the area of a regular hexagon is quadrupled, by what amount are the lengths of the sides increased?

2.5 A fashion designer has created a rectangular pattern for a line of tablecloths and napkins. The area of each rectangle on the tablecloth is 2.25 times the area of each rectangle on the napkin. What is the ratio of the lengths of corresponding sides?

2.6 A farmer plants a rectangular field 75 m by 90 m with soybeans. She wishes to double the area of the field, while maintaining a similar shape.

    a. What scale factor does she need to determine the dimensions of the new field?

    b. What are the dimensions for the new field?

Additional Review—for use with Activity 3

3.1   Calculate a real-number value for each cube root below. Round non-integer values to the nearest hundredth.

    a. $\sqrt[3]{343}$ **b.** $\sqrt[3]{-1728}$

    c. $\sqrt[3]{592.704}$ **d.** $\sqrt[3]{-4913}$

3.2   Complete the following table.

Scale Factor	Ratio of Areas	Ratio of Volumes
3/5		
	25:4	
		$m^3 : n^3$
	s^2 / t^2	
	u / v	

3.3   The surface areas of two similar solids are 144 cm^2 and 289 cm^2, respectively. Find the ratio of their volumes.

3.4   A balloon 25-cm long holds 3200 cm^3 of air. Find the length of a similar balloon that holds 840 cm^3 of air.

3.5   According to the 1990 *Guinness Book of World Records*, the largest hamburger ever made was cooked on July 9, 1988, in Coral Springs, Florida. The hamburger weighed 2313.3 kg. A typical frozen hamburger patty weighs approximately 113 g and measures about 1 cm thick and 11 cm in diameter. If the world's largest hamburger was similar to a typical hamburger, what were its dimensions?

## Periodic Assessment 1—for use after Activity 3

1. Two towns, George and Martha, have similar water towers. If the height of the tower in George is 1.3 times the height of the one in Martha, how much more water would the tower in George hold?

2. A perfume manufacturer plans to offer its best-selling fragrance in a larger bottle, while retaining its distinctive shape. If the company increases the volume of the bottle by a factor of 4, by what factor would it increase the surface area?

3. A furniture company makes similar chairs for adults and children. The height of the adult chair is 80 cm, while the height of the children's chair is 50 cm.

   a. What is the ratio of their widths?

   b. What is the ratio of their surface areas?

   c. What is the ratio of the volume of material used to make the chairs?

   d. What is the ratio of their masses?

4. A graphic designer wants to double the area of his most popular poster. A friend suggests that this can be done by doubling its length and width. Do you agree? Justify your response.

5. When Sandra painted her doll house, she used about 0.75 L of paint. Now she would like to paint her tree house. The two houses are similar, and the height of the tree house is 5.4 times that of the doll house. How much paint will she need?

Additional Review—for use with Activity 4

4.1 Create a table of values for each equation below. Then sketch a graph of each equation.
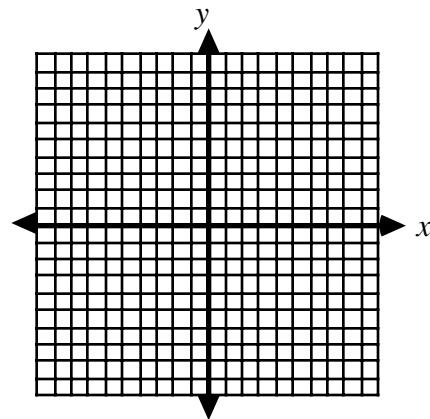
a. $y = 1.3x^2$

x	y
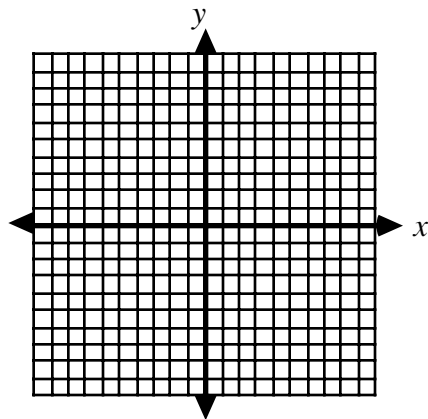
b. $y = 0.83x^3$

x	y

4.2 For each equation in Problem **4.1**, determine the value of x (to the nearest hundredth) if $y = 87.93$.

4.3 The table below shows the measurements of five cantaloupes at a local market.

Circumference (cm)	Weight (kg)
50.8	1.83
38.1	0.73
48.3	1.55
63.5	3.59
66.0	3.94

a. Make a scatterplot of the data and find a power equation that models it.

b. Use your model to estimate the circumference of a cantaloupe with a mass of 1.4 kg.

Additional Review—for use with Activity 5

5.1   Convert each of the following weights to mass in kilograms.

    a. 98 lb   **b.** 125 lb   **c.** 143 lb

5.2   Convert each of the following masses to force in Newtons.

    a. 3.4 kg   **b.** 11.3 kg   **c.** 546 g

5.3   A student weighs 115 lb and has a foot area of 187 cm^2. Find the pressure (in N/cm^2) that this person exerts on the floor when standing flat-footed on both feet.

5.4   A competition basketball backboard weighs approximately 200 lb. It is suspended from the ceiling by two steel wires. To withstand the force of slam dunks, each wire needs to be able to hold 5 times the weight of the backboard. The tensile strength of steel wire is $2.8 \bullet 10^4$ N/cm^2. Determine the minimum diameter of wire required to support the backboard.

Additional Review—For use with Activity 6

6.1 Calculate the area of a circle with each of the following dimensions.

    a. $d = 4.7$ cm   **b.** $r = 8\frac{3}{4}$ in   **c.** $d = 56.9$ m

6.2 A block of steel in the shape of a rectangular prism has a base 2 m by 3 m and a height of 5 m. A cubic meter of steel has a mass of about 8000 kg. Use this information to complete Parts **a–c**.

    a. Determine the mass of the block and the pressure (in kg/m^2) it exerts on the ground.

    b. If the dimensions of the block were doubled, what would its volume be? What pressure would it exert on the ground?

    c. In general, what happens to the volume, mass, and pressure exerted on the ground as the dimensions of the block change by a given scale factor?

6.3 The movie "The Chipmunk that Ate Chicago" stars a monster chipmunk 10 m tall. The average chipmunk stands 12 cm high and has a mass of 125 g. Since chipmunks often sit on their hind legs, these legs must support their entire mass. The maximum pressure a femur bone can withstand is 1200 N/cm^2. What is the minimum diameter, to the nearest centimeter, of the femur bone of the monster chipmunk?

Periodic Assessment 2—for use after Activity 6

1. While studying a plant's loss of water through its leaves, a scientist found that water loss appeared to be related to surface area. She then collected the following data.

Leaf Length (cm)	Leaf Area (cm^2)
3.7	24.2
5.1	9.7
8.8	29.0
10.1	67.7
19.7	208.1
19.1	135.5
15.7	96.8
21.5	227.4
24.5	268.5

a. Make a scatterplot of the data.

b. Find a power equation that models the scatterplot.

c. Use your model to estimate the surface area of a leaf 17.3 cm long.

2. The mass of a horse is 570 kg. The area of the bottom of each hoof is approximately 98 cm^2. Find the pressure, in N/cm^2, that this horse places on the ground when standing still.

3. The diameter of the smallest part of a horse's femur is 4.5 cm. The diameter of the smallest part of the femur of a *Tyrannosaurus rex* is 22 cm. The weight of the horse is 8000 N, while the estimated weight of the dinosaur was 55,000 N.

a. Determine the minimum area of a cross section of each femur.

b. Which femur bears more pressure? Justify your response.

c. Imagine a giant horse with a femur the size of the dinosaur's femur. If this horse were similar to an ordinary horse, what would its weight be in Newtons?

Level 1: Volume 2
AIDS: The Preventable Epidemic

Additional Review—for use with Activity 1

1.1   Each of the following exponential equations models the growth in a given population. Identify the growth rate indicated by each model.

   a. $y = 4 \cdot 1.7^x$ b. $y = 23 \cdot 0.83^x$ c. $y = 68 \cdot 3^x$ d. $y = a \cdot b^x$

1.2   Use the data in the table below to complete Parts **a–c**.

| x	y
0	1000.00
1	1060.00
2	1123.60
3	1191.02
4	1262.48
5	1338.23

   a. Create a scatterplot of the data.

   b. Find an exponential equation to model the data.

   c. Use your model to predict the value of y when $x = 18$.

1.3   The table below shows some data on the prairie dog population living on a private wildlife reserve.

Year	Prairie Dogs
1993	37
1994	40
1995	45
1996	47
1997	50
1998	58
1999	66

   a. Make a scatterplot of the data. Let x represent the year (denote 1993 with year 0) and let y represent the number of prairie dogs.

   b. One possible model for this data is $y = 37 \cdot 1.09^x$. Determine the sum of the absolute value of the residuals for this model.

   c. Do you think that this equation is a good model for the data? Justify your response.

Additional Review—for use with Activity 2

2.1 Of the 103 students that attend Grayson High School, 46 belong to the German Club, 40 belong to Pep Club, and 20 belong to Chess Club.
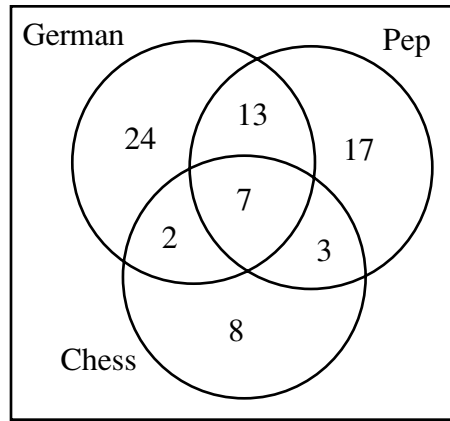
a. How many students are members of more than one club?

b. What is the probability that a student chosen at random will be a member of exactly two of these clubs?

c. How many students are not involved with any of these clubs?

2.2 The Halstead family is planning a reunion. To help plan the menu, they conducted a survey of salad preferences. The results of the survey are shown in the table below.

Salad Preference	Number of People
potato	40
fruit	37
Caesar	36
potato and fruit	22
potato and Caesar	18
fruit and Caesar	25
potato, fruit, and Caesar	12

a. Use a Venn Diagram to organize this data.

b. How many people indicated their salad preference?

c. What is the probability that a response chosen at random would indicate Caesar only?

d. What is the probability that a response chosen at random would indicate potato, fruit, and Caesar?

e. The reunion organizers expect 82 family members to attend. Modify your Venn diagram to reflect this total.

Periodic Assessment 1—for use after Activity 2

1. The population of turtles in a protected habitat is growing at a rate of 16% annually. The habitat was initially stocked with 17 turtles.

   a. Write an exponential equation to model this situation.

   b. Use your model to predict what the turtle population will be 25 years after the initial stocking.

2. The population of bison in a wildlife refuge can be modeled by the equation $y = 112 \bullet 1.04^x$, where y represents the number of bison and x represents the number of years since the refuge was established.

   a. Identify the initial population and the growth rate.

   b. Use your model to predict what the bison population will be 30 years after the refuge was established.

   c. Do you think this equation can provide a good model for a bison population in a limited area? Explain your reasoning.

3. In a recent survey, students at Beaumont High School were asked how they liked to spend their free time during the summer months. The distribution of their responses is shown in the table below.

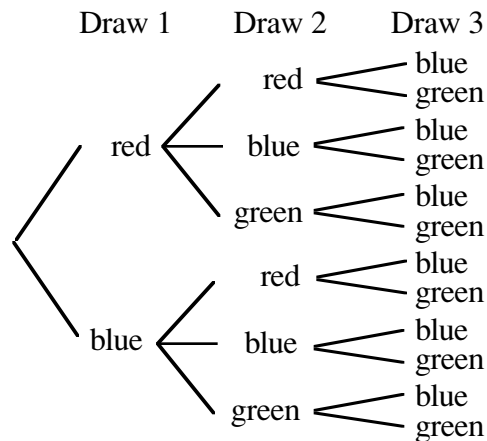 | Preferred Activity | Number of Students |
   |---|---|
   | fishing | 92 |
   | hiking | 96 |
   | cycling | 91 |
   | fishing and hiking | 34 |
   | fishing and cycling | 30 |
   | hiking and cycling | 37 |
   | all three activities | 12 |

   a. Use a Venn diagram to organize this data.

   b. Beaumont High School has a total of 232 students. How many students do not spend their time fishing, cycling, or hiking? Modify your Venn diagram to reflect this information.

   c. What is the probability that a student chosen at random enjoys hiking?

   d. What is the probability that a student chosen at random enjoys all three activities?

Additional Review—for use with Activity 3

3.1   **a.** Draw a tree diagram to illustrate the sample space for forming three-digit numbers using the digits 3, 5, and 9, without repetition.

   b. If the digits are chosen randomly, what is the probability that the number 359 will be formed?

   c. If the digits are chosen randomly, what is the probability that the three-digit number will begin with a 9?

   d. If the digits are chosen randomly, what is the probability that the number formed will be greater than 539?

3.2   How many five-digit numbers can be formed using the digits 5, 7, 3, 8, and 4, without repetition?

3.3   A local espresso shop has begun offering a special lunch, which includes soup, salad, and bread. Customers can choose from 3 different soups, 4 different salads, and 6 different types of bread. They can also select from 13 different beverages. How many different lunch combinations, including beverages, are possible?

3.4   A prime number is a number that has exactly two factors, 1 and itself. A composite number is a number that has more than two factors. The number 1 is neither prime nor composite.

   a. When rolling an ordinary six-sided die, what is the probability of obtaining each of the following?

      1. a prime number

      2. a composite number

      3. neither

   b. **1.** Considering only prime (p), composite (c), and neither (n) as possible outcomes, list the sample space when rolling a die three times.

      2. What is the probability of rolling two prime numbers followed by a composite number, or $P(ppc)$?

      3. What is the probability of rolling two primes and a composite in any order?

      4. What is $P(nnn)$?

   c. How many outcomes would the sample space contain if the die were rolled four times? Explain your response.

Periodic Assessment 2—for use after Activity 3

1. Jared's suitcase contains khaki pants, khaki shorts, and five T-shirts—blue, green, red, olive, and camouflage—along with sandals, tennis shoes, and loafers. How many different outfits can he create?

2. In a carnival game, players draw one colored chip from three different jars. Use the tree diagram below to complete Parts **a–c**.

Draw 1	Draw 2	Draw 3

```
            Draw 1      Draw 2      Draw 3
                                    blue
                          red  <
                                    green
                                    blue
              red  <      blue <
                                    green
                                    blue
                         green <
                                    green
                                    blue
                          red  <
                                    green
                                    blue
             blue <       blue <
                                    green
                                    blue
                         green <
                                    green
```

   a. What is the probability of drawing a red, a blue, then a green, or *P*(RRG)?

   b. What is the probability of drawing a red, a blue, and a green, in any order?

   c. What is *P*(RRR)?

3. The following table shows student participation in NCAA sports during the 1996–97 school year. Use this data to complete Parts **a–c**.

| Sport	Males	Females	Total
Football	53,984	0	53,984
Volleyball	1052	12,284	13,336
Basketball	15,141	13,392	28,533
Soccer	17,053	14,829	31,882
Outdoor Track	19,305	15,578	34,883
Total	106,535	56,083	162,618

Source: *Statistical Abstract of the United States.* Washington, DC: U.S. Bureau of the Census, 1999.

   a. What is the probability that a student selected at random from this group is female?

   b. What is the probability that a student participated in soccer?

   c. What is the probability that a female athlete participated in volleyball?

   **d.** What is the probability that a student who participated in basketball is male?

Level 1: Volume 3—Going in Circuits

Additional Review—for use with Activity 1

1.1   Use the diagram below to complete Parts **a–d**.
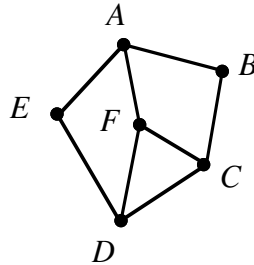
a. List all the vertices in the diagram.

b. Name a path in the diagram.

c. Identify a path that is not a circuit.

d. Identify a Hamiltonian circuit.

1.2   The following diagram shows a weighted graph in which the vertices represent stores in a mall and the numbers on the edges represent the time in seconds required to walk from one store to another.
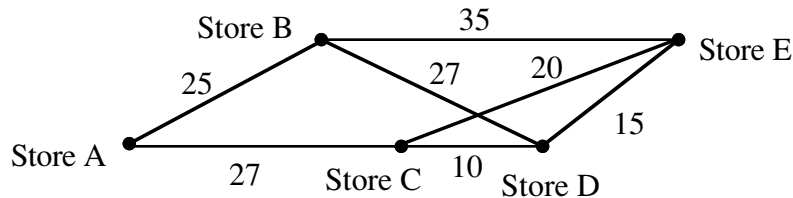
a. Find the path from Store A to Store E that takes the least amount of time.

b. Identify a Hamiltonian circuit beginning with Store A and determine the time required to walk the circuit.

c. Identify another Hamiltonian circuit in the graph that results in a different total time.

1.3   Create a weighted graph showing the distances between the following cities: Seattle, WA; Washington, DC; Orlando, FL; Los Angeles, CA; and Chicago, IL. Identify a Hamiltonian circuit that connects these cities, beginning in Seattle, and determine the total distance traveled. Compare this total with others in your class.

Additional Review—for use with Activity 2

2.1　Write each of the following expressions in factorial form.

　　a.　$5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

　　b.　$22 \cdot 21 \cdot \cdots \cdot 3 \cdot 2 \cdot 1$

　　c.　$n \cdot (n-1) \cdot \cdots \cdot 2 \cdot 1$

2.2　Expand each of the expressions below.

　　a. $6!$　　　　　　**b.** $100!$　　　　　　**c.** $(n-3)!$

2.3　Simplify each of the following.

　　a. $\dfrac{5!}{3!}$　　　　**b.** $\dfrac{42!}{3!40!}$　　　　**c.** $\dfrac{n!}{(n-3)!}$

2.4　Callie has a standard deck of 52 playing cards. She places 3 cards face up on the table in front of her. How many possible combinations of 3 cards are there in this deck? Would it be reasonable to ask Callie to list them all using a brute-force algorithm?

Additional Review—for use with Activity 3

3.1 **a.** Use the fundamental counting principle to determine the number of ten-digit codes that can be created using the digits 0 through 9, without repetition.

b. Use factorial notation to represent your response to Part **a**.

c. Determine the number of four-digit codes that can be created using the digits 0 through 9, without repetition.

d. Represent your response to Part **c** using factorial notation.

3.2 Rosa is a travel agent. She has been asked to plan an itinerary that begins and ends in Seattle, including stops in Chicago, Los Angeles, Orlando, and Washington, DC. The table below shows the airfares between these cities.

	Chicago	Seattle	Washington	Orlando	Los Angeles
Chicago		$341.00	$276.00	$398.00	$407.00
Seattle	$341.00		$618.50	$425.00	$271.00
Washington	$276.00	$618.50		$197.00	$583.00
Orlando	$398.00	$425.00	$197.00		$313.50
Los Angeles	$407.00	$271.00	$583.00	$313.50	

a. Determine the number of different itineraries that are possible.

b. Use the cheapest-link algorithm to determine one possible itinerary.

c. Rosa wants to make sure that the itinerary she suggests is the least expensive. Is the one you found in Part **b** the cheapest? If so, determine the cost of the itinerary. If not, identify the cheapest itinerary and determine how much more the itinerary in Part **b** would cost.

## Periodic Assessment —for use after Activity 3

1. Using the diagram below to complete Parts **a–d**.
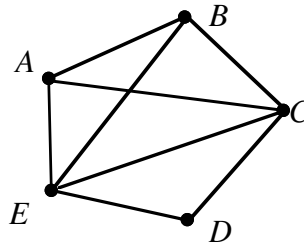
    a. Identify a path containing four vertices.

    b. Identify a circuit that is not Hamiltonian.

    c. Find a Hamiltonian circuit beginning with vertex A.

    d. Find a different Hamiltonian circuit than the one in Part **c** that also begins at vertex A.

2. Write each of the following in factorial form.

    a. $(n+2)(n+1)(n)\cdots\bullet 3\bullet 2\bullet 1$; for $n>4$

    b. $9\bullet 8\bullet 7\bullet\cdots\bullet 3\bullet 2\bullet 1$

3. Expand each of the expressions below.

    a. $92!$ **b.** $(n-4)!$, for $n>10$

4. Simplify each of the following.

    a. $8!/5!$ **b.** $(n+2)!/(n-2)!$

5.   **a.** On the graph below, draw a Hamiltonian circuit using the nearest-neighbor algorithm, starting at vertex A.
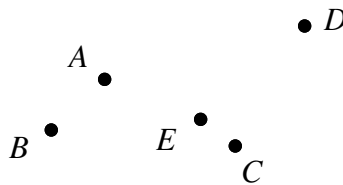
    b. On the following graph, draw a Hamiltonian circuit using the cheapest link algorithm, starting at vertex A.
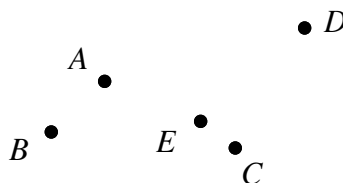
    c. Compare the two circuits you drew in Parts **a** and **b**.

Level 1: Volume 3—One Step Beyond

Additional Review—for use with Activity 1
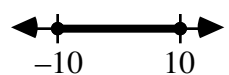
1.1 Use an inequality to represent each of the following intervals, then graph each inequality on a number line.

    a. all real numbers between –7 and 12, inclusive

    b. all real numbers less than 27

    c. all real numbers between 0 and 1, including 1 but not 0

1.2 Graph each of the following inequalities:
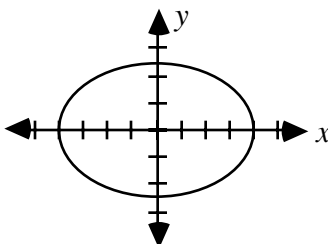
    a. $5 \le x < 13$ **b.** $-6 < x < -2$ **c.** $9 \ge x \ge 4$
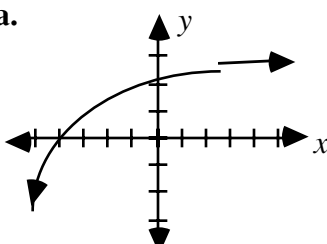
1.3 Use interval notation to describe each graph below.

1.4 List the domain and range of the following relation and determine whether or not it is also a function. Justify your response.

$$\{(19,2),(45,8),(-34,63),(27,-14),(53,67)\}$$

1.5 Which, if any, of these graphs represents a function? Explain your response.

1.6 Consider the equation $y = \sqrt{x}$. Using interval notation, describe the greatest domain that makes $y = \sqrt{x}$ a function and identify the corresponding range.

1.7 Mr. Van DeLay rounds his students' percentage scores to the units place, then uses the grading scale shown in the table below. Using inequalities, describe the intervals of percentages that would receive a B if Mr. Van DeLay rounds up, rounds down, or rounds to the nearest integer.

Percentage	Grade
93–100	A
85–92	B
76–84	C
65–75	D
0–64	F

Additional Review—for use with Activity 2

2.1   Evaluate each of the following expressions.
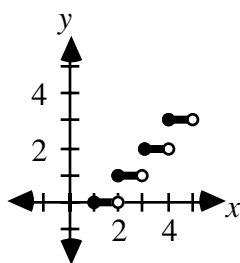
   a. $[19.6]$ **b.** $[-9.2]$ **c.** $[7.4]$ **d.** $[-0.55]$

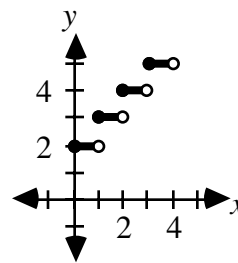**2.2**   Sketch a graph of the equation $y = 4[x] - 8$.

   a. How does the number 4 in this equation transform your graph from the graph of $y = [x]$?

   b. How does the number –8 in this equation transform your graph from the graph of $y = [x]$?

2.3   Write an equation for each graph below.

   a.

   b.

2.4   Recently, some people have suggested eliminating the penny from the U.S. currency, leaving the nickel as the coin of least value. Imagine that you own a candy store. To adjust existing prices, you propose rounding values in the same manner as the greatest integer function. Make a table that shows the new prices of items that would have cost $1.00 or less. Create a graph of the data and write an equation that represents the graph.

Periodic Assessment—for use after Activity 3

1. Write the inequality that represents all real numbers from –3 to 12 including 12, but not including –3.

2. Graph the inequality on a number line that represents all real numbers from 10 to 35, inclusive.

3. Use interval notation to represent the following graph.

$$-7 \qquad 8$$

4. Determine the value of y in each of the equations below.

   a. $y = [-4.2]$ b. $y = [10.9]$

5. Set G includes seven points on a coordinate plane. Do these points represent a function? Justify your response.

$$G = \{(1,3),(2,4),(3,5),(4,6),(4,7)(5,8),(6,9)\}$$

6. The shipping costs in many mail-order catalogs can be modeled by step functions. One retailer lists the following table of shipping charges:

Purchase ($)	Shipping ($)
0.00–49.99	5.00
50.00–99.99	10.00
100.00–149.99	15.00
150.00–199.99	20.00
200.00–249.99	25.00
250.00–299.99	30.00
300.00–349.99	35.00
350.00–399.99	40.00
400.00–449.99	45.00
450.00+	50.00

   a. Create a graph of the data in the table.

   b. Which rounding function would best model your graph? Explain your response.

   c. Write an equation that models the shipping charges for purchases less than $500.00.

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Level 1: Volume 3—From Rock Bands to Recursion

Additional Review—for use with Activity 1

1.1 Write a recursive formula for each arithmetic sequence below, then list the next three terms.

  a. 7, 13, 19, 25, 31, 37, . . .

  b. 3, –4, –11, –18, –25, –32, . . .

  c. 8.3, 16, 23.7, 31.4, 39.1, 46.8, . . .

1.2 Consider the following recursive formula:

$$\begin{cases} a_1 = 13 \\ a_n = a_{n-1} + 6, \ n > 1 \end{cases}$$

  a. What is the common difference?

  b. What is the first term in the sequence?

  c. What are the next three terms in the sequence?

  d. What does the n in the equation represent? What does $n-1$ represent?

1.3 Write recursive formulas for the arithmetic sequences described below.

  a. a sequence whose first term is 5 and whose common difference is –8

  b. a sequence whose first term is –7.6 and whose common difference is 3.9

1.4 The Townsend family has recently purchased an apple orchard. The existing orchard has 47 trees. To expand the business, they plan to plant an additional 28 trees each year.

  a. Write a recursive formula to model this situation.

  b. How many trees will the orchard have after 10 years? after 25 years?

  c. Will the Townsends be able to continue this planting schedule indefinitely? Justify your response.

1.5 Kelly plans to run in the Boston Marathon. She begins training 8 months before the race. Her plan involves running a total of 20 miles in the first week. After 2 weeks, she will increase the total to 25 miles per week. After 2 more weeks, she will add another 5 miles to the total, and so on.

  a. Write a recursive formula to model Kelly's running schedule per week.

  b. How many times will Kelly increase her weekly mileage during her training?

  c. According to this plan, how many miles should Kelly be running in the week before the race? Does this seem reasonable?

Additional Review—for use with Activity 2

2.1 Write an explicit formula for each arithmetic sequence below.

    a. 13, 18.3, 23.6, 18.9, 34.2, 39.5, . . .

    b. 22, 14, 6, –2, –10, –18, . . .

    c. –17, 2, 21, 40, 59, 78, . . .

2.2 Consider the explicit formula $a_n = 5 + 7.5(n - 1)$.

    a. What is the first term of the sequence?

    b. What is the common difference?

    c. What is the 23rd term of the sequence?

2.3 Write an explicit formula for each arithmetic sequence described below, then find its 50th term.

    a. The first term is 31 and the common difference is –16.

    b. The first term is –12 and the common difference is 7.

2.4 Mitchell has begun collecting trading cards. He currently has 32 cards and plans to add 12 cards to his collection each week.

    a. Write an explicit formula for Mitchell's total number of cards.

    b. If Mitchell sticks to his plan, how many cards will he have at the end of the first year?

2.5 Jade is a food critic for a city newspaper. She currently reviews 4 restaurants each month. Her editor would like to increase this number by 3 each month for the next 7 months.

    a. Write an explicit formula for the number of reviews each month.

    b. How many restaurant reviews must Jade write in the seventh month? Is this a realistic expectation?

Periodic Assessment 1—for use after Activity 2

1. Consider the sequence 5, 12, 19, 26, 33, 40, ...

   a. Write a recursive formula for the sequence.

   b. Write an explicit formula for the sequence.

   c. Identify the 12th term and the 43rd term.

2. Write an explicit formula for a sequence whose first term is 16 and whose common difference is –6.

3. Consider the following recursive formula:

$$\begin{cases} a_1 = 5 \\ a_n = a_{n-1} + 3.2, \ n > 1 \end{cases}$$

   a. What is the first term of the sequence?

   b. What is the common difference?

   c. What does $n - 1$ represent in the equation?

4. The Key Club operates a concession stand at high school basketball games. They begin each game with a stock of 250 hot dogs. On average, they sell 32 hot dogs every 15 min.

   a. Write a recursive formula to model the number of hot dogs remaining in stock.

   b. Write an explicit formula to model the number of hot dogs remaining.

   c. After an hour and a half, how many hot dogs will the club have left to sell?

   d. How long will the stock of hot dogs last?

5. A local charity is sponsoring a walk-a-thon. Volunteers will raise money by soliciting pledges from friends and neighbors. A corporate donor has already pledged $2300. Each volunteer hopes to earn another $25 in pledges.

   a. If 52 volunteers take part in the walk-a-thon, how much money will the event raise?

   b. How many volunteers would the charity need in order to raise $10,000?

Additional Review—for use with Activity 3

3.1 Write a recursive formula for each of the following geometric sequences, then list the next three terms.

    a. 4, 4.8, 5.76, 6.912, 8.2944, 9.95328, . . .

    b. 24, 12, 6, 3, 1.5, 0.75, . . .

    c. 2, –6, 18, –54, 162, –486, . . .

3.2 Consider the following recursive formula:

$$\begin{cases} g_1 = 3.2 \\ g_n = g_{n-1} \bullet 5, \ n > 1 \end{cases}$$

    a. What is the common ratio?

    b. What is the first term?

    c. What are the next four terms?

3.3 Write a recursive formula for each geometric sequence described below.

    a. a sequence whose first term is 4.4 and whose common ratio is 3.1

    b. a sequence whose first term is –3 and whose common ratio is 7

3.4 Last year, Jayme received an allowance of $5 per week. Now that she is almost 15 years old, her parents have offered to increase her allowance by a factor of 1.3 on each birthday, up to and including her 18th.

    a. Write a recursive formula to model this situation.

    b. Find the first 4 terms of the sequence.

3.5 The Shutes had hoped to sell their family home for $138,000. After receiving no offers, however, their real estate agent suggested that they lower the price. They now plan to reduce the price by 3% each month, until the home is sold.

    a. Write a recursive formula to model the price of the home.

    b. What will the price of the home be after 6 months?

Additional Review—for use with Activity 4

4.1 Write an explicit formula for each of the following geometric sequences.

a. 4000, 2000, 1000, 500, 250, 125, . . .

b. 13, –39, 117, –351, 1053, –3159, . . .

c. –4, –9.6, –23.04, –55.296, –132.7104, 318.50496, . . .

4.2 Consider the explicit formula $g_n = 7 \bullet 3.1^{n-1}$.

a. What is the common ratio?

b. What is the first term?

c. What are the next three terms?

4.3 Write an explicit formula for each geometric sequence described below.

a. a sequence whose first term is –2.4 and whose common ratio is 1.3

b. a sequence whose first term is 9 and whose common ratio is 0.8

4.4 A business association has 247 members and hopes to increase its membership by a factor of 1.2 each year for the next 7 years.

a. Write an explicit formula to model this situation.

b. What will the membership be at the end of the 7-year period?

4.5 A ball is dropped from the top of a 15-m tower. With each bounce, it regains 60% of its previous height.

a. Write an explicit formula for the height of each bounce.

b. Find the height after 12 bounces.

c. Do you think that this pattern will continue indefinitely? Explain your reasoning.

Periodic Assessment 2 —for use after Activity 4

1. Consider the sequence 86, 68.8, 55.04, 44.032, 35.2256, 28.18048, ...

    a. Write a recursive formula for this sequence.

    b. Write an explicit formula for this sequence.

    c. Find the 10th term.

2. Write a recursive formula for a sequence whose first term is 23 and whose common ratio is 4.3.

3. Consider the explicit formula $g_n = 3 \cdot 2.8^{n-1}$.

    a. What is the first term in the sequence?

    b. What is the common ratio?

    c. What is the 8th term of the sequence.

4. Amy works for an advertising agency. She is an excellent employee and the company hopes that she will remain with them as her skills and knowledge increase. At the present time, Amy earns $1600 a month. If she continues to receive positive evaluations, the company has offered to raise her salary by a factor of 4% every six months.

    a. Write a recursive formula to model this situation.

    b. Write an explicit formula to model this situation.

    c. If the pattern continues, what will Amy's salary be after 5 years?

5. At the time of his 16th birthday, Oliver had saved a total of $1200. He decided to place this money in an investment account, in hopes of buying a used car when he leaves for college, 3 months after his 18th birthday. The account pays 0.5% interest each month.

    a. Write an explicit formula to model this situation.

    b. How much money will be in Oliver's account 3 months after his 18th birthday?

Level 1: Volume 3
Under the Big Top but Above the Floor

Additional Review—for use with Activity 1

1.1   Graph and label the following lines on the same coordinate grid.

      a. $y = 5$ **b.** $x = -7$ **c.** $y = -(2/3)x + 1$

1.2   Graph each of the following on a separate coordinate grid.

      a. $x < 9$ **b.** $y \geq -4$ **c.** $y \leq -4$ **and** $x > 2$

1.3   Describe the constraints on the solution set and identify the corner point for each region graphed below. **Note:** Each axis is marked in increments of 1 unit.

a.
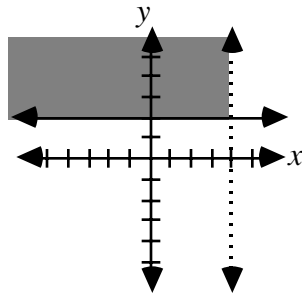
b.
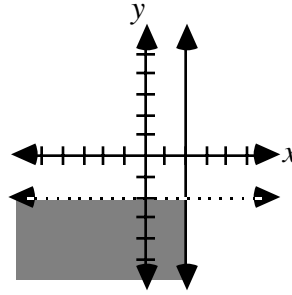
c.
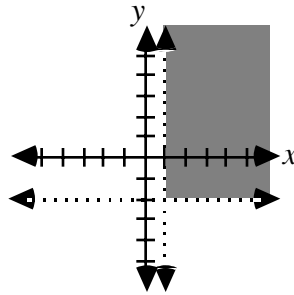
d.
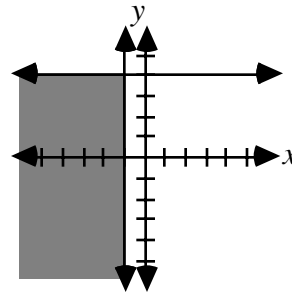
1.4   Terry, Stan, and Lindsey are designing vegetable gardens. Using the horizontal axis to represent the length and the vertical axis to represent the width, draw a graph to describe each of the following statements:

    a. Terry decides that her garden should be no more than 8 m long and less than 6 m wide.

    b. Stan decides his garden should be more than 16 m long and at least 10 m wide.

    c. Lindsey decides that her garden should be at most 4 m long and no more than 3 m wide.

Additional Review—for use with Activity 2

2.1   For the region graphed below, describe the constraints on the solution set and find the coordinates of the corner points. **Note:** Each axis is marked in increments of 1 unit.
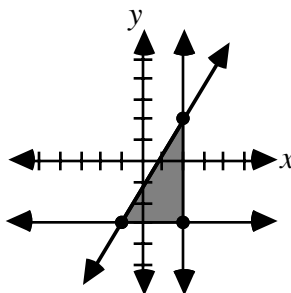
2.2   Graph the following system of equations and estimate the coordinates of the corner points.

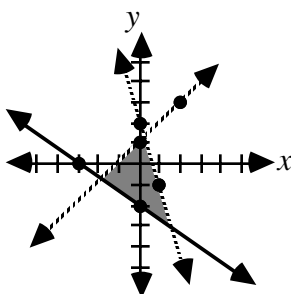$$\begin{cases} x - 2y = 8 \\ 3x - y = -1 \\ x + y = 9 \end{cases}$$

2.3   Solve each of the following systems of equations. Use graphs to check your solutions.

a. $\begin{cases} 3x - y = -1 \\ x + y = 9 \end{cases}$ 　　　　**b.** $\begin{cases} x - 2y = 8 \\ 3x - y = -1 \end{cases}$ 　　　　**c.** $\begin{cases} x - 2y = 8 \\ x + y = 9 \end{cases}$

2.4   Use a system of linear inequalities to describe the solution set in the graph below. **Note:** Each axis is marked in increments of 1 unit.

2.5   The Cronin and Nakagomi families are going camping together. At 9:00 A.M., the Cronins leave town traveling at an average speed of 90 km/hr. The Nakagomis don't leave until 9:20 A.M., but they drive at an average speed of 100 km/hr. Use a system of linear equations to determine how long it will take the Nakagomis to catch up with the Cronins. How far down the highway will the two families be before they meet?

Periodic Assessment 1—for use after Activity 2

1.   Graph and label the following lines on the same coordinate grid: $y = 6$, $x = -1$, and $y = 2x - 4$. Identify the coordinates of their intersection points.

2.   Sketch a graph of the set of all points described by the conjunction $x < 7$ and $y \geq -4$.

3.   List the inequalities that describe the shaded region below and identify an ordered pair that is a solution. **Note:** Each axis is marked in increments of 1 unit.
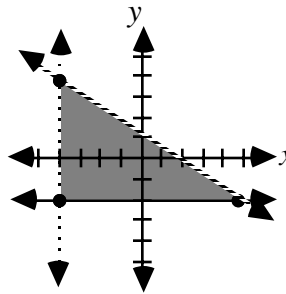
4.   Is the point $(3, 7)$ the solution for the system of equations given below? Justify your response.

$$\begin{cases} y = x + 4 \\ 3x + y = 16 \end{cases}$$

5.   Solve the following system of equations. Show all of your work, including the method used to check your solution.

$$\begin{cases} x - y = 2 \\ 5x - 3y = 12 \end{cases}$$

6.   Juanita works as an automobile salesperson. The dealership offers two salary options. Option 1 features a salary of $1500 per month plus a commission of $100 for each car she sells. Option 2 includes a monthly salary of $500, with a commission of $350 for each car sold. Use a system of equations to determine how many cars Juanita would have to sell each month for her pay to be the same under either option.

Additional Review—for use with Activities 3 and 4

3.1   Graph the feasible region, and identify the coordinates of its vertices, for each of the following systems of inequalities.

a.
$$\begin{cases} x \ge 0 \\ y \ge 0 \\ 4x + 3y \le 12 \end{cases}$$

b.
$$\begin{cases} x \ge 1 \\ y \ge -1 \\ x + y \le 5 \end{cases}$$

c.
$$\begin{cases} 2x + 3y \le 6 \\ x - 2y \ge -4 \\ y \ge -2 \end{cases}$$

d.
$$\begin{cases} x \ge 3 \\ x \le 5 \\ y \ge -2 \\ y \le 4 \end{cases}$$

e.
$$\begin{cases} x \ge 0 \\ y \ge 0 \\ y \le 8 \\ 4x + 3y \le 32 \end{cases}$$

f.
$$\begin{cases} x - 2y \ge -10 \\ 7x + 5y \le 44 \\ 7x + 4y \ge -16 \\ 3x - 7y \le 28 \end{cases}$$

3.2   Describe the constraints on the feasible region in each of the following graphs.
Note: Each axis is marked in increments of 1 unit.

a.
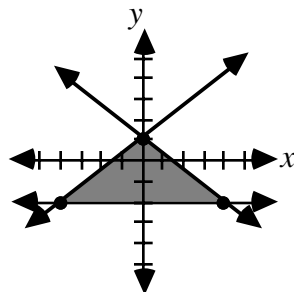
b.
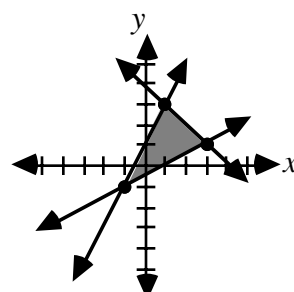
c.
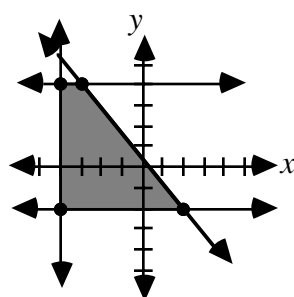
d.
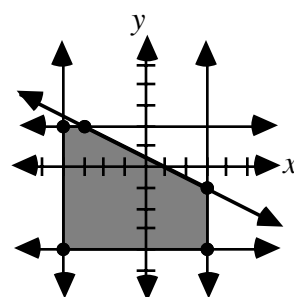
3.3   The Owen family grows wheat and barley on their 3000-acre farm. This year, they have decided to plant at least 1000 acres of wheat and at least 500 acres of barley.

a.   Write three inequalities to describe the constraints in this situation.

b.   Graph the feasible region and identify the coordinates of its vertices.

c.   If the farm will earn $45.00 per acre on wheat and $90.00 per acre on barley, how many acres of each crop are required to maximize income?

Periodic Assessment 2 —for use after Activity 4

1. Graph the feasible region, and identify the coordinates of its vertices, for each of the following systems of inequalities.
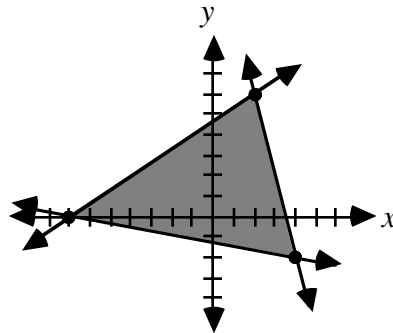
   a.

   $$\begin{cases} x \geq 2 \\ y \leq 8 \\ 3x - 2y \leq 2 \end{cases}$$
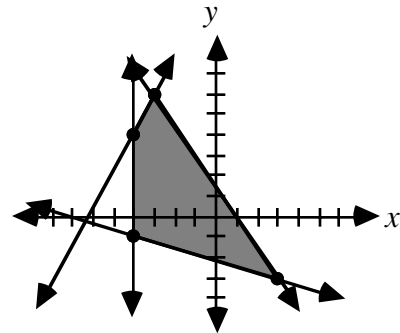
   b.

   $$\begin{cases} x \geq -1 \\ x \leq 6 \\ y \geq 2 \\ 2x + 7y \leq 40 \end{cases}$$

2. Describe the constraints on the feasible region in each of the following graphs.
   Note: Each axis is marked in increments of 1 unit.

   a.

   b.

3. Brynne has two part-time jobs: tutoring and lawn-mowing. She would like to work no more than 12 hr per week, with at least 4 hr of tutoring and no more than 6 hr of mowing. She earns $5.00 per hour for tutoring and $6.50 per hour for mowing. How should Brynne divide her work hours in order to earn the most money?

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Level 1: Volume 3—Digging into 3-D

Additional Review—for use with Activity 1

1.1   Plot and label each of the following points on the *xyz*-coordinate grid below.
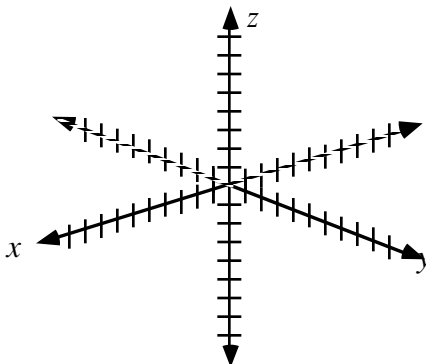
    a. *A(6,7,3)*   **b.** *B(0,4,0)*   **c.** *C(3,0,5)*
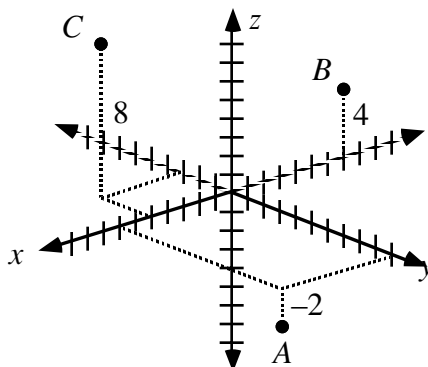
   **d.** *D(–8,2,0)*   **e.** *E(4,–4,1)*   **f.** *F(–1,–5,–3)*

1.2   Identify the coordinates of each labeled point in the diagram below. **Note:** Each axis is marked in increments of 1 unit.

1.3   Plot and label each of the following ordered triples on the grid below. Use segments to connect the vertices in such a way that a right triangular prism is formed. Use dotted segments to depict any unseen edges.

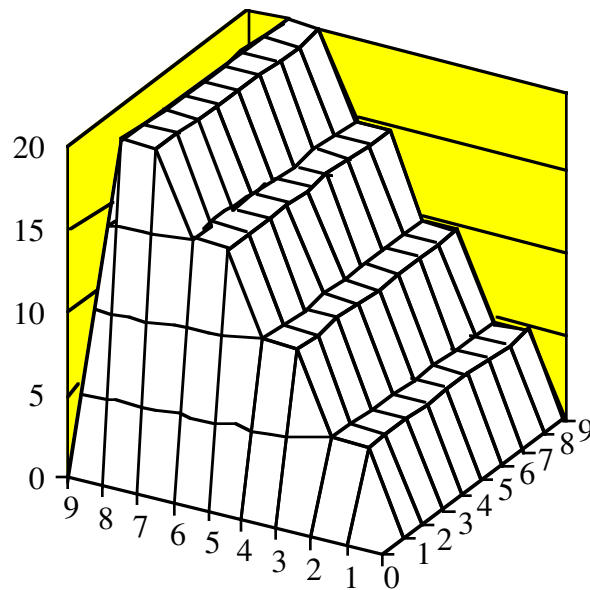   *A(2,1,0), B(1,4,0), C(4,3,0), D(2,1,5), E(1,4,5), F(4,3,5)*
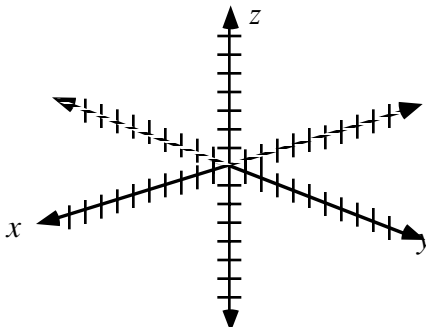
Additional Review—for use with Activity 2

2.1   On a three-dimensional coordinate system, sketch the surface plot represented by the following data.

	0	1	2	3	4	5	6
0	0	0	0	0	0	0	0
1	0	15	7.5	7.5	7.5	3	0
2	0	15	7.5	7.5	7.5	3	0
3	0	15	7.5	7.5	7.5	3	0
4	0	15	7.5	7.5	7.5	3	0
5	0	15	7.5	7.5	7.5	3	0
6	0	0	0	0	0	0	0

2.2   Complete a matrix for the following surface plot.

Periodic Assessment—for use after Activity 2

1.   Plot each ordered triple on the three-dimensional coordinate system below.
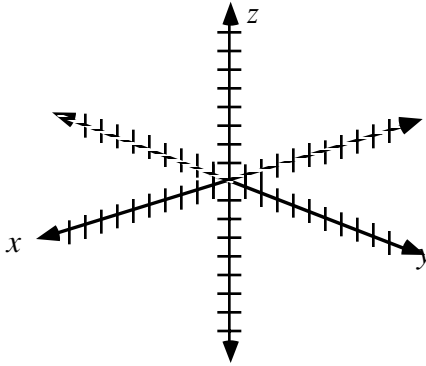
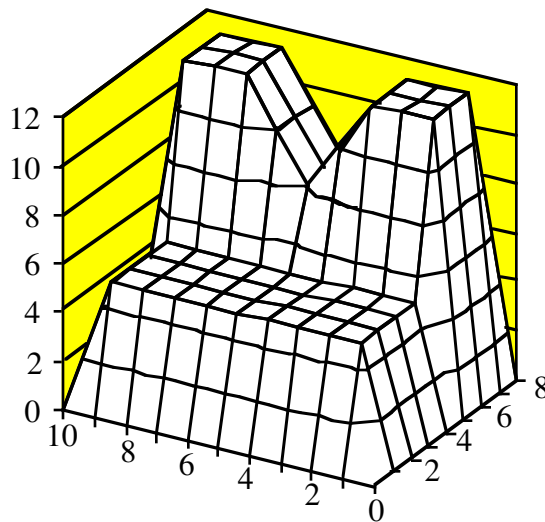   **a.** $A(6,0,5)$ **b.** $B(-4,2,0)$ **c.** $C(3,-8,1)$

      d. $D(0,0,-6)$ **e.** $E(-1,-4,6)$ **f.** $F(0,9,4)$


2.   Create a matrix that corresponds to the surface plot below.

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3.   Topographic maps are two-dimensional representations of regions of the earth's surface. On a topographic map, the curved lines indicate points of equal elevation measured from sea level. These lines are referred to as **contour lines**. Contour lines can be used to estimate the elevation of a given location. For example, the shore of the lake on the map below is located approximately 700 m above sea level.

   The grid on a topographic map allows the reader to determine the distance between points, as well as their geographic location. Each unit on the grid below indicates a horizontal distance of 100 m.
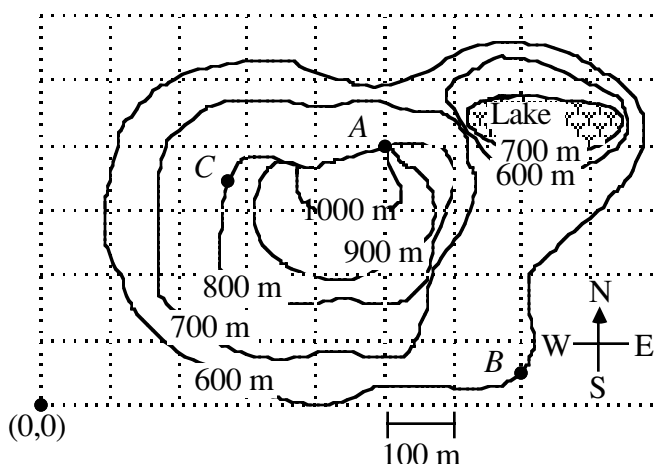
a. Identify the approximate elevations of points A, B, and C on the map.

b. Identify the approximate coordinates of points A, B, and C if the lower left-hand corner represents the origin of an xy-plane.

c. Plot points A, B, and C on the three-dimensional coordinate system below.
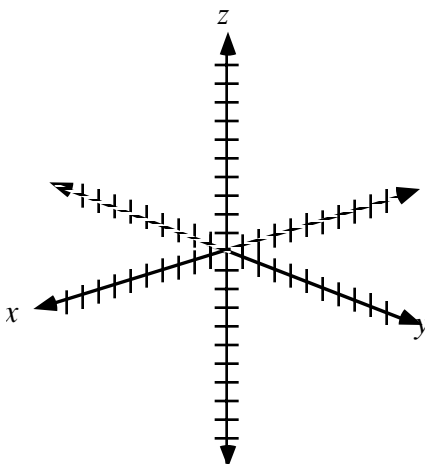
d. On a topographic map, what would a negative z-coordinate in an ordered triple indicate? Explain your response.