10.1 All Skate!

Perimeter and Area

Students should be able to answer these questions after Lesson 10.1:

- What is the area of a closed figure?
- What is the perimeter of a closed figure?
- What formulas can you use to find the area and perimeter of a closed figure?
- What is the relationship between the area and perimeter of a closed figure?

Directions

Read Question 1 and its solution. Then complete Questions 2 and 3.

1. Danielle bought a framing kit to frame a new poster. The kit contains 12 feet of frame, which can be cut to any length, and a piece of clear plastic. Danielle's new poster is 36 inches in length and 24 inches in width. Can she frame it using the kit she bought? How many inches of frame will she be short or have left over?

Step 1 Convert 12 feet to inches.

$$12 \text{ feet} \times \frac{12 \text{ inches}}{1 \text{ foot}} = 144 \text{ inches}$$

Step 2 Find the perimeter of the poster.

Perimeter = (2 × length) + (2 × width)

Perimeter = (2 × 36) + (2 × 24) = 72 + 48 = 120

The perimeter of the poster is 120 inches.

Step 3 Subtract the perimeter of the poster from the total length of the framing material.

144 − 120 = 24

So, Danielle can frame her new poster with the kit. She will have 24 inches of framing material left over.

Perimeter and Area

To find the perimeter of a rectangle, multiply 2 times the length and 2 times the width and add the products together. To find the area of a rectangle, multiply the length times the width.

2. What is the area of Danielle's new poster?

3. Rex has a poster that is 30 inches wide. What is the maximum length his poster can be if he wants to frame it with a kit that is identical to the one that Danielle bought?

10.2 Round Food Around the World

Circumference and Area of a Circle

Students should be able to answer these questions after Lesson 10.2:

- What is a circle?
- What are the radius, diameter, and circumference of a circle?
- How can you find the radius, diameter, and circumference of a circle?
- How can you find the area of a circle?
- What is pi?

Directions

Read Question 1 and its solution. Then complete Questions 2 and 3.

1. A circle has a diameter of 8 feet. Find the circumference and area of the circle. Use 3.14 for π.

Step 1 Find the circumference using the formula $C = \pi d$.

$C \approx (3.14)(8) = 25.12$ feet

Step 2 To find the radius, divide the diameter by 2.

$r = 8 \div 2 = 4$

So, the radius is 4 feet.

Step 3 Find the area using the formula $A = \pi r^2$.

$A = \pi r^2 \approx 3.14(4^2) = 3.14 \cdot 16 = 50.24$ square feet

So, the circumference of the circle is about 25.12 feet and the area of the circle is about 50.24 square feet.

Circumference and Area

To find the circumference of a circle, use the formula $C = \pi d$. To find the radius of a circle, divide the diameter by 2. To find the area of a circle, use the formula $A = \pi r^2$.

2. A circle has a diameter of 12 inches. Find the circumference and area of the circle. Use 3.14 for π.

3. A circle has a radius of 16 centimeters. Find the circumference and area of the circle. Use 3.14 for π.

10.3 City Planning

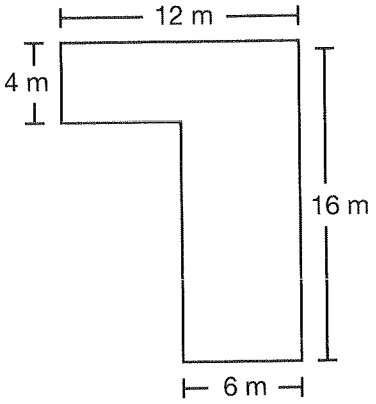
Areas of Parallelograms, Triangles, Trapezoids, and Composite Figures

Students should be able to answer these questions after Lesson 10.3:

- How can you find areas of triangles, parallelograms, and trapezoids?
- What are composite figures?
- How can you find areas of composite figures?

Directions

Read Question 1 and its solution. Then complete Question 2.

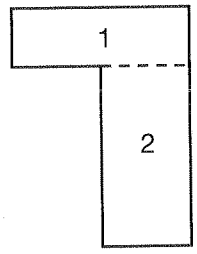


1. Find the area of the figure.

Step 1 Find the missing measurements, based on what you already know about the figure.

The horizontal missing measurement is 6 meters.
The vertical missing measurement is 12 meters.

Step 2 Divide the shape into common figures. Note that there are several different ways to divide the shape.



Step 3 Find the area of each common figure.

Area of rectangle 1 $= \ell \cdot w = 4 \text{ m} \cdot 12 \text{ m} = 48$ square meters

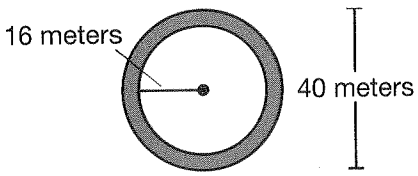
Area of rectangle 2 $= \ell \cdot w = 6 \text{ m} \cdot 12 \text{ m} = 72$ square meters

Step 4 Add the areas.

48 square meters + 72 square meters = 120 square meters

So, the area of the figure is 120 square meters.

2. Find the area of the shaded portion of the figure. Write your answer in terms of π.



10.4 Sports Fair and Square

Squares and Square Roots

Students should be able to answer these questions after Lesson 10.4:

- What is a square?
- What is a perfect square?
- What is a square root?
- How can you find squares and square roots of numbers?

Directions

Read Question 1 and its solution. Then complete Questions 2 and 3.

1. Estimate the square root of 77 to the nearest tenth.

Step 1 Find the perfect squares closest to 77.

64 is the closest perfect square less than 77 and 81 is the closest perfect square greater than 77.

So, $\sqrt{77}$ is between $\sqrt{64} = 8$ and $\sqrt{81} = 9$.

Step 2 To find the best estimate for the square root of 77, choose numbers between 8 and 9 and find the square of the numbers.

$(8.7)(8.7) = 75.69$

$(8.8)(8.8) = 77.44$

Step 3 Determine which number is closer to 77.

75.69 is 1.31 from 77. 77.44 is 0.44 from 77.

So, the square root of 77 is approximately equal to 8.8.

2. Estimate the square root of 12 to the nearest tenth.

3. Estimate the square root of 30 to the nearest tenth.

Squares and Square Roots

The square of a number is the product of the number multiplied by itself. The square root of a number is one of two identical factors of a number. Perfect squares have integers as their square roots. Most numbers do not have integers as their square roots.

10.5 Are You Sure It's Square?

The Pythagorean Theorem

Students should be able to answer these questions after Lesson 10.5:

- What is the Pythagorean theorem?
- What is the hypotenuse of a right triangle?
- How can you use the Pythagorean theorem to find the hypotenuse of a right triangle?

Directions

Read Question 1 and its solution. Then complete Questions 2 and 3.

1. A right triangle has one leg that is 16 meters long. Another leg is 12 meters long. How long is the third side, or hypotenuse?

Step 1 Write the Pythagorean theorem. Then replace a and b with the lengths of the two legs.

$$a^2 + b^2 = c^2$$

$$16^2 + 12^2 = c^2$$

Step 2 Solve the equation. First, evaluate exponents. Then, find the sum.

$$256 + 144 = c^2$$

$$400 = c^2$$

Step 3 Find the square root of each side.

$$\sqrt{400} = \sqrt{c^2}$$

$$20 = c$$

So, the length of the hypotenuse is 20 meters.

2. A right triangle has one leg that is 9 inches long. Another leg is 12 inches long. How long is the hypotenuse?

3. A right triangle has one leg that is 24 feet long. Another leg is 18 feet long. How long is the hypotenuse?

10.6 A Week at Summer Camp

Using the Pythagorean Theorem

Students should be able to answer these questions after Lesson 10.6:

- What is the converse of the Pythagorean theorem?
- How is the converse of the Pythagorean theorem used?
- What is a Pythagorean triple?

Directions

Read Question 1 and its solution. Then complete Questions 2 and 3.

1. A right triangle has a base that measures 7 meters and a hypotenuse that measures 13 meters. What is the triangle's height, to the nearest tenth?

Step 1 Write the Pythagorean theorem and substitute for the given values.

$a^2 + b^2 = c^2$

$a^2 + 7^2 = 13^2$

Step 2 Solve the equation.

$a^2 + 49 = 169$

$a^2 = 169 - 49$

$a^2 = 120$

$a = \sqrt{120}$

Step 3 Estimate to find the square root of 120.

$10.9^2 = 118.81$

$11.0^2 = 121$

So, the triangle's height is about 11.0 meters.

2. A right triangle has a height that measures 13 inches and a hypotenuse that measures 18 inches. What is the triangle's base, to the nearest tenth?

3. A right triangle has a base that measures 6.4 feet and a hypotenuse that measures 9.8 feet. What is the triangle's height, to the nearest tenth?

11.1 Sometimes You're Just Rained Out

Finding Simple Probabilities

Students should be able to answer these questions after Lesson 11.1:

- What is probability?
- How can you write the probability of an event?

Directions

Read Question 1 and its solution. Then complete Questions 2 through 5.

1. Lauren and her family went to a baseball game. When the teams were warming up, Lauren caught a ball in the stands. If 40 players were on the field—including Lauren's favorite player—what is the probability that the ball was hit by Lauren's favorite player?

Step 1 Write a fraction. The denominator is the total number of possible outcomes.

$\frac{\square}{40}$ total number of players on the field

Step 2 Write the favorable outcome as the numerator. The favorable outcome is Lauren's one favorite player.

$\frac{\boxed{1}}{40}$ Lauren's favorite player / total number of players on the field

Step 3 Check to see whether the fraction can be simplified.

So, the probability that the ball came from Lauren's favorite baseball player is $\frac{1}{40}$.

2. Look at the diagram below. Lauren's father handed out their five tickets randomly. What is the probability that Lauren will be in an end seat?

end seat	middle seat	middle seat	middle seat	end seat

3. What is the probability that Lauren will be in a middle seat?

4. Of the 12,355 people in the stands for the game, 1 will win season passes for next year. What is the probability that someone in Lauren's family will win?

5. On a team of 40 players, only about 20 play during one game. If the players were chosen randomly, what is the probability that a player will play the game?

11.2 Socks and Marbles

Finding Probabilities of Compound Events

Students should be able to answer these questions after Lesson 11.2:

- How can you distinguish between a dependent and an independent event?
- How can you calculate the probability of a compound event?

Directions

Read Question 1 and its solution. Then complete Questions 2 and 3.

1. You have a bag of 20 peanuts and 15 cashews. You reach in the bag without looking and get a peanut. You throw it back in the bag and reach back in. What is the probability that the second nut is a peanut?

Step 1 Write a fraction to show the probability of the first event.

$\frac{20}{35}$ $\frac{\text{peanuts}}{\text{total nuts in bag}}$

Step 2 Decide whether the events are dependent or independent. In other words, has the second number changed because of what happened with the first event?

Because you put the peanut back after the first event, the number of nuts in the bag did not change for the second event. The events are independent.

Step 3 Write a fraction to show the probability of the second event. Because the events are independent, the total number of nuts in the bag has not changed.

$\frac{20}{35}$ $\frac{\text{peanuts}}{\text{total nuts in bag}}$

Step 4 Multiply the probabilities of each event to determine the probability of both events happening (the compound event).

$$\frac{20}{35} \times \frac{20}{35} = \frac{400}{1225}$$

Step 5 Simplify the fraction.

$$\frac{400}{1225} = \frac{400 \div 25}{1225 \div 25} = \frac{16}{49}$$

So, the probability of getting two peanuts in a row is $\frac{16}{49}$.

2. What is the probability of getting a cashew on the first try?

3. You reach into the bag without looking, get a nut, eat it (without replacement), and then, without looking, get another nut. What is the probability that the first nut is a cashew and the second nut is a cashew?

11.3 What Do You Want to Be?

Mean, Median, Mode, and Range

Students should be able to answer these questions after Lesson 11.3:

- How can you find the mean of a data set?
- How can you find the mode of a data set?
- How can you find the median of a data set?
- How can you find the range of a data set?

Directions

Read Question 1 and its solution. Then complete Questions 2 and 3.

1. Jack markets alternative bands. He keeps track of how often radio stations play songs from his bands' albums. The numbers of times that 12 different stations played one band's new single in a week are shown below. Find the mean, mode, median, and range of the data. What is the average number of times the song was played last week?

5, 7, 3, 11, 4, 7, 9, 8, 5, 7, 2, 3

Step 1 Rewrite the numbers in order from least to greatest. Be sure to write each number every time that it appears.

2, 3, 3, 4, 5, 5, 7, 7, 7, 8, 9, 11

Step 2 To find the mean, add the data values and divide by the number of data values. Round, if necessary.

$71 \div 12 = 5.91\overline{6} \approx 6$

Step 3 Find the mode. The mode is the number or numbers that appear most often.

7

Step 4 Find the median. If the data set has an odd number of values, the median is the middle number in your ordered list. If the data set has an even number of values, find the mean of the two middle numbers.

$(5 + 7) \div 2 = 6$

Step 5 Find the range. Find the difference between the greatest and least numbers in the set.

$11 - 2 = 9$

The mean is about 6, the mode is 7, the median is 6, and the range is 9. The song has been played an average of 6 times over the last week.

2. The numbers of times that 13 different stations played a different band's new single in a week are shown below. Find the mean, mode, median, and range.

9, 8, 10, 4, 3, 2, 2, 1, 5, 7, 0, 3, 2

3. Compare the data sets for the two songs. Which song was played more?

11.4 Get the Message?

Histograms

Students should be able to answer these questions after Lesson 11.4:

- How can you create a frequency table?
- How can you create a histogram?

Directions

Read Question 1 and its solution.

1. Connor is trying to decide whether to pay for an electronic-card service. He tracked the number of e-cards that he sent. The table shows the number of e-cards he sent each month for a year. Create a frequency table and a histogram to reflect his use of e-cards.

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2	5	3	2	0	1	2	0	1	3	4	8

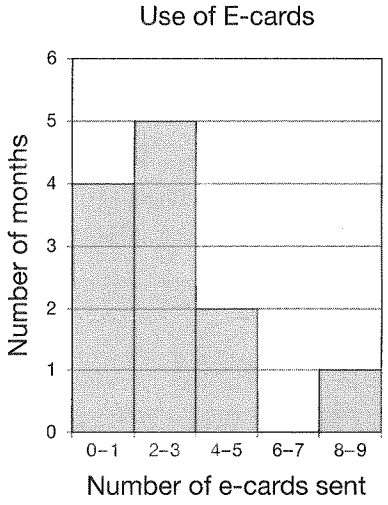
Step 1 Decide on a range of intervals for your frequency table. Write each range in the first row of the frequency table. In this case, because the least number is 0 and the greatest is 8, use an interval size of 2. (You can have intervals that do not have data.)

Data Intervals	0–1	2–3	4–5	6–7	8–9
Tally	||||	𝍸 |||	||		|
Frequency	4	5	2	0	1

Step 2 Make a tally mark (|) in the interval column each time that a data value falls in that interval. Then total the tally marks to find the frequency. Count your tallies and add your frequency totals to be sure you've accounted for all twelve months.

Step 3 Use your frequency table to construct a histogram. The ranges become the numbers along the *x*-axis and the frequencies become the numbers along the *y*-axis. Add a title.

Step 4 Draw a bar to represent the frequency of each interval.



Looking at the histogram, Connor can see that he usually uses e-cards 2–3 times a month.

11.5 Go for the Gold!

Stem-and-Leaf Plots

Students should be able to answer these questions after Lesson 11.5:

- How can you create a stem-and-leaf plot?
- How can you find the mean, median, mode, and range from a stem-and-leaf plot?

Directions

Read Question 1 and its solution. Then complete Question 2.

1. The speeds for the top ten men in Olympic Mountain Bike Racing in 2004 are listed below (in kilometers per hour). Most people mountain bike at a rate of about 8 kilometers per hour. Create a stem-and-leaf plot. Then find the mean, median, mode, and range.

18.4 18.4 18.4 18.6 18.6 18.7 18.8 18.9 19.0 19.2

Step 1 The stem-and-leaf plot is shown below. The "stem" part is the tens digit and ones digit. The "leaf" part is the tenths digit. As you write each stem and leaf, write each stem series in numerical order. In other words, write all three 18.4s before writing any other number in the 18 stem.

18	4 4 4 6 6 7 8 9
19	0 2

18 | 4 = 18.4 kilometers per hour

Step 2 Find the mean by adding the data values and dividing by the number of data values.

$18.4 + 18.4 + 18.4 + 18.6 + 18.6 + 18.7 + 18.8 + 18.9 + 19.0 + 19.2 = 187.0$

$187.0 \div 10 = 18.7$

Step 3 Find the median by finding the mean of the two middle numbers.

The two middle numbers are 18.6 and 18.7. $(18.6 + 18.7) \div 2 = 18.65$

Step 4 Find the mode—or modes—by finding the numbers that appear most often.

Look at the stem-and-leaf plot to see that 18.4 appears most often.

Step 5 Find the range by subtracting the least number from the greatest number.

$19.2 - 18.4 = 0.8$

The mean speed is 18.7 kilometers per hour, the median speed is 18.65 kilometers per hour, the mode is 18.4 kilometers per hour, and the range is 0.8 kilometer per hour.

2. Twenty women completed the Olympic Mountain Bike Race in 2004. Below are their average speeds (in kilometers per hour). Order the data. Then create a stem-and-leaf plot. Then use the information to find the mean, median, mode, and range.

13.7 14.5 14.0 14.3 13.7 14.4 14.7 16.0 14.8 14.5
14.7 15.3 15.4 15.6 14.9 15.7 14.5 14.9 15.9 14.0

11.6 All About Roller Coasters

Box-and-Whisker Plots

Students should be able to answer these questions after Lesson 11.6:

- What does a box-and-whisker plot show?
- How can you create a box-and-whisker plot?

Directions

Read Question 1 and its solution. Then complete Question 2.

1. Below is a list of the ten greatest drop heights of wooden roller coasters. Use the information to create a box-and-whisker plot.

150 141 137 140 139 124 155 129 147 214

Step 1 List the numbers from least to greatest.

124 129 137 139 140 141 147 150 155 214

Step 2 Find the median. In this case, the median is the mean of the middle two numbers.

$(140 + 141) \div 2 = 140.5$

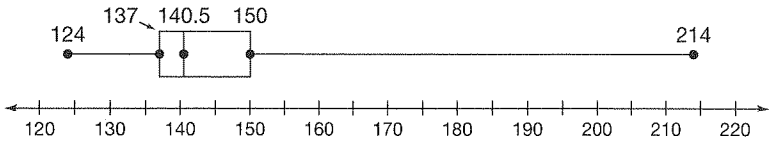
Step 3 Find the upper quartile by finding the median of the upper half of the data (all of the numbers above the median).

150

Step 4 Find the lower quartile by finding the median of the lower half of the data (all of the numbers below the median).

137

Step 5 Find where these five numbers would be on the number line below: the greatest number, the least number, the median, the upper quartile, and the lower quartile. Plot and label the points.



Step 6 Draw a box with sides at both quartiles and a vertical line through the median. Then draw a whisker from the box to both the greatest and least data value.

2. There are nine basic types of roller coasters. The list below shows the numbers of each type that are in the U.S. Use the information to create a box-and-whisker plot.

25 1 16 1556 10 17 176 97 7

11.7 What's Your Favorite Flavor?

Circle Graphs

Students should be able to answer this question after Lesson 11.7:

- How can you create a circle graph?

Directions

Read Question 1 and its solution. Then complete Question 2.

1. Kevin wants to make a circle graph of his family's favorite frozen yogurt flavors.

Step 1 Knowing their favorite flavors, Kevin creates a fraction for each flavor.

Frozen Yogurt Flavors	Butter Pecan	Double Chocolate	Peanut Butter Swirl	Vanilla Bean
	1	1	1	2
Fraction of Total	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{2}{5}$

Step 2 He converts his fractions to decimals by dividing the top number by the bottom number. He then multiplies the decimal by 100 to get the percent.

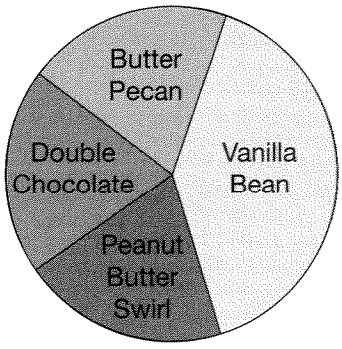
Frozen Yogurt Flavors	Butter Pecan	Double Chocolate	Peanut Butter Swirl	Vanilla Bean
	1	1	1	2
Fraction of Total	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{2}{5}$
Fraction of Total as a Decimal	0.2	0.2	0.2	0.4
Percent of Total	20%	20%	20%	40%

Step 3 Kevin creates a circle graph. He creates each section by writing and solving a proportion to find the number of degrees in each section.

$$\frac{20}{100} = \frac{x}{360}$$

$x = 72$ degrees

So, the section for Butter Pecan is represented by 72° of the circle. Keith then labels each section with the type of frozen yogurt.



2. Conduct a poll with at least ten people to find their favorite frozen yogurt flavors. Create your own table and circle graph with your findings.

12.1 Your Friendly Neighborhood Grocer

Three-Dimensional Figures

Students should be able to answer this question after Lesson 12.1:

- How can you identify three-dimensional figures?

Directions

Read Question 1 and its solution. Then complete Questions 2 through 4.

1. Shelby is learning the art of origami, which is the Asian art of paper folding, from a book. One shape that she made had a circular base with one vertex. What three-dimensional shape did she make?

Step 1 First decide whether the shape is a polyhedron or a circular-faced shape.

A polyhedron has faces that are polygons. Because a circle is not a polygon, use the chart titled Solid Shapes with Circular Faces to determine the shape that Shelby made.

Step 2 Find the figure in the table that has one vertex and one circular base.

Shelby made a cone.

		Solid	Number of Edges, *E*	Number of Faces, *F*	Number of Vertices, *V*
Polyhedrons	Prisms	triangular	9	5	6
		rectangular	12	6	8
		pentagonal	15	7	10
	Pyramids	triangular	6	4	4
		rectangular	8	5	5
		pentagonal	10	6	6

Solid Shapes with Circular Faces	
cylinder	solid with 2 equal circular bases
cone	solid with one vertex and a circular base

2. Next, Shelby made a figure with six edges and the same number of faces and vertices. What shape did she make this time?

3. Shelby made a figure with six faces, eight vertices, and twelve edges. What shape did Shelby make?

4. Finally, Shelby made a figure with two circular bases. What is the shape called?

12.2 Carnegie Candy Company

Volumes and Surface Areas of Prisms

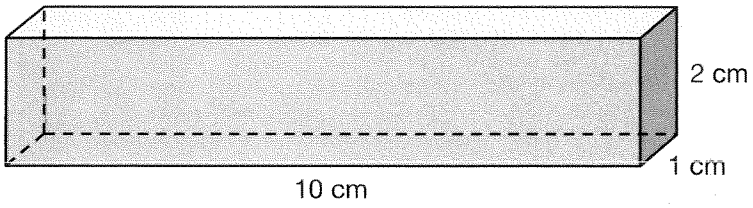
Students should be able to answer these questions after Lesson 12.2:

- How can you find the volume of rectangular prisms?
- How can you find the surface area of rectangular prisms?

Directions

Read Question 1 and its solution. Then complete Question 2.

1. Carnegie Candy is creating a new candy bar. They need to determine the amount of chocolate to use and the amount of packaging required.



Step 1 Find the volume of chocolate in the bar of candy above. Multiply the length times the width times the height.

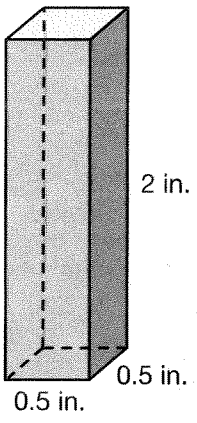
$10 \text{ cm} \times 1 \text{ cm} \times 2 \text{ cm} = 20 \text{ cubic cm}$

Step 2 Find the surface area by finding the area of each face, then adding them together. Because opposite sides are congruent, take a short cut and multiply once—add twice!

$(2 \times 10) + (1 \times 2) + (1 \times 10) + (2 \times 10) + (1 \times 2) + (1 \times 10) = 64 \text{ square cm}$

So, the new candy bar has 20 cubic centimeters of chocolate and 64 square centimeters of packaging.

2. Carnegie tried a different shape for a new candy bar. Find the volume and surface area of the shape at the right. Remember to use the correct labels.



12.3 The Playground Olympics

Volumes and Surface Areas of Cylinders

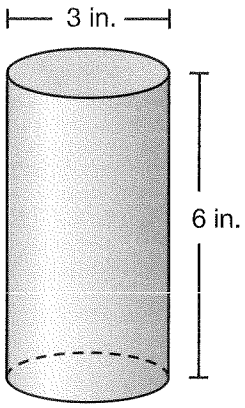
Students should be able to answer these questions after Lesson 12.3:

- How can you find the volume of cylinders?
- How can you find the surface area of cylinders?

Directions

Read Question 1 and its solution. Then complete Question 2.

1. Canned Springs is ready to release a new product—canned water. Find the volume and surface area of the can at the right.



Step 1 To find the volume, use the formula $V = \pi r^2 h$. Use 3.14 for π.

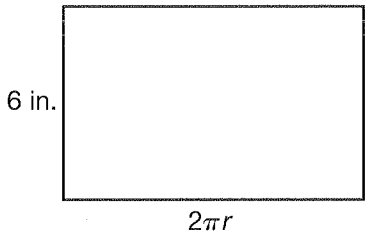
r = radius

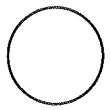
h = height

$V \approx 3.14(1.5)^2(6)$

$= 3.14(2.25)(6) = 42.39$ cubic inches

Step 2 To find the surface area, add the areas of the circular bases and the area of the rectangle that forms the side of the cylinder. Use 3.14 for π.





Area of rectangle $= 2\pi rh$

$\approx 2(3.14)(1.5)(6)$

$= 56.52$

Area of bases $= 2\pi r^2$

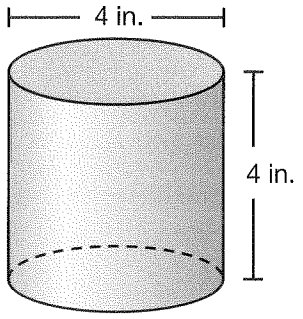
$\approx 2(3.14)(1.5)^2$

$= 14.13$

Surface Area $= 56.52 + 14.13 = 70.65$ square inches

So, the volume of the can is 42.39 cubic inches and the surface area is 70.65 square inches.

2. Find the volume and surface area of the can at the right. Use 3.14 for π.



12.4 The Rainforest Pyramid

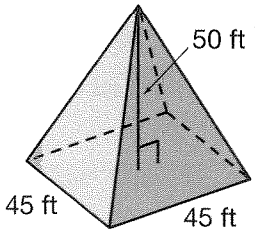
Volumes of Pyramids and Cones

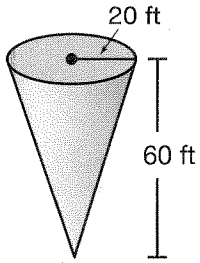
Students should be able to answer these questions after Lesson 12.4:

- How can you find the volume of pyramids?
- How can you find the volume of cones?

Directions

Read Question 1 and its solution.
Then complete Question 2.





1. Compare the volume of the square pyramid to the volume of the cone.

Step 1 To find the volume of the square pyramid, use the formula $V = \frac{1}{3}Bh$, where B is the area of the base and h is the height.

$$V = \frac{1}{3}(\ell \cdot w)(h)$$

$$= \frac{1}{3}(45 \text{ ft} \cdot 45 \text{ ft})(50 \text{ ft})$$

$$= 33{,}750 \text{ cubic feet}$$

Step 2 To find the volume of the cone, use the formula $V = \frac{1}{3}\pi r^2 h$, where r is the radius and h is the height. Use 3.14 for π.

$$V = \frac{1}{3}\pi r^2 h$$

$$\approx \frac{1}{3}(3.14)(20^2)(60)$$

$$= 25{,}120 \text{ cubic feet}$$

Step 3 Compare the volumes.

33,750 cubic feet > 25,120 cubic feet

So, the volume of the square pyramid is greater than the volume of the cone.

2. Compare the volume of a square pyramid with a height of 60 feet and a length of 45 feet to the volume of a cone with a radius of 45 feet and a height of 60 feet.

12.5 What on Earth?

Volumes and Surface Areas of Spheres

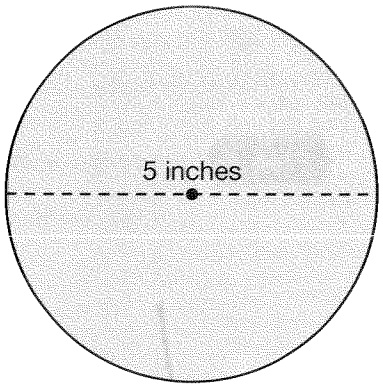
Students should be able to answer these questions after Lesson 12.5:

- How can you find the volume of spheres?
- How can you find the surface area of spheres?

Directions

Read Question 1 and its solution. Then complete Question 2.

1. Find the volume and surface area of the spherical model of Mars.



Step 1 To find the volume of the sphere, use the formula $V = \frac{4}{3}\pi r^3$, where r is the radius. Use 3.14 for π.

$$V = \frac{4}{3}\pi r^3$$

$$\approx \frac{4}{3}(3.14)(2.5)^3$$

$$= 65.41\overline{6} \text{ cubic inches}$$

The volume of the sphere is about 65.42 cubic inches.

Step 2 To find the surface area of the sphere, use the formula $4\pi r^2$, where r is the radius. Use 3.14 for π.

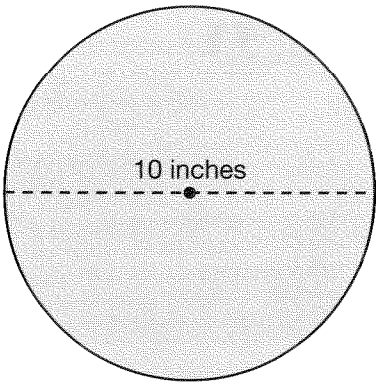
$$\text{Surface Area} = 4\pi r^2$$

$$\approx 4(3.14)(2.5)^2$$

$$= 78.5 \text{ square inches}$$

So, the volume of the spherical model is about 65.42 cubic inches and the surface area is 78.5 square inches.

2. Find the volume and surface area of the spherical model of Venus. Use 3.14 for π.



12.6 Engineers and Architects

Nets and Views

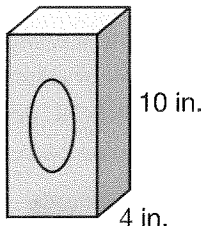
Students should be able to answer these questions after Lesson 12.6:

- What is a net?
- How can you design the net of a three-dimensional figure?
- How can you find the dimensions of a figure from a net?

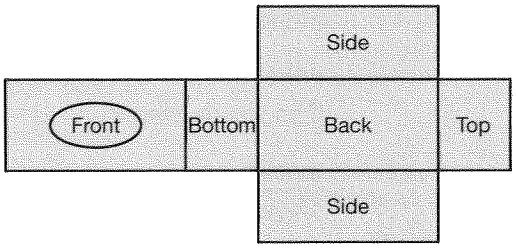
Directions

Read Question 1 and its solution. Then complete Question 2.

1. Bryce made the birdhouse shown at the right. He decided to make a net, which is a two-dimensional pattern, of the birdhouse so that he can create more birdhouses. Create the net. Include the dimensions on the net. Find the volume of the birdhouse. Then find the surface area of the birdhouse before cutting the entrance from the front.

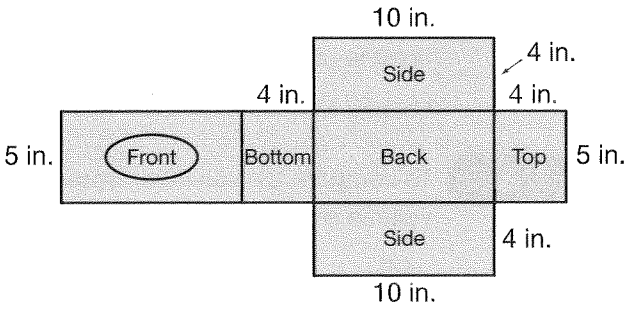


Step 1 To create the net, draw each face of the birdhouse. In the figure at the right, the front has a hole for the birds to enter the birdhouse.



Step 2 Label each piece in the net as front, side, back, bottom, or top. Then label the measurements.

Step 3 To find the volume, multiply the length of the figure by the width of the figure by the height of the figure. To find the surface area, find the sum of the areas of the faces of the figure.



Volume = 10 in. × 4 in. × 5 in. = 200 cubic inches

Surface Area = (5 in. × 10 in.) + (4 in. × 5 in.) + (10 in. × 4 in.) + (5 in. × 10 in.) + (4 in. × 5 in.) + (10 in. × 4 in.) = 220 square inches

So, the volume of the birdhouse is 200 cubic inches and the surface area is 220 square inches.

2. Design your own creation using one solid figure. Create the net and find the surface area and volume of the figure.

12.7 Double Take

similar solids

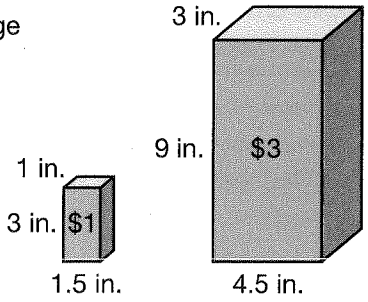
Students should be able to answer these questions after Lesson 12.7:

- How can you tell whether solids are similar?
- How can you compare volumes of similar solids?

Directions

Read Question 1 and its solution. Then complete Question 2.

1. Amy wanted to find the better buy: peanut butter popcorn in one large box or peanut butter popcorn in three smaller boxes, as shown at the right. Are the boxes similar? If so, how do the volumes of the boxes compare?



Step 1 To determine whether the figures are similar, set up ratios that compare the height, length, and width of the smaller box to those of the larger box.

If the ratios of corresponding dimensions are the same, the figures are similar. If so, go to Step 2.

$\frac{\text{smaller box}}{\text{larger box}}$ height $= \frac{3}{9} = \frac{1}{3}$ length $= \frac{1}{3}$ width $= \frac{1.5}{4.5} = \frac{1}{3}$

Step 2 Find the volume of each box.

Volume of the smaller box $= 1 \text{ in.} \times 3 \text{ in.} \times 1.5 \text{ in.} = 4.5$ cubic inches

Volume of the larger box $= 3 \text{ in.} \times 4.5 \text{ in.} \times 9 \text{ in.} = 121.5$ cubic inches

Step 3 To compare the volumes, write the ratio of the volume of the smaller box to the volume of the larger box. Then simplify.

$$\frac{4.5}{121.5} = \frac{1}{27}$$

The figures are similar, but the volume of the larger box is 27 times larger than the smaller box. Three small boxes cost \$3 and one large box costs \$3. The total volume of three small boxes is 13.5 cubic inches. So, one large box is a better buy.

2. Are these boxes of cereal similar? If so, how do the volumes of the boxes compare?