7th Grade Review Summer Packet

Name ___________________________

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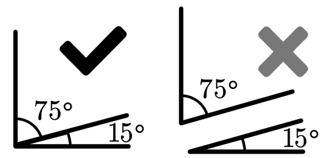
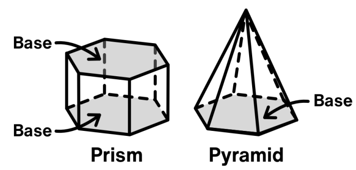
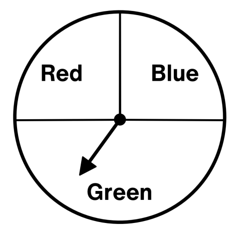
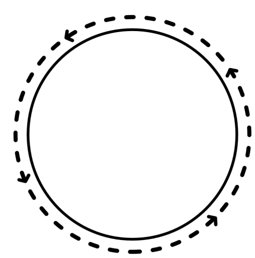
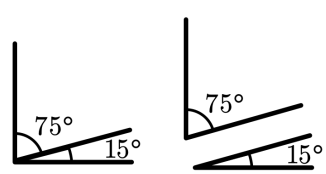
Math 7 Glossary

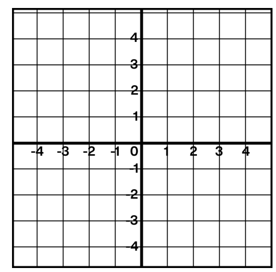
Term	Definition
adjacent angles	Adjacent angles share a side and a vertex. In the diagram on the left, the $75°$ angle and the $15°$ angle are adjacent. In the diagram on the right, they are not adjacent. 
base	A prism has two identical bases that are parallel. A pyramid has one base. A prism or pyramid is named for the shape of its base. 
chance experiment	A chance experiment is something you can do over and over again, and you don't know what will happen each time. For example, each time you spin the spinner, it could land on red, blue, or green. 
circle	A circle is a shape made out of all of the points that are the same distance from a center.
circumference	The circumference of a circle is the distance around the circle. If you imagine the circle as a piece of string, it is the length of the string. If the circle has a diameter d, then the circumference, $C = \pi d$. The circumference of a circle with a radius of 5 cm is $C = \pi \cdot 2 \cdot 5 = 10\pi$ cm, or about 31.416 cm. 
complementary angles	Complementary angles have measures that add up to 90 degrees. For example, a $75°$ angle and a $15°$ angle are complementary. 

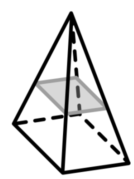
Math 7 Glossary

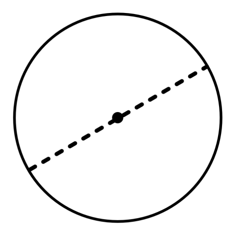
<table>
<tr><th>Term</th><th>Definition</th></tr>
<tr><td>constant of proportionality</td><td>
A constant of proportionality is a unit rate. Multiplying one value in a proportional relationship by the constant of proportionality gives the corresponding value.

In this table, one constant of proportionality is 1.5.

The cost is $\$1.50$ for every square foot of carpet.

<table>
<tr><th>Carpet (sq. ft.)</th><th>Cost (dollars)</th></tr>
<tr><td>10</td><td>$\xleftarrow{\times\frac{2}{3}}$ 15.00</td></tr>
<tr><td>20</td><td>$\xleftarrow{\times\frac{2}{3}}$ 30.00</td></tr>
<tr><td>50</td><td>$\xleftarrow{\times\frac{2}{3}}$ 75.00</td></tr>
</table>
</td></tr>
<tr><td>coordinate plane</td><td>
The coordinate plane is a grid of two perpendicular axes that intersect at a point called the origin, or $(0, 0)$.

</td></tr>
<tr><td>cross section</td><td>
A cross section is the new face you see when you slice through a three-dimensional figure.

For example, if you slice a rectangular pyramid parallel to the base, you get a smaller rectangle as the cross section.

</td></tr>
<tr><td>diameter</td><td>
A diameter is a line segment that goes from one edge of a circle to the other and passes through the center.

Every diameter of the circle is the same length.

</td></tr>
<tr><td>equivalent expression</td><td>
Expressions that are equal for every value of a variable are called equivalent expressions.

For example, $6x + 2x$ is equivalent to $5x + 3x$. No matter what value x is, the two expressions are always equal.
</td></tr>
</table>

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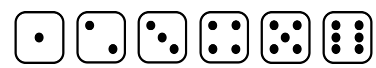
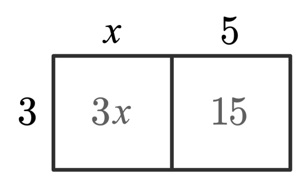
<table>
<tr><th>Term</th><th>Definition</th></tr>
<tr><td>equivalent ratios</td><td>Two ratios are equivalent if you can multiply each number in the first ratio by the same factor to get the numbers in the second ratio.

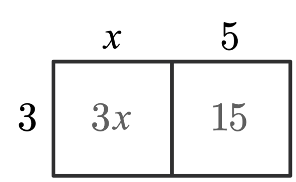
For example, 10 square feet of carpet costs $\$15$. If you buy 20 square feet of carpet, it would cost $\$30$, because $10: 15$ and $20: 30$ are equivalent ratios.

<table><tr><th>Carpet (sq. ft.)</th><th>Cost (dollars)</th></tr><tr><td>10</td><td>15.00</td></tr><tr><td>20</td><td>30.00</td></tr><tr><td>50</td><td>75.00</td></tr></table></td></tr>
<tr><td>event</td><td>An event is a set of one or more outcomes in a chance experiment. For example, if we roll a number cube, there are six possible outcomes.
</td></tr>
<tr><td>expand</td><td>To expand an expression, use the distributive property to multiply the two factors and rewrite the expression as a sum.

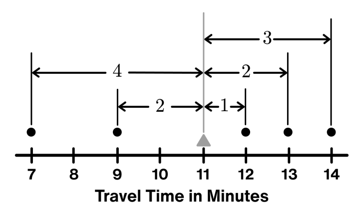
The new expression is equivalent to the original expression.
For example, we can expand $3(x + 5)$ to get the equivalent expression $3x + 15$.

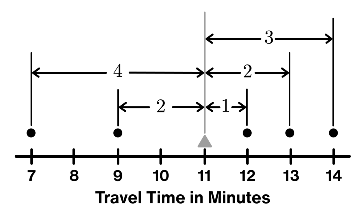
The sum of the two boxes in the diagram show the expression in expanded form.

</td></tr>
<tr><td>factor</td><td>To factor an expression, use the distributive property to rewrite an expression as the product of two or more factors.

The new expression is equivalent to the original expression.
For example, we can factor $3x + 15$ to get the equivalent expression $3(x + 5)$.

The product of the two sides in the diagram show the expression in factored form.

</td></tr>
<tr><td>identical copy</td><td>An identical copy of a figure is one that has the same shape and size.</td></tr>
</table>

Math 7 Glossary

<table>
<tr><th>Term</th><th>Definition</th></tr>
<tr><td>interquartile range (IQR)</td><td>
The interquartile range is one way to measure how spread out a data set is. We also call this the IQR.
To find the interquartile range, we subtract the first quartile from the third quartile.
For example, the IQR of this data set is 20 because $50 - 30 = 20$.
<table>
<tr><td>22</td><td>29</td><td>30</td><td>31</td><td>31</td><td>43</td><td>44</td><td>45</td><td>50</td><td>50</td><td>59</td></tr>
<tr><td></td><td></td><td>Q1</td><td></td><td></td><td>Q2</td><td></td><td></td><td>Q3</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>mean</td><td>
The mean is one way to measure the center of a data set. We can think of it as a balance point.
For example, for the data set $7, 9, 12, 13, 14,$ the mean is 11.


</td></tr>
<tr><td>mean absolute deviation (MAD)</td><td>
The mean absolute deviation is one way to measure how spread out a data set is. Sometimes we call this the MAD.
To find the MAD, add up the distance between each data point and the mean. Then, divide by how many numbers there are.
For example, in this data set, the MAD is $\frac{4+2+1+2+3}{5} = \frac{12}{5}$ because there are 5 data points and each is a different distance away from the mean.


These travel times are typically $\frac{12}{5}$ or 2.4 minutes away from the mean.
</td></tr>
</table>

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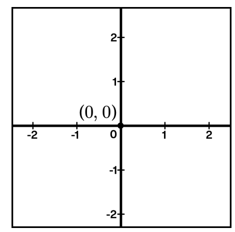
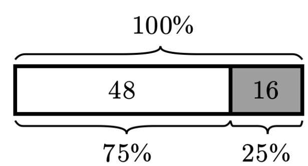
Math 7 Glossary

Term	Definition
median	The median is one way to measure the center of a data set. It is the middle number when the data set is listed in order. Set A: $7, 9, 12, 13, 14$ Set B: $3, 5, 11, 12$ For data set A, the median is 12. For data set B, there are two numbers in the middle. The median is the average of those numbers: $\frac{5+11}{2} = 8$.
origin	The origin is the point $(0, 0)$ in the coordinate plane. This is where the horizontal axis and the vertical axis cross. 
outcome	An outcome of a chance experiment is one of the things that can happen when you do the experiment. For example, the possible outcomes of tossing a coin are heads and tails.
percent decrease	A percent decrease tells us how much a quantity went down, expressed as a percentage of the starting amount. For example, a store had 64 hats in stock on Friday. They had 48 hats left on Saturday. The amount of hats went down by 16.  This was a 25% decrease because 16 is 25% of 64.
percent error	Percent error is a way to describe error, expressed as a percentage of the correct or desired amount. For example, a box is supposed to have 150 folders in it. Clare counts only 147 folders in the box. This is an error of 3 folders. The percent error is 2% because 3 is 2% of 150. $\frac{3}{150} = 0.02 = 2\%$.

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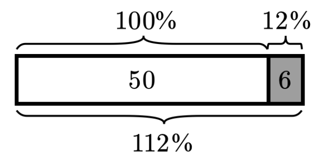
<table>
<tr><th>Term</th><th>Definition</th></tr>
<tr><td>percent increase</td><td>
A percent increase tells us how much a quantity went up, expressed as a percentage of the starting amount.

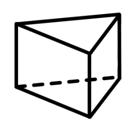
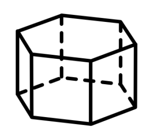
For example, Elena had $50 on Monday. She helped a neighbor, so she had $56 on Tuesday. The amount went up by $6.



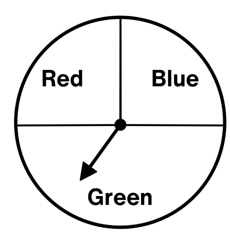
This was a 12% increase because 6 is 12% of 50.
$\frac{6}{50} = 0.12 = 12\%$.
</td></tr>
<tr><td>pi</td><td>
Pi is a number that represents the constant of proportionality between the diameter and circumference of any circle. The symbol for pi is π.

Some common approximations for π are $\frac{22}{7}$, 3.14, and 3.14159.
</td></tr>
<tr><td>population</td><td>
A population is a set of people or things that we want to study. For example, if we want to study the heights of people on different sports teams, the population would be all the people on the teams.
</td></tr>
<tr><td>prism</td><td>
A prism is a solid that has two bases that are identical copies.

The bases are connected by rectangles or parallelograms.


Triangular Prism

Hexagonal Prism
</td></tr>
<tr><td>probability</td><td>
The probability of an event is a number that tells how likely it is to happen. A probability of 1 means the event will always happen. A probability of 0 means the event will never happen.

For example, the probability of spinning red is $\frac{1}{4}$.



</td></tr>
<tr><td>proportional relationship</td><td>
A proportional relationship is a set of equivalent ratios. The values for one quantity are each multiplied by the same number to get the values for the other quantity.

For example, every cost in the table is equal to 1.5 times the number of square feet of carpet.

<table>
<tr><th>Carpet (sq. ft.)</th><th>Cost (dollars)</th></tr>
<tr><td>10 $\xrightarrow{x\,1.5}$</td><td>15.00</td></tr>
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<tr><td>50 $\xrightarrow{x\,1.5}$</td><td>75.00</td></tr>
</table>
</td></tr>
</table>

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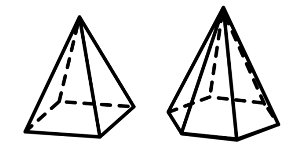
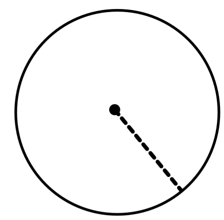
<table>
<tr><th>Term</th><th>Definition</th></tr>
<tr><td>pyramid</td><td>A pyramid is a solid in which the base is a polygon.

All of the other faces are triangles that meet at a single vertex.


Rectangular Pyramid   Hexagonal Pyramid</td></tr>
<tr><td>radius</td><td>A radius is a line segment that goes from the center to the edge of a circle.

Every radius of the circle is the same length.

</td></tr>
<tr><td>random</td><td>Outcomes of a chance experiment are random if they are all equally likely to happen.</td></tr>
<tr><td>reciprocal</td><td>Two factors whose product is 1 are called reciprocals.

In this example, $\frac{3}{2}$ and $\frac{2}{3}$ are reciprocals because $\frac{3}{2} \cdot \frac{2}{3} = 1$.

<table><tr><th>Carpet (sq. ft.)</th><th>Cost (dollars)</th></tr><tr><td>10</td><td>15.00</td></tr><tr><td>20</td><td>30.00</td></tr><tr><td>50</td><td>75.00</td></tr></table></td></tr>
<tr><td>repeating decimal</td><td>A repeating decimal has digits that repeat in the same pattern over and over. The repeating digits are marked with a line above them. If the repeating digits are all zeroes, we call the decimal terminating.

For example, the decimal representation of $\frac{1}{3}$ is $0.\overline{3}$, which means $0.33333...$.

The decimal representation of $\frac{25}{22}$ is $1.1\overline{36}$, which means $1.1363636...$.</td></tr>
<tr><td>representative</td><td>A sample is representative of a population if its distribution resembles the population's distribution in center, shape, and spread.</td></tr>
</table>

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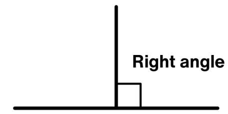
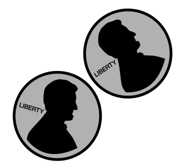
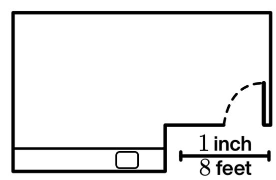
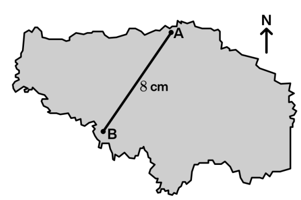
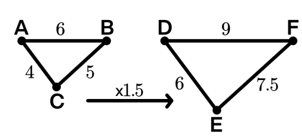
Term	Definition
right angle	A right angle is half of a straight angle. It measures $90°$. 
sample	A sample is part of a population. For example, a population could be all the seventh grade students at one school. One sample of that population is all the seventh grade students who are in band.
sample space	The sample space is the list of every possible outcome for a chance experiment. For example, the sample space for tossing two coins is: heads-heads, tails-heads, heads-tails, tails-tails. 
scale	A scale tells us how the measurements in a scale drawing represent the actual measurements of the object. For example, the scale of this floor plan tells us that 1 inch on the drawing represents 8 feet in the actual room. This means that 2 inches would represent 16 feet, and a half inch represents 4 feet. 
scale drawing	A scale drawing represents an actual place or object. All the measurements in the drawing correspond to the measurements of the actual object by the same scale. For example, a scale may show that 1 centimeter on a map represents 30 miles on land. The distance marked on this map is 8 centimeters, or 240 miles. 
scale factor	To create a scaled copy, we multiply all the lengths in the original figure by the same number. This number is called the scale factor. For example, the scale factor from ABC to DEF is 1.5. 

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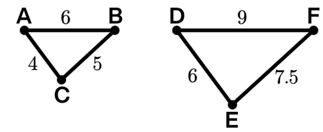
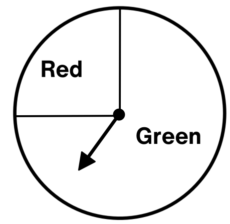
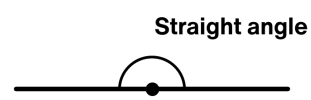
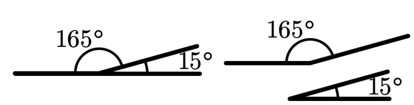
Math 7 Glossary

Term	Definition
scaled copy	A scaled copy is a copy of a figure where every length in the original figure is multiplied by the same number. 
simulation	A simulation is an experiment that is used to estimate the probability of a real-world event. For example, suppose the weather forecast says there is a 25% chance of rain. We can simulate this situation with a spinner. If the spinner stops on red, it represents rain. If not, it represents no rain. 
solution to an equation	A solution to an equation is a value of a variable that makes the equation true. For example, 5 is a solution to the equation $3x = 15$ because $3(5) = 15$. 6 is not a solution to the equation $3x = 15$ because $3(6) = 15$ is not true. $3x = 15$ $x = 5$ $3(5) = 15$
solutions to an inequality	The solutions to an inequality are all of the values of a variable that make that inequality true. For example, $x < 5$ represents the solutions to the inequality $3x < 15$ because any value that is less than 5 will make the inequality true.
straight angle	A straight angle forms a straight line. It measures $180°$. 
supplementary angles	Supplementary angles have measures that add up to 180 degrees. For example, a $165°$ angle and a $15°$ angle are supplementary. 

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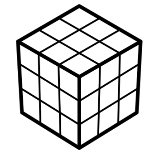
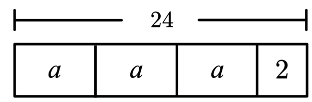
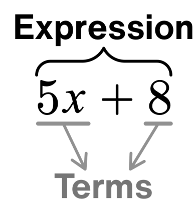
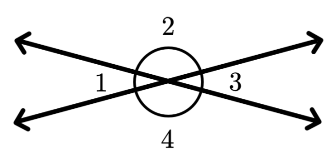
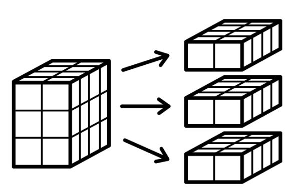
Term	Definition
surface area	The surface area of a polyhedron is the number of square units that covers all the faces of the polyhedron, without any gaps or overlaps. For example, if the six faces of a cube each have an area of 9 square centimeters, then the surface area of the cube is $6 \cdot 9$, or 54 square centimeters. 
tape diagram	A tape diagram is a narrow rectangle broken into pieces by length and used to represent relationships between quantities. For example, this tape diagram shows that 3 pieces of tape a units long and 1 piece of tape 2 units long total 24 units. 
term	A term is a part of an expression that involves addition. It can be a single number, a variable, or a variable and a number multiplied together. For example, the expression $5x + 8$ has two terms. The first term is $5x$ and the second term is 8. 
terminating decimal	A terminating decimal has a finite number of non-zero digits after the decimal point. The decimal representation of $\frac{2}{25}$ is 0.08.
vertical angles	Vertical angles are angles opposite each other where two lines cross. Their angle measures are equal. Angles 1 and 3 are a pair of vertical angles. Another pair is angles 2 and 4. 
volume	Volume is the number of cubic units that fill a three-dimensional region without any gaps or overlaps. For example, the volume of this rectangular prism is 24 cubic units, because it is composed of 3 layers that are each 8 cubic units. 

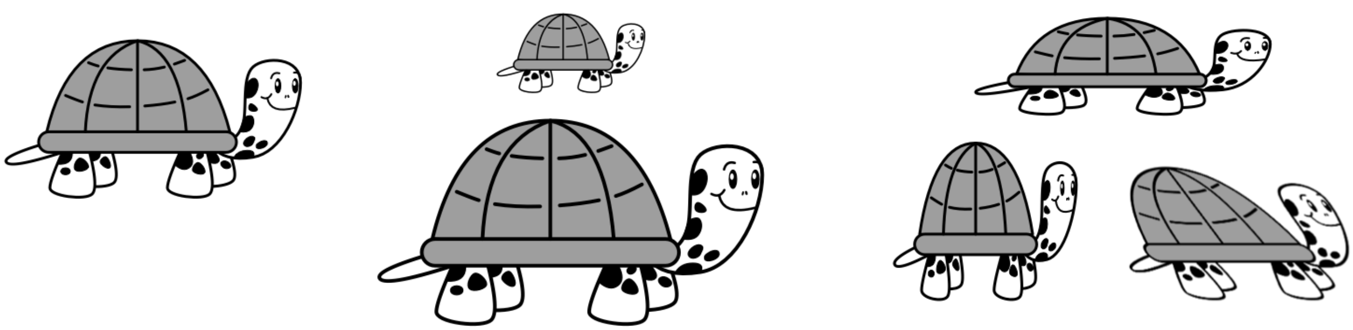
Unit 1 Summary

Prior Learning	Math 7, Unit 1	Future Learning
Math 6 • Fraction multiplication and division • Polygon area	• Scaled copies • Scale drawings	Math 7, Units 2 and 4 • Proportional relationships Math 8 • Similarity and dilations

Scaled Copies

An image is a **scaled copy** of the original if the shape is stretched in a way that does not distort it.

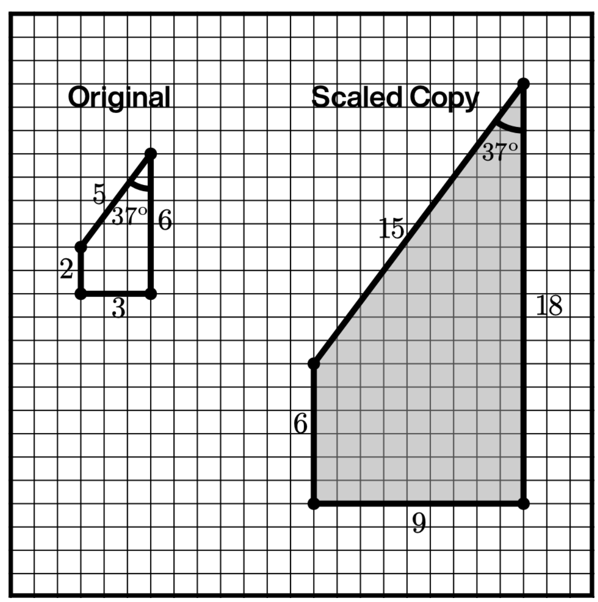
Original | **Scaled Copies** | **Non-Scaled Copies**



Side Lengths: All side lengths in a scaled copy are multiplied by a number called a **scale factor**.

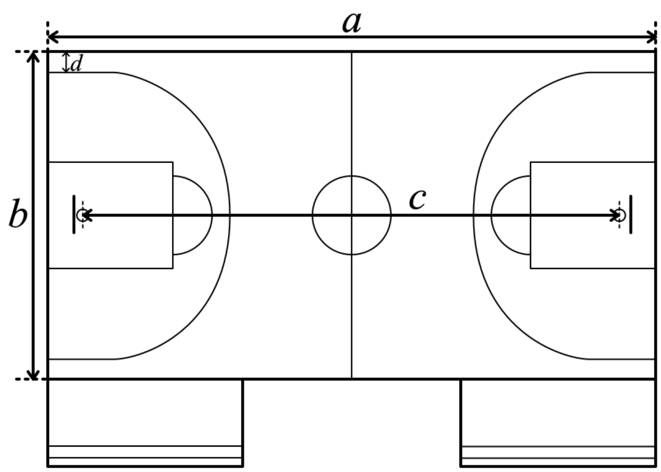
Angles: All angle measures stay the same.

Area: The area does not increase by the scale factor. For example, the area of the original is 12 square units and the area of the scaled copy is 108 square units.



Scale Drawings

A **scale drawing** is a two-dimensional representation of an actual object or place. Maps and floor plans are some examples of scale drawings.



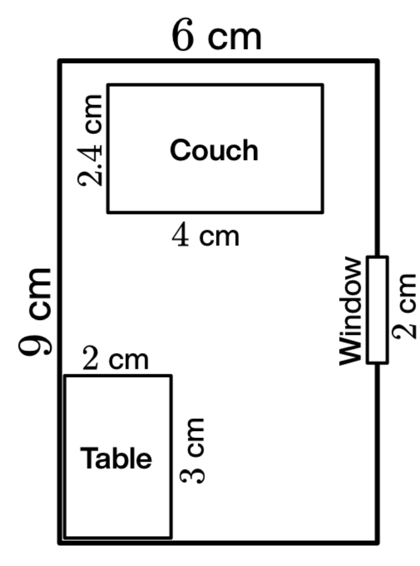
A **scale** tells us what the measurements in a scale drawing represent on the actual object.

For example, a scale of “1 inch to 5 miles” means that 1 inch on the drawing represents 5 actual miles. If the drawing shows a road that is 2 inches long, the road is actually $2 \cdot 5$, or 10 miles long.

It is also possible to use a scale to create a scale drawing.

The couch in this scale drawing of a living room is 4 centimeters in length.

The scale of the drawing is 3 centimeters to 2 meters, so the actual length of the couch is $2\frac{2}{3}$ meters.

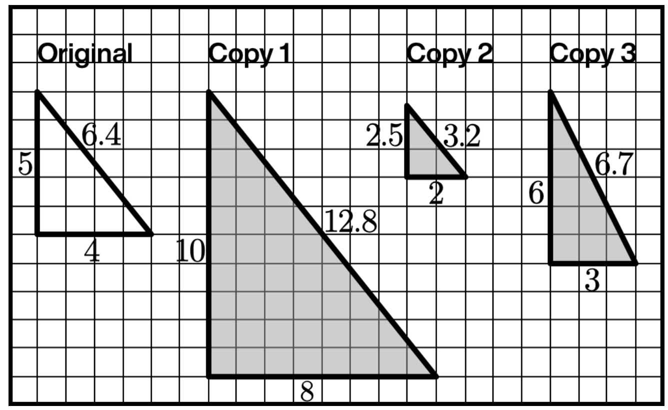


Scale = 3 **cm to** 2 **m**

Try This at Home

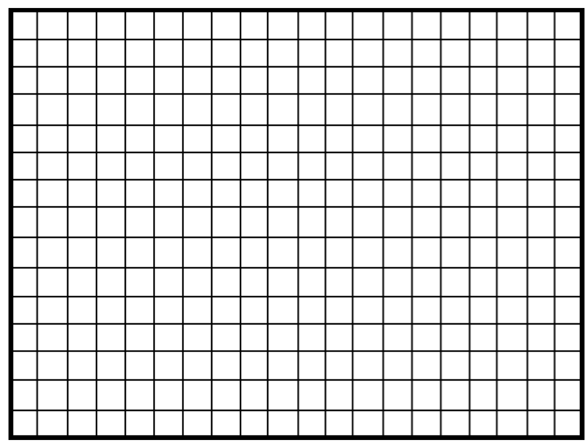
Scaled Copies

1.1 For each copy, decide whether or not it is a scaled copy of the original triangle.



1.2 For each scaled copy, determine the scale factor from the original to the copy.

1.3 Sketch another scaled copy of the original triangle using a different scale factor.



1.4 Suppose you want to scale the copy you drew back to its original size. What scale factor should you use?

Scale Drawings

Xavier drew a floor plan of his classroom using the scale 1 inch to 6 feet.

2.1 Xavier's drawing is 4 inches wide and $5\frac{1}{2}$ inches long. What are the dimensions of the actual classroom?

2.2 A table in the classroom is 3 feet wide and 6 feet long. What size should it be on the scale drawing?

2.3 Xavier wants to make a larger scale drawing of the same classroom. Which of these scales could he use?

A. 1 in. to 5 ft. B. 2 in. to 12 ft. C. 2 in. to 15 ft.

Unit 2 Summary

Prior Learning	Math 7, Unit 2	Future Learning
Grades 3–5 • Fraction operations • Graphing coordinates Math 6 • Equivalent ratios • Unit rates Math 7, Unit 1 • Scale factor	• Proportional relationships (in tables, equations, and graphs)	Math 7, Unit 4 • Proportional relationships and percentages Math 8 • Slope • Linear relationships

Proportional Relationships in Tables

Carpets are sold at a price per square foot, so the ratios for amount of carpet to cost are all equal.

$$\frac{\$15}{10\ sq.ft.}=\frac{\$30}{20\ sq.ft.}=\frac{\$75}{50\ sq.ft}=\$1.5 \text{ per square foot}$$

This is called a **proportional relationship.**

Carpet (sq. ft.)	Cost (dollars)
10	15.00
20	30.00
50	75.00

In this relationship, every square foot of carpet costs $\$1.50$.

This number 1.5 is called a **constant of proportionality.**

Carpet (sq. ft.)	Cost (dollars)
10 $\xrightarrow{\times 1.5}$	15.00
20 $\xrightarrow{\times 1.5}$	30.00
50 $\xrightarrow{\times 1.5}$	75.00

Another constant of proportionality in this example is $\frac{2}{3}$.

You get $\frac{2}{3}$ of a square foot of carpet for every dollar spent.

Carpet (sq. ft.)	Cost (dollars)
10 $\xleftarrow{\times \frac{2}{3}}$	15.00
20 $\xleftarrow{\times \frac{2}{3}}$	30.00
50 $\xleftarrow{\times \frac{2}{3}}$	75.00

desmos

Unit 7.2, Family Resource

Proportional Relationships in Equations

The cost of carpet is 1.5 times the number of square feet.
We can represent this relationship with the equation:

$y = 1.5x$	x represents the number of carpet bought. y represents the cost of the carpet, in dollars.

In general, the equation for a proportional relationship looks like:

$y = kx$	x and y represent the two related quantities. k represents the constant of proportionality.

Proportional Relationships in Graphs

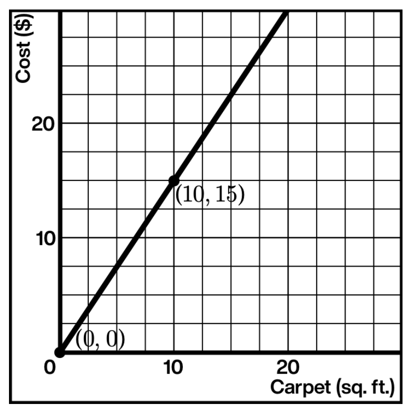
Graphs of proportional relationships:

- Lie on a line.
- Include the point $(0, 0)$, called the origin.

If you buy 10 square feet of carpet, it costs $\$15$.

If you buy 0 square feet of carpet, it costs $\$0$.

These are represented by the points $(10,\ 15)$ and $(0,\ 0)$.



Using Proportional Relationships

We can identify the constant of proportionality (1.5) in every representation.

Description

Each square foot of carpet costs $\$1.50$.

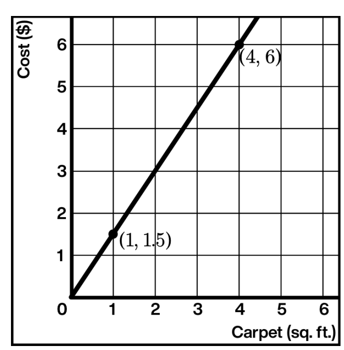
Table

Carpets (sq. ft.)	Cost (dollars)
0	0
1	1.50
4	6

Equation

$y = 1.5x$

Graph



$$\frac{6}{4} = 1.5$$

Try This at Home

Proportional Relationships in Tables

Here is a brief recipe for pineapple soda:

For every 5 cups of soda water, mix in 2 cups of pineapple juice.

1. Create a table that shows at least three possible combinations of soda water and pineapple juice to make pineapple soda.

2. How much pineapple juice would you mix with 20 cups of soda water?

3. How much soda water would you mix with 20 cups of pineapple juice?

4. What is one constant of proportionality for this situation?

Proportional Relationships in Equations

5. Write an equation that represents the relationship in the recipe above, using s for cups of soda water and p for cups of pineapple juice.

6. Write a second equation that represents this relationship.

7. Select all the equations that represent a proportional relationship:

- ☐ $K = C + 283$
- ☐ $m = \frac{1}{4}j$
- ☐ $V = s^3$
- ☐ $h = \frac{14}{x}$
- ☐ $c = 6.28r$

Proportional Relationships in Graphs

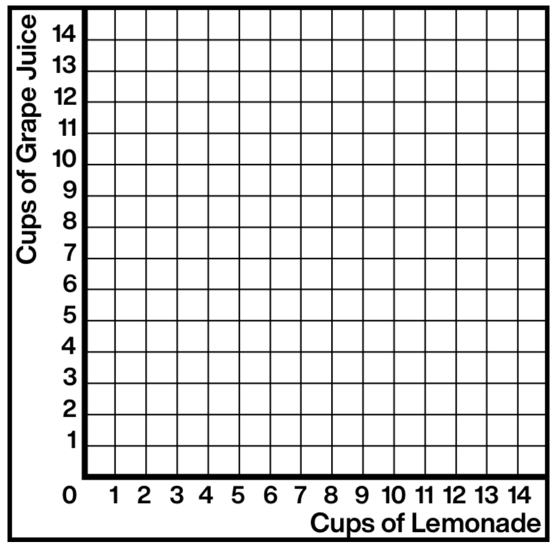
Here is a brief recipe for Grape-Ade:

For every 6 cups of lemonade, mix in 3 cups of grape juice.

8. Create a graph that represents the relationship between the amounts of lemonade and the amounts grape juice in different-sized batches of Grape-Ade.

9. Choose one point on your graph. Explain what that point means in a sentence.

10. What is a constant of proportionality for this relationship? Circle where you see the constant of proportionality in the graph.



Using Proportional Relationships

11. Describe a proportional relationship between quantities that you might encounter in your life.

12. What is a constant of proportionality in the relationship from Problem 4?

What does this number mean?

Unit 3 Summary

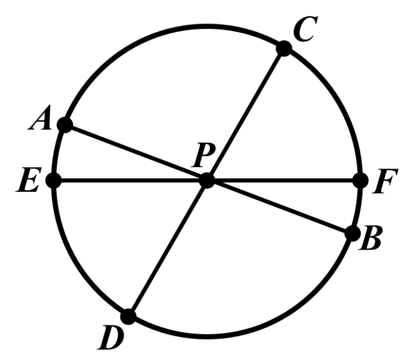
Prior Learning	Math 7, Unit 3	Future Learning
Math 6 ● Area of triangles and quadrilaterals ● Evaluating formulas Math 7 ● Proportional relationships	● Circumference of a circle ● Area of a circle	Math 8, Unit 5 ● Volume of cylinders, cones, and spheres

Circumference of a Circle

Circles are shapes made up of all the points that are the same distance away from a center.

Here are some common measurements of a circle.

- The **radius** goes from the center to the edge of a circle.
- The **diameter** goes from one edge of a circle to the other and passes through the center.
- The **circumference** is the distance around the circle.



There is a proportional relationship between the diameter and circumference of a circle.

The constant of proportionality of this relationship is π (pronounced "pie").

Common approximations for π are 3.14, $\frac{22}{7}$, and 3.14159, but none of these are exactly π.

The relationship between the diameter and circumference of a circle is exactly $C = \pi d$.

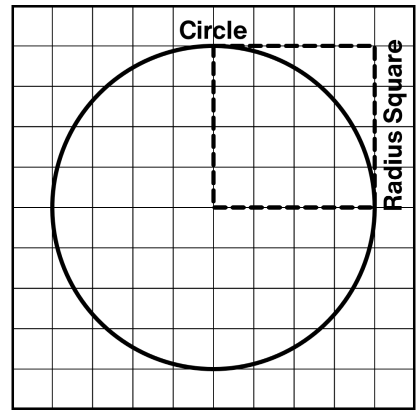
If AP is 5 inches, then AB is $2 \cdot 5 = 10$ inches.

The circumference is $C = \pi(10) = 10\pi$ inches, or about 31.4 inches.

Area of a Circle

We can estimate the area of a circle using radius squares.

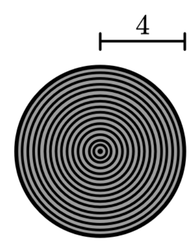
A little more than 3 radius squares cover any circle, so this circle's area would be a little more than $3 \cdot 4^2 = 48$ square units.



The relationship between the radius and area of a circle is exactly $A = \pi r^2$.

The area of the circle above is $\pi(4)^2 = 16\pi \approx 50.27$ square units.

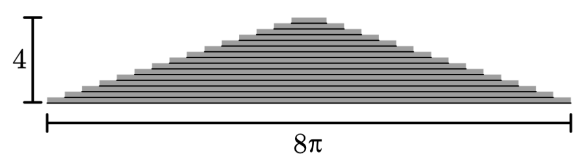
We can prove that this formula is correct by cutting a circle into rings and rearranging the rings into a triangle.



The height of the triangle is the radius of the circle.

The base of the triangle is its circumference.

The area of the triangle is:



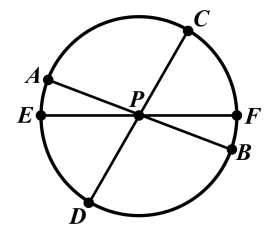
$$
\begin{aligned}
A &= \frac{1}{2} \cdot b \cdot h \\
&= \frac{1}{2} \cdot 8\pi \cdot 4 \\
&= 16\pi \text{ square units.}
\end{aligned}
$$

Try This at Home

Circumference of a Circle

1.1 AP is a radius of this circle. List every other radius.

1.2 EF is a diameter of this circle. List every other diameter.

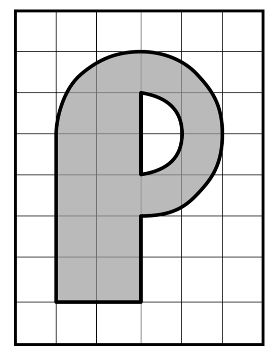


A candle has a diameter of 12 centimeters.

2.1 What is the distance from the edge of the candle to the wick (at the center)?

2.2 Would a ribbon 40 centimeters long wrap around the candle? Explain your thinking.

3. Determine the total perimeter of this figure.



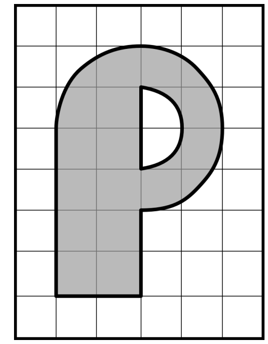
Area of a Circle

A rectangular wooden board, 20 inches wide and 40 inches long, has a circular hole cut out of it.

4.1 If the diameter of the circle is 6 inches, what is the area of the circular hole?

4.2 What is the area of the board after the circle is removed?

5. Determine the total shaded area of this figure.



Unit 4 Summary

Prior Learning	Math 7, Unit 4	Future Learning
Grades 3–5 • Fraction operations Math 6 • Equivalent ratios • Unit rates Math 7, Unit 2 • Proportional relationships	• Percentages as proportional relationships • Applying percentages	Math 7, Unit 6 • Solving equations High School • Exponential functions

Percentages as Proportional Relationships

This unit continues the study of proportional relationships, now incorporating fractional quantities and percentages.

A 4-by-6 photograph can be scaled and printed to be many different sizes.

In this example, each value in the second column is $\frac{3}{2}$ times the length of the value in the first column.

Height (in.)	Width (in.)
4	6
$1\frac{1}{2}$	$2\frac{1}{4}$
5	$7\frac{1}{2}$

Increasing or decreasing an original amount by a percentage is another example of a proportional relationship. The original amount is always represented by 100% or 1.

Three runners training for a race agree that they will each run 10% further next week than they ran this week.

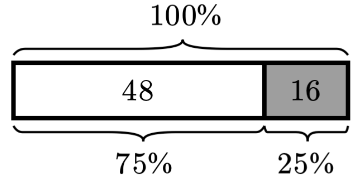
Each value in the second column is 10% greater than the value in the first column. The constant of proportionality is 1.10.

This is an example of a **percentage increase**.

Miles Ran This Week	Miles to Run Next Week
5	5.5
11	12.1
6.5	7.15

Here is an example of a **percentage decrease.**

The computer club had 64 students. Then, they lost 16 students.



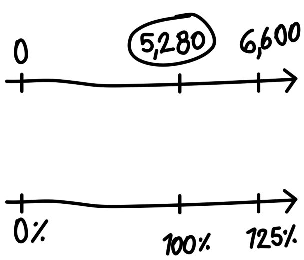
This is a 25% decrease because $\frac{16}{64} = 0.25$.

The club now has 48 students, which is 75% of the starting amount:
$0.75 \cdot 64 = 48$.

Sometimes problems require us to work backwards. The population of Boom Town has increased by 25% since last year. The population is now $6\ 600$. What was the population last year?

We can use a variety of representations to solve the problem:

Double Number Line



Table

OLD	NEW
100%	×1.25 125%
5280	×1.25 6,600

Equation

$$\frac{6{,}600}{1.25} = \frac{\cancelto{1}{1.25} \cdot b}{\cancel{1.25}}$$

$$5280 = b$$

Applying Percentages to Solve Problems

Percentages are useful in a variety of real-world situations.

A customer buys an item that costs $\$20$. The customer has an 18% off coupon, and then pays a sales tax of 7.5%.

Original Cost	$20.00
18% Off Coupon	$
Subtotal	$
7.5% Tax	$
Total	$?.??

82% of the bill remains after the 18% off coupon, and 82% of $\$20$ is $20 \cdot 0.82 = 16.40$.

For the total after tax, you can calculate $16.40 \cdot 1.075 = 17.63$.

The customer will pay a total of $\$17.63$.

We can also use **percent change** to analyze statistics about the larger society in which we live.

Try This at Home

Percentages as Proportional Relationships

A supermarket offers some food by the pound. A customer orders $1\frac{1}{2}$ pounds of potato salad for $\$9$ and $1\frac{3}{4}$ pounds of coleslaw for $\$11.20$.

1.1 How much would 5 pounds of potato salad cost?

1.2 Which food is more expensive per pound?

2. A car dealership pays $\$8350$ for a car. They sell it for 17% more than they paid. How much does the dealership sell the car for?

3. On Tuesday, the high temperature was $54º$ Fahrenheit. This was 10% lower than the high temperature on Monday. What was the high temperature on Monday?

Applying Percentages to Solve Problems

4. A restaurant bill before tip was $\$18.75$. If you paid $\$22$, what percent tip did you leave for the server?

The price tag on a backpack is $\$34.20$.

5.1 The store has a 15% off sale. What is the new price of the backpack?

5.2 The sales tax in this city is 5%. How much would a customer pay after the sale and the tax?

Solutions:

1.1 $\$30$. One approach is to divide the cost by the weight to find the cost per pound.

$9 \div 1\frac{1}{2} = 6$ dollars per pound. 5 pounds at that rate is $\$30$.

1.2 Coleslaw is more expensive. One approach is to divide each cost by each weight.

Potato salad: $9 \div 1\frac{1}{2} = 6$ dollars per pound

Coleslaw: $11.20 \div 1\frac{3}{4} = 6.40$ per pound

2. $\$9\,769.50$. One approach is to multiply $8350 \cdot 1.17 = 9769.5$.

3. $60º$. One approach is to write and solve an equation, where 90% of some number is $54º$:

$0.9x = 54 \rightarrow x = \frac{54}{0.9} = 60$.

4. About 17.3%. One approach is write and solve an equation, where 18.75 multiplied by an unknown number is 22. $18.75x = 22 \rightarrow x = \frac{22}{18.75} 1.17333...$. The 1 that comes before the decimal represents the original 100%, while the rest of the decimal number is the growth. When written as a rounded percent, $.17333$ is 17.3%.

5.1 $\$29.07$. One approach is to calculate $34.20 \cdot 0.85$, which is 29.07.

5.2 $\$30.52$. One approach is to multiply the answer from the previous problem, 29.07, by 1.05.

Unit 5 Summary

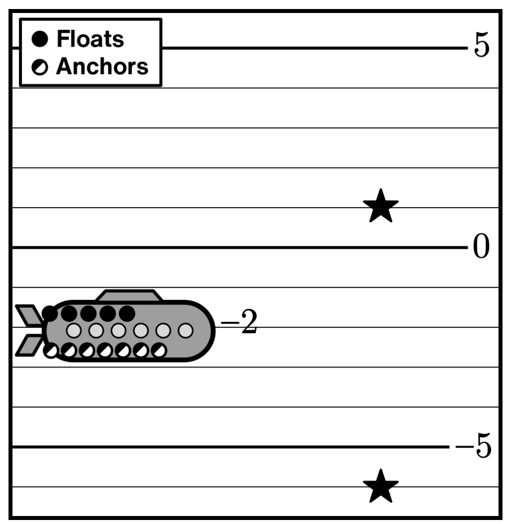
Prior Learning	**Math 7, Unit 5**	**Future Learning**
Grades 3–5 ● Fraction and decimal operations Math 6 ● Negative numbers ● Solving equations	● Operations with positive and negative numbers ● Applying operations	Math 7, Unit 6 ● Solving equations Math 8, Unit 8 ● Rational and irrational numbers

Adding and Subtracting

We can think of adding and subtracting numbers as adding and removing floats and anchors.

For example, to get the submarine from -2 to 1, you can add three floats or remove three anchors. To get from -2 to -6, you can either remove four floats or add four anchors.

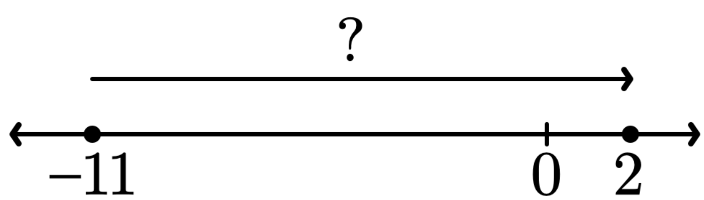
Start	**Action**	**Final Value**
-2	Add 3 floats	$-2 + 3 = 1$
-2	Remove 3 anchors	$-2 - (-3) = 1$
-2	Add 4 anchors	$-2 + (-4) = -6$
-2	Remove 4 floats	$-2 - 4 = -6$



We can also think of adding and subtracting numbers as movement on a number line.

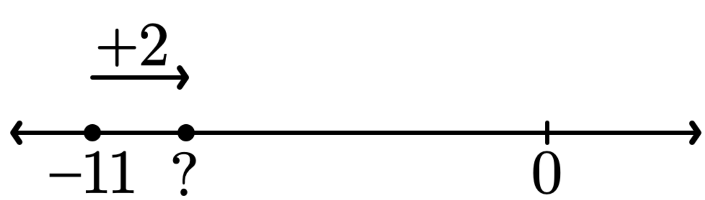
$2 - (-11)$ is another way of asking: *What is the distance from -11 to 2?*

$2 - (-11) = 13$



$(-11) + 2$ is another way of asking: *What is the point on the number line* that is 2 *to the right of -11?*

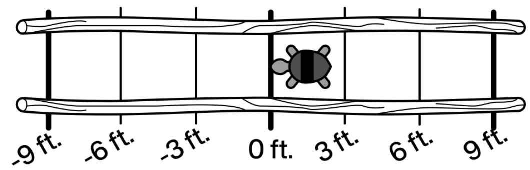
$(-11) + 2 = -9$



Multiplying and Dividing

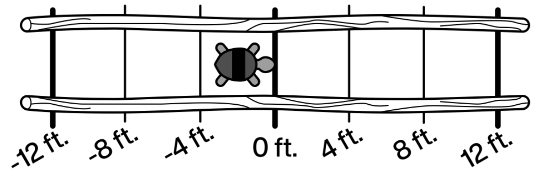
One way to imagine multiplying positive and negative numbers is to use distance, rate, and time.

For example, this turtle starts at 0 feet and travels west at a rate of -3 feet per second.



In 2 seconds it will be at $(-3) \cdot 2 = -6$ feet.

2 seconds ago, the turtle was at $(-3) \cdot (-2) = 6$ feet.



A second turtle travels east. 3 seconds ago it was at -12 feet, so its rate is $\frac{-12}{-3} = 4$ feet per second.

Applications With Positive and Negative Numbers

Positive and negative numbers are useful in a variety of real-world situations.

A utility company charges $\$0.19$ per kilowatt-hour of energy that a customer uses.

They also give a credit of $-\$0.17$ for every kilowatt-hour of electricity that a customer with a solar panel generates.

This family used $\frac{180.5}{0.19} = 950$ kWh of electricity.

They also generated $\frac{-136.85}{-0.17} = 805$ kWh.

The total due for this bill is $180.5 + (-136.85) = 43.65$ dollars.

Bill			
	Kilowatt Hours (kWh)	Charge/ Credit per kWh	Total Charge/ Credit
Electricity Used		$0.19	$180.50
Electricity Generated		–$0.17	–$136.85
Total Due			

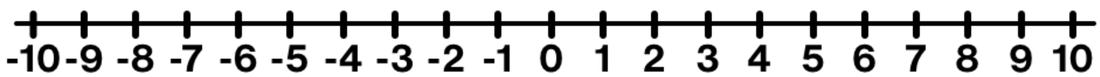
Try This at Home

Adding and Subtracting

1. Select all of the expressions that have the same value as $3 + (-5)$.

   ▢ $-3 + (-5)$ ▢ $5 - 3$ ▢ $-5 + 3$ ▢ $3 - 5$

2. Use the number line to show the value of $3 + (-5) =$ _____.



Determine the value of the variable that makes each equation true.

3.1 $-2 + a = 5$

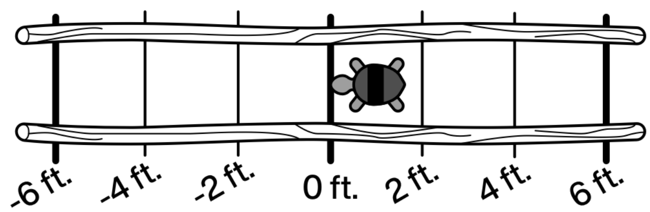
3.2 $7.5 - b = 12$

3.3 $\frac{2}{3} + c = -\frac{4}{3}$

Multiplying and Dividing

A turtle is traveling west at a rate of −2 feet per second. Right now the turtle's position is at 0 feet.

4.1 Calculate $(-2) \cdot 5$. What does this tell us about the turtle's journey?



Match each expression to a question for which it could help answer.

4.2 $-2 \cdot 5$

4.3 $-2 \cdot (-5)$

4.4 $\frac{5}{-2}$

Questions

When was the turtle at 5 feet?

Where will the turtle be in 5 seconds?

Where was the turtle 5 seconds ago?

Applications With Positive and Negative Numbers

Each year in September, the Arctic sea ice reaches its annual minimum levels. The table below shows minimums for various years, measured in square kilometers.[1]

Year	Arctic Sea Ice Minimums (square kilometers)
1980	7 670 000
1990	6 140 000
2000	6 250 000
2010	4 870 000
2019 (latest available data)	4 320 000

5. During which decade did the Arctic sea ice minimum change the most?

6. What was the approximate change in square kilometers of ice during this decade? Show whether the change was positive or negative.

7. What was the average rate of change of ice each year during this decade?

[1] "Arctic Sea Ice Minimum," Global Climate Change: Vital Signs of the Planet, https://climate.nasa.gov/vital-signs/arctic-sea-ice/

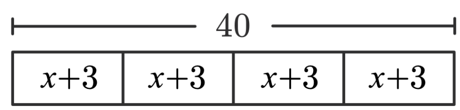
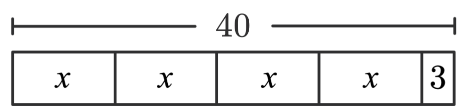
Unit 6 Summary

Prior Learning	Math 7, Unit 6	Future Learning
Math 6 • Solving one-step equations • The distributive property Math 7, Unit 5 • Operations with positive and negative numbers	• Creating equations and tape diagrams • Solving equations • Writing, solving, and graphing inequalities	Math 7, Unit 7 • Angle relationships Math 8, Unit 4 • Solving linear equations with variables on both sides • Solving systems of linear equations

Equations and Tape Diagrams

There are many different ways to represent the same situation.

Here are two similar situations:

Situation	Equation	Tape Diagram
Some decks of playing cards in Italy and Spain have 40 cards. There are four suits. Each suit has 3 face cards and x non-face cards.	$40 = 4(x + 3)$	
A chef at a Burmese restaurant makes 40 quarts of mohinga, a noodle and fish soup. She uses 3 quarts now and divides the rest equally into 4 containers to freeze.	$40 = 4x + 3$	

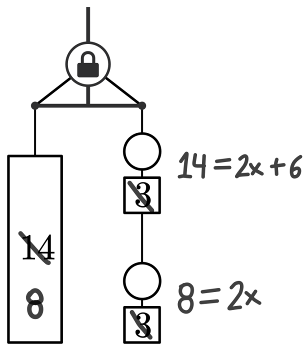
In the first situation, each part of the tape diagram is 10 units, so $x = 7$ because $7 + 3 = 10$.

In the second situation, the part of the tape diagram with 4 groups of x is 37 units, so $x = 9.25$ because $4(9.25) = 37$.

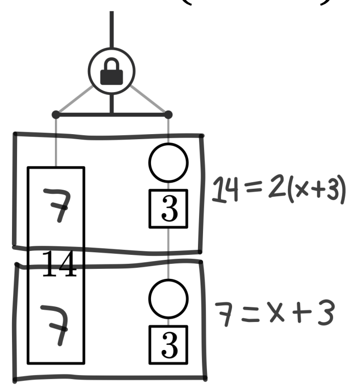
Solving Equations

Some equations can be represented by hangers where both sides are balanced. Solving an equation is like determining an unknown weight of a shape on a hanger.

$$14 = 2x + 6$$



$$14 = 2(x + 3)$$



For some equations, it can be helpful to write one side using fewer terms first so that the equation looks more familiar before we start solving steps. For example:

$-2(x - 5) + 8x = 14$	Multiply $(x - 5)$ by -2.
$-2x + 10 + 8x = 14$	Add $-2x$ and $8x$.
$6x + 10 = 14$	This equation looks more familiar.

Inequalities

We can use inequalities to describe a range of numbers. Here is an example of a situation that could be described using an inequality.

The cost to rent a scooter is $\$2.00$, plus another $\$0.30$ per minute you ride.

Callen has a $\$10$ credit.

For how many minutes could he ride?

$$0.30x + 2 \leq 10$$

Determine when he would spend exactly $\$10$.

$$0.30x + 2 = 10$$

$$x = 26.\overline{66}$$

Since he cannot ride part of a minute, Callen could ride anywhere between 0 and 26 minutes.

desmos

Unit 7.6, Family Resource

Try This at Home

Equations and Tape Diagrams

1.1 Draw a tape diagram to represent the equation $3x + 6 = 24$.

1.2 Draw a tape diagram to represent the equation $24 = 3(x + 6)$.

1.3 Decide which equation-diagram pair above matches this story. Explain your reasoning.

Diya made three different-flavored pastries for her family. She made the pastries one at a time. For each, she measured 6 tablespoons of flour and a little more to keep the dough from sticking. In total, she used 24 tablespoons of flour.

1.4 Write a story that goes with the other equation-diagram pair.

Solving Equations

Solve each equation.

2.1 $3x + 6 = 24$ 2.2 $24 = 3(y + 6)$ 2.3 $-2(x + 6) = 30$ 2.4 $5 - 2(x + 6) =$

Match each expression with an equivalent expression from the list. One expression in the list will be left over.

3.1 $5x + 8 - 2x + 1$

3.2 $6(4x - 3)$

3.3 $(5x + 8) - (2x + 1)$

3.4 $-12x + 9$

- $3x + 7$
- $3x + 9$
- $-3(4x - 3)$
- $24x + 3$
- $24x - 18$

Inequalities

Malik has saved $\$10.50$. His elderly neighbor gives him $\$3$ every time he does a chore at his house. Malik wants to know how many chores he needs to do in order to have at least $\$30$.

4.1 Will Malik reach his goal if he does chores for his neighbor 8 times?

4.2 Which inequality could Malik write to represent his situation? Explain how you know.

A. $3c + 10.50 \leq 30$

B. $3c + 10.50 \geq 30$

C. $3c - 10.50 \leq 30$

D. $3c - 10.50 \geq 30$

4.3 Solve the inequality you chose.

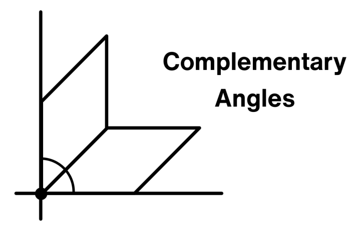
4.4 Use your solution to answer Malik's question.

Unit 7 Summary

Prior Learning	Math 7, Unit 7	Future Learning
Math 6 ● Area and surface area ● Volume of rectangular prisms Math 7 ● Solving equations ● Properties of circles	● Angle relationships ● Building and drawing triangles with given conditions ● Volume and surface area of non-rectangular prisms	Math 8, Units 1 and 5 ● Congruence ● Volume of cylinders, cones, and spheres High School ● Triangle congruence theorems

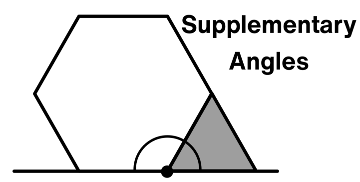
Angle Relationships

We can use common angle relationships to determine unknown angles in diagrams.



If two angles add to $90°$, they are *complementary angles*.

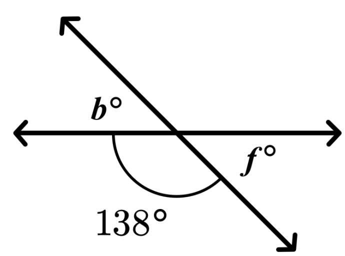
In the diagram, each marked angle must be $45°$ because $2(45) = 90$.



If two angles add to $180°$, they are *supplementary angles*.

If one angle of the triangle is $60°$, the larger marked angle must be $120°$ because $60 + 120 = 180$.

We can write equations based on angle relationships.



For example, $f + 138 = 180$ because they are supplementary angles.

It is also true that $b + 138 = 180$, so b and f are equal.

Angles b and f are called *vertical angles*, angles that are opposite each other where two lines cross.

The measures of vertical angles are always equal.

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Unit 7.7, Family Resource

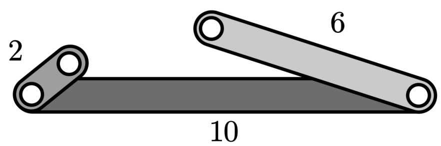
Drawing Triangles

The second part of the unit is all about drawing polygons based on descriptions. How many triangles are possible to draw based on given information?

Sometimes it is not possible to draw any triangle.

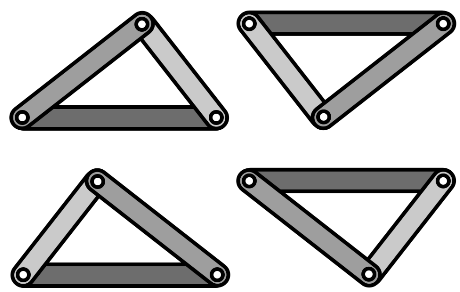
The two shortest sides are not long enough to form a triangle.

They would need to be longer than the third side to connect.



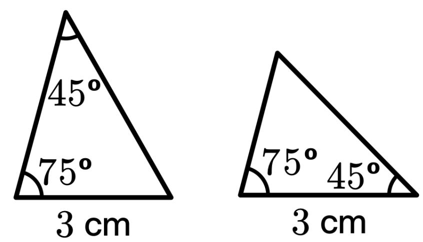
Sometimes it is only possible to draw one triangle.

All of the triangles with side lengths of 3 units, 4 units, and 5 units are *identical copies.*



Sometimes it is possible to draw more than one triangle.

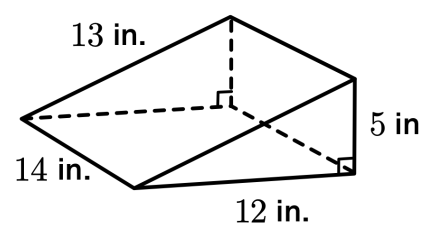
One side length of 3 cm, one $75°$ angle, and one $45°$ angle could describe two triangles that are not identical copies.



Solid Geometry

There are two features we often measure in a three-dimensional object: its *volume* (how much space is inside the object) and its *surface area* (the amount of material needed to cover the object).

A *prism* is a solid that has two *bases* that are identical. In this prism, the bases are right triangles.



Volume: We can calculate the volume of any prism by multiplying the area of the base by the height.

Volume = Area of Base • Height

Volume = $\frac{1}{2}(5 \cdot 12) \cdot 14 = 30 \cdot 14 = 420$ cubic inches

Surface area: This is the sum of the area of each face.

This prism has two triangular faces and three rectangular faces.

Surface Area = $30 + 30 + 70 + 168 + 182 = 480$ square inches

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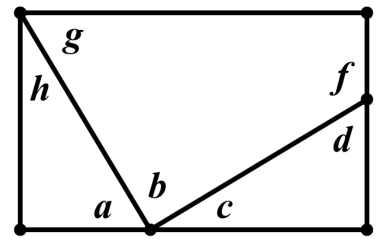
Unit 7.7, Family Resource

Try This at Home

Angle Relationships

Here is a rectangle.



1.1 List two angles that are **complementary.**

1.2 List two angles that are **supplementary.**

1.3 If angle h is $31°$, determine the measure of angle g. Label it on the diagram.

1.4 If angle f is $121°$, determine the measure of angle d. Label it on the diagram.

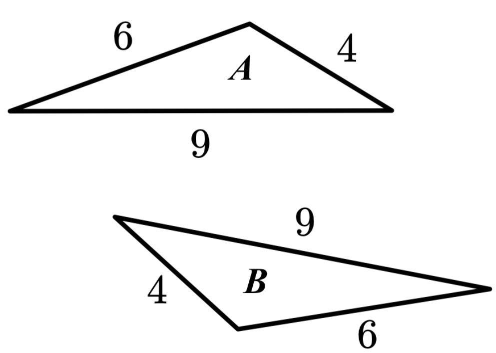
1.5 If the measure of angle b is $90°$, are angles a and c complementary? Explain your thinking.

Drawing Triangles

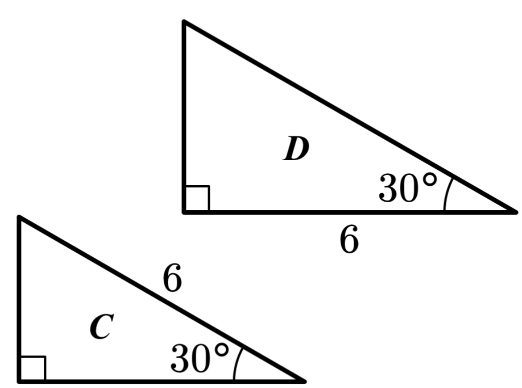
2. How many nonidentical triangles can be made using the side lengths 5 cm, 15 cm, and 25 cm? Explain your thinking.

For each pair of triangles, explain what is similar and different about the triangles. Then determine whether or not the triangles are identical copies.

3.1

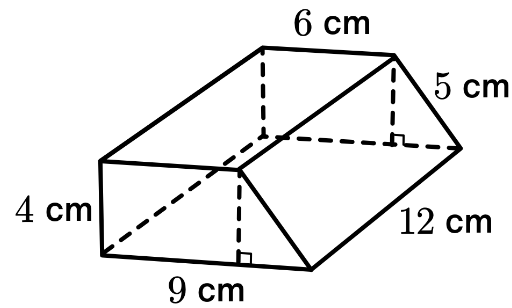


3.2



Solid Geometry

Here is a prism.



4.1 Shade one base of the prism.

4.2 Calculate the volume of this prism. Organize your calculations so that others can follow them.

4.3 How many faces does the prism have?

4.4 Calculate the surface area of this prism. Organize your calculations so that others can follow them.

4.5 If this were a box and you wanted to know how much cardboard you would need to build it, what would be more useful information: volume or surface area? Explain your thinking.

Unit 8 Summary

Prior Learning

Math 6
- Statistical variability
- Data distributions

Math 7
- Proportional reasoning (Unit 2)
- Percent change (Unit 4)

Math 7, Unit 8

- Probability
- Sampling
- Using center and variability to compare populations.

Future Learning

Math 8, Unit 6
- Scatter plots
- Lines of best fit

Probability

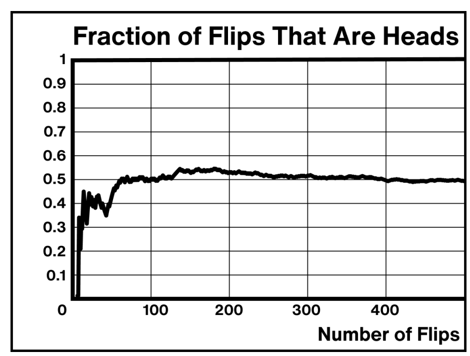
A *probability* is a number that represents how likely something is to happen.

If you flip a coin, the probability of the coin landing heads up is 0.5.

The probability that the coin turns into a bunny is 0.

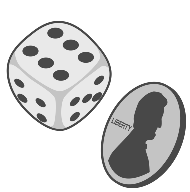
When you repeat an experiment, the results get closer and closer to the probability.

If you flip a coin 100 times, it might land heads up 50 times, 49 times, 52 times, or maybe even 60 times. As you flip the coin more times, the fraction of heads gets closer to 0.5.



In an experiment, it is often helpful to know the *sample space*, a list of every possible outcome.

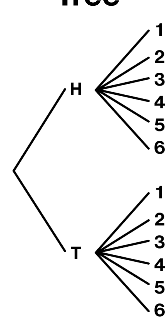
Here are two ways to represent the 12 possible outcomes of flipping a coin and then rolling a number cube.



Table

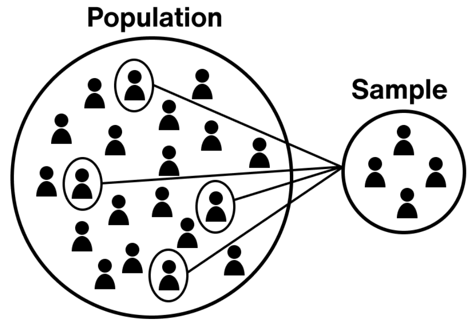
	1	2	3	4	5	6
H						
T						

Tree



Sampling

Sometimes we want to know information about a group, but the group is too large for us to be able to ask everyone. It can be useful to collect data from a *sample* (some of the group) of the *population* (the whole group).



For example, we might want to know what percentage of Americans work from home. It would be too challenging to ask all Americans, so we can ask a smaller sample of working Americans.

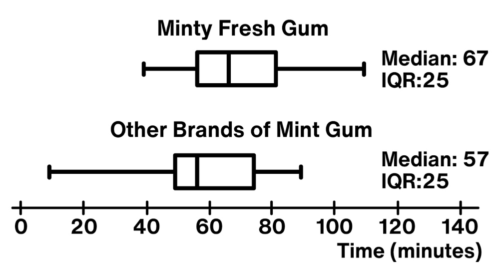
If our sample is some employees at a grocery store, we may get very different results than if our sample is some employees of a technology company. Neither sample is representative of the population of all working Americans.

A sample selected at random is most likely to be *representative* of the population because it has the chance to include all kinds of working adults.

We can use samples to estimate information about a population and to make comparisons.

For example, the Minty Fresh company collects data from a sample of gum buyers to see how many minutes it takes for their mint gum to lose flavor compared to other brands.

These box plots show that the median time for the sample of Minty Fresh Gum is longer than the sample of other brands.



However, there may not be a difference between two populations because there is a lot of overlap between the two samples, and because the difference in the medians is less than one IQR (interquartile range).

If you are interested in learning more about how these statistical measures are calculated, see the Statistics Summary.

Solutions

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Unit 7.1, Family Resource

Solutions:

1.1 Copy 1 is a scaled copy of the original triangle. The scale factor is 2 because each side in Copy 1 is twice as long as the corresponding side in the original triangle. $5 \cdot 2 = 10$, $4 \cdot 2 = 8$, $(6.4) \cdot 2 = 12.8$.

1.2 Copy 2 is a scaled copy of the original triangle. The scale factor is $\frac{1}{2}$ or 0.5 because each side in Copy 2 is half as long as the corresponding side in the original triangle. $5 \cdot (0.5) = 2.5$, $4 \cdot (0.5) = 2$, $(6.4) \cdot (0.5) = 3.2$.

1.3 Copy 3 is not a scaled copy of the original triangle. The shape has been distorted. The angles are different sizes, and there is not one number we can multiply by each side length of the original triangle to get the corresponding side length in Copy 3.

1.4 *Responses vary.* Sample response: A right triangle with side lengths of 12, 15, and 19.2 units would be a scaled copy of the original triangle using a scale factor of 3.

2.1 24 feet wide and 33 feet long. Since each inch on the drawing represents 6 feet, we can multiply by 6 to find the actual measurements. The actual classroom is 24 feet wide because $4 \cdot 6 = 24$. The classroom is 33 feet long because $5\frac{1}{2} \cdot 6 = 5 \cdot 6 + \frac{1}{2} \cdot 6 = 30 + 3 = 33$.

2.2 $\frac{1}{2}$ inch wide and 1 inch long. We can divide by 6 to find the measurements on the drawing. $6 \div 6 = 1$ and $3 \div 6 = \frac{1}{2}$.

2.3 A. 1 in. to 5 ft.

The scale "1 in. to 5 ft." would make a scale drawing that is larger than the scale "1 in. to 6 ft." because Xavier would need more inches on the drawing to represent the same actual length.

The scale "1 in. to 6 ft." is equivalent to the scale "2 in. to 12 ft.," because 1 inch would represent the same actual length in both scales.

The scale "2 in. to 15 ft." would make a scale drawing that is smaller than the scale "1 in. to 6 ft." because each inch on the new drawing would represent more actual length.

desmos

Unit 7.2, Family Resource

Solutions:

1. *Responses vary.*

Cups of Soda Water	Cups of Pineapple Juice
5	2
10	4
2.5	1

2. 8 cups of pineapple juice would be needed for 20 cups of soda water. One way to think about this is that you need 4 times the recipe because $5 \cdot 4 = 20$, and so $2 \cdot 4 = 8$ cups. Another way to think about it is that there are $\frac{2}{5}$, or 0.4, cups of pineapple juice per cup of soda water. Therefore, you would need $\frac{2}{5} \cdot 20 = 8$ cups of pineapple juice.

3. 50 cups of soda water would be needed for 20 cups of pineapple juice. There are $\frac{5}{2}$, or 2.5, cups of soda water per cup of pineapple juice. $\frac{5}{2} \cdot 20 = 50$ cups of soda water.

4. Both $\frac{2}{5}$ and $\frac{5}{2}$ are constants of proportionality for this situation.

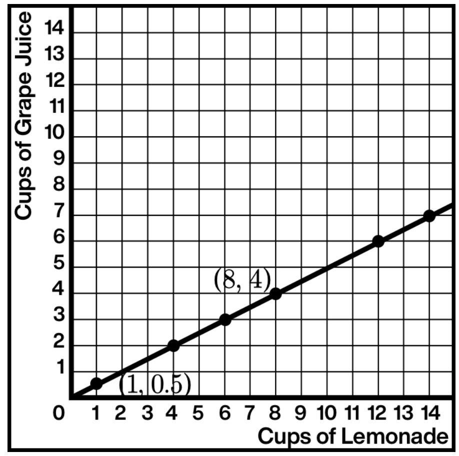
5. Two equations that represent this situation are $p = 0.4s$ and $s = 2.5p$, where s represents the number of cups of soda water and p represents the number of cups of pineapple juice used.

6. See above.

7. ✓ $m = \frac{1}{4}j$

   ✓ $c = 6.28r$

8.



9. The point $(8, 4)$ means that you can make Grape-Ade using 8 cups of lemonade and 4 cups of grape juice.

10. The constant of proportionality is 0.5 or $\frac{1}{2}$. You can see this as the second coordinate of the point $(1, 0.5)$, or in the simplified ratio $\frac{4}{8} = \frac{1}{2}$.

11. *Responses vary.*
    - Miles driven on a new tank vs. gallons of gas used
    - Number of toy cars purchased vs. cost
    - Amount of flour used in cookies vs. number of cookies baked

12. *Responses vary.* The meaning of the constant of proportionality often involves “per” or “for every.”

desmos

Unit 7.3, Family Resource

Solutions:

1.1 BP, CP, DP, EP, FP

1.2 AB, CD

2.1 6 centimeters. This would be the radius of the circle, which is half of the diameter.

2.2 Yes.

Explanations vary. The distance around the candle is its circumference, which would be $C = \pi(12) = 12\pi \approx 37.7$ centimeters. This means a 40-centimeter ribbon would wrap around.

3. $4\pi + 10$ units

The perimeter of the outside of the shape is $\frac{3}{4} \cdot \pi \cdot 4 = 3\pi$ units plus 8 units for the straight edges. The perimeter of the inside of the shape is 2 units plus $\frac{1}{2} \cdot \pi \cdot 2 = \pi$ units. $(3\pi + 8) + (\pi + 2) = 4\pi + 10$ units.

4.1 $\pi(3^2) = 9\pi \approx 28.3$ square inches

4.2 $800 - 9\pi \approx 771.7$ square inches

5. $2.5\pi + 8$ square units

The area of the large shape is $\frac{3}{4} \cdot \pi \cdot (2^2) = 3\pi$ square units for the part of a circle plus $2 \cdot 4 = 8$ square units for the area of the rectangle. The area of the hole is $\frac{1}{2} \cdot \pi \cdot (1^2) = 0.5\pi$ square units. $(3\pi + 8) - (0.5\pi) = 2.5\pi + 8$ square units.

desmos

Unit 7.4, Family Resource

Solutions:

1.1 $\$30$. One approach is to divide the cost by the weight to find the cost per pound.

$9 \div 1\frac{1}{2} = 6$ dollars per pound. 5 pounds at that rate is $\$30$.

1.2 Coleslaw is more expensive. One approach is to divide each cost by each weight.

Potato salad: $9 \div 1\frac{1}{2} = 6$ dollars per pound

Coleslaw: $11.20 \div 1\frac{3}{4} = 6.40$ per pound

2. $\$9\,769.50$. One approach is to multiply $8350 \cdot 1.17 = 9769.5$.

3. 60°. One approach is to write and solve an equation, where 90% of some number is 54°:

$0.9x = 54 \rightarrow x = \frac{54}{0.9} = 60$.

4. About 17.3%. One approach is write and solve an equation, where 18.75 multiplied by an unknown number is 22. $18.75x = 22 \rightarrow x = \frac{22}{18.75} 1.17333....$ The 1 that comes before the decimal represents the original 100%, while the rest of the decimal number is the growth. When written as a rounded percent, $.17333$ is 17.3%.

5.1 $\$29.07$. One approach is to calculate $34.20 \cdot 0.85$, which is 29.07.

5.2 $\$30.52$. One approach is to multiply the answer from the previous problem, 29.07, by 1.05.

desmos

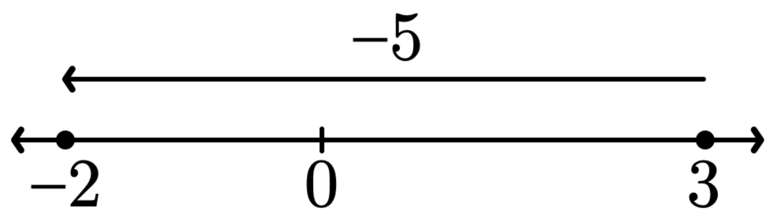
Unit 7.5, Family Resource

Solutions:

1. ✓ $-5 + 3$

   ✓ $3 - 5$

2.



3.1 $a = 7$

3.2 $b = -4.5$

3.3 $c = -2$

4.1 -10. *Explanations vary*. This number tells us that the turtle's position in 5 seconds will be -10 feet.

4.2 Where will the turtle be in 5 seconds?

4.3 Where was the turtle 5 seconds ago?

4.4 When was the turtle at 5 feet?

5. The Arctic summer sea ice changed the most from 1980 to 1990.

6. $6\ 140\ 000 - 7\ 670\ 000 = -1\ 530\ 000$ square kilometers.

7. On average, Between 1980 and 1990, the ice changed by $\frac{6\ 140\ 000-7\ 670\ 000}{10}$

   $= -153\ 000$ square kilometers per year.

desmos

Unit 7.6, Family Resource

Solutions:

1.1

24			
x	x	x	6

1.2

24		
$x+6$	$x+6$	$x+6$

1.3 $3(x + 6) = 24$. *Explanations vary.* Each of the pastries uses 6 tablespoons plus a little more, so there are 3 groups and each group has more than 6 tablespoons in it.

1.4 *Responses vary.* My brother, my half sister, and I open up a new box of 24 cookies. Yum! We each eat the same number so it's fair. When we're done, there's 6 left over for our mom.

Strategies vary.

2.1
$$3x + 6 = 24$$
$$3x = 18$$
$$x = 6$$

2.2
$$24 = 3(x + 6)$$
$$8 = x + 6$$
$$2 = x$$

2.3
$$-2(x + 6) = 30$$
$$-2x - 12 = 30$$
$$-2x = 42$$
$$x = -21$$

2.4
$$5 - 2(x + 6) =$$
$$5 - 2x - 12 =$$
$$-2x - 7 = 3$$
$$-2x = 37$$
$$x = -\frac{37}{2}$$

3.1 $5x + 8 - 2x + 1 = 3x + 9$

3.2 $6(4x - 3) = 24x - 18$

3.3 $(5x + 8) - (2x + 1) = 3x + 7$

3.4 $-12x + 9 = -3(4x - 3)$

4.1 Yes! Malik will make $3(8) = 24$ dollars. If we add that to the \$10.50 he already has, that is more than \$30.

4.2 $3c + 10.50 \geq 30$. The $3c + 10.50$ is like how much money he earns, and he wants to earn *at least* \$30, so the total needs to be greater than or equal to 30.

4.3 $3c + 10.50 \geq 30$

$$3c + 10.50 = 30$$
$$3c = 19.50$$
$$c = 6.5$$

$$c \geq 6.5$$

4.4 Since Malik cannot do half of a chore, he needs to do 7 or more chores to reach his goal.

desmos

Unit 7.7, Family Resource

Solutions:

1.1 Angles g and h

1.2 Angles d and f

1.3 $g = 59°$ $(31 + 59 = 90)$

1.4 $d = 59°$ $(121 + 59 = 180)$

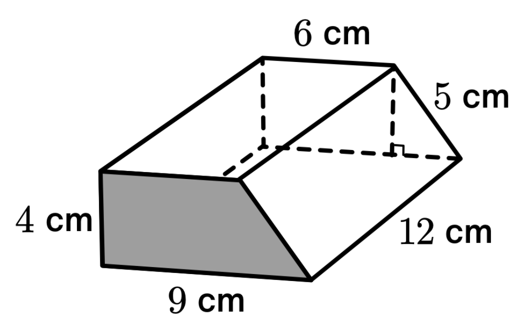
1.5 Yes. *Explanations vary.* The sum of the measures of angles a, b, and c is $180°$. If the measure of angle b is $90°$, then the measures of the other two angles must add up to $90°$, which means they are complementary angles.

2. None. *Explanations vary.* In order to connect and make a triangle, the two shortest sides need to be longer than the third side. $5 + 15 < 25$, so the sides are too short to create a triangle.

3.1 These are identical triangles. They are the same shape and size, even though one triangle is turned in a different direction.

3.2 These are not identical triangles. They are the same shape, but not the same size. Both triangles are facing the same direction and both have two equal sides. The equal sides in triangle D are 6 units long. The equal sides in triangle C are less than 6 units long.

4.1 See figure.



4.2 Base Area = Area of Rectangle + Area of Triangle

$A = 4 \cdot 6 + \frac{1}{2} \cdot 4 \cdot 3 = 24 + 6 = 30$ square cm

Volume = Base Area • Height

$V = 30 \cdot 12 = 360$ cubic cm

4.3 6 faces. 2 bases and 4 other faces.

4.4 *Strategies vary.*

- Surface Area $= 30 + 30 + 108 + 60 + 72 + 48 = 348$ square units
- Surface Area $= 2(30) + 12(9 + 5 + 6 + 4) = 60 + 12(24) = 348$ square units

4.5 Surface area. *Explanations vary.* Surface area is the number of square units that covers all the faces of the object, without any gaps or overlaps. Volume is more about the amount of space that fills up an object.

Solutions:

1.1 $\frac{1}{4}$ (or equivalent)

1.2 No. *Explanations vary.* With a sample of only 5 lollipops, it isn't surprising. The more lollipops you buy, the closer the fraction of strawberry lollipops will get to the probability.

1.3 *Responses vary.* Even though about 25% of your lollipops will be mango, we do not know exactly how many will be. It might be 50 lollipops, slightly more, or slightly less. There is even a small chance it will be way more or less than 50.

2.1 10 possible outcomes

2.2 $\frac{1}{10}$ (or equivalent)

2.3 $\frac{3}{10}$ (or equivalent)

3.1 *Responses vary.*

- Put the addresses of all the buildings into a computer and have the computer select 50 addresses randomly from the list.
- Put all of the street names in a bag. Pick several streets randomly and then test all the houses on that street.

3.2 *Responses vary.*

- Testing all the same type of buildings (like all the schools or all the gas stations).
- Testing buildings all in the same location, such as the buildings closest to city hall.
- Testing all the newest buildings or all of the oldest buildings.
- Testing a small number of buildings, like 5 or 10.

4. No, she does not need to be nervous.

Explanations vary. Even though this year, the mean height of her sample is less than it was last year, the difference is not that big. This year's plants are 4.5 inches shorter than last year's, which is less than the MAD. This means it's more likely that she just happened to end up with smaller plants in her sample, but that the populations are not that different.