Unpacking the Standards

The topics described in the Standards for Mathematical Content will vary from year to year. However, the *way* in which you learn, study, and think about mathematics will not. The Standards for Mathematical Practice describe skills that you will use in all of your math courses. These pages show some features of your book that will help you gain these skills and use them to master this year's topics.

MP.1.1 Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem… They analyze givens, constraints, relationships, and goals. They make conjectures about the form… of the solution and plan a solution pathway…

EXAMPLE 3 Problem Solving — FL 8.EE.3.7b

The Coleman family had their bill at a restaurant reduced by $7.50 because of a special discount. They left a tip of $8.90, which was 20% of the reduced amount. How much was their bill before the discount?

Analyze Information

The answer is the amount before the discount.

Formulate a Plan

Use an equation to find the amount before the discount.

Solve

STEP 1 Write the equation $0.2(x - 7.5) = 8.9$, where x is the amount of the Coleman family's bill before the discount.

STEP 2 Use the Distributive Property: $0.2x - 1.5 = 8.9$

STEP 3 Use inverse operations to solve the equation.

$$0.2x - 1.5 = 8.9$$
$$\underline{+1.5 \quad +1.5} \qquad \text{Add 1.5 to both sides.}$$
$$0.2x = 10.4$$
$$\frac{0.2x}{0.2} = \frac{10.4}{0.2} \qquad \text{Divide both sides by 0.2.}$$
$$x = 52$$

The Coleman family's bill before the discount was $52.00.

Math Talk — Mathematical Practices: Why do you use 0.2 in Step 1?

Problem-solving examples and exercises lead students through problem solving steps.

MP.2.1 Reason abstractly and quantitatively.

Mathematically proficient students… bring two complementary abilities to bear on problems…: the ability to decontextualize—to abstract a given situation and represent it symbolically… and the ability to contextualize, to pause… in order to probe into the referents for the symbols involved.

H.O.T. FOCUS ON HIGHER ORDER THINKING

29. **Draw Conclusions** Which measurement would be least

Unit 1 Performance Tasks

1. **CAREERS IN MATH** **Astronomer** An astro

Focus on Higher Order Thinking exercises in every lesson and **Performance Tasks** in every unit require you to use logical reasoning, represent situations symbolically, use mathematical models to solve problems, and state your answers in terms of a problem context.

MP.3.1 Construct viable arguments and critique the reasoning of others.

Mathematically proficient students… justify their conclusions, [and]… distinguish correct… reasoning from that which is flawed.

Reflect

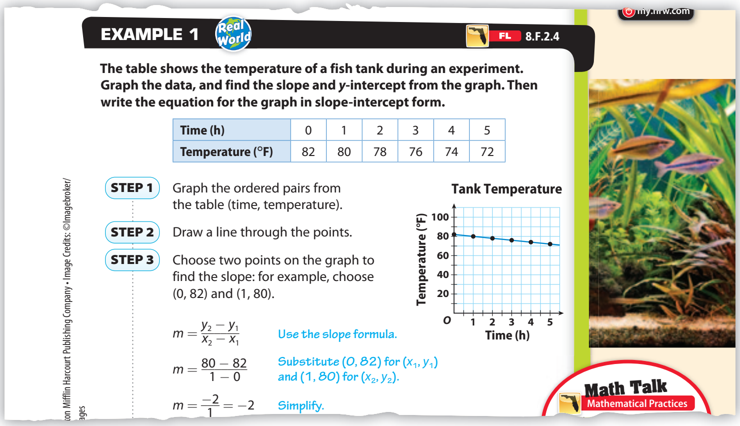
2. **Make a Conjecture** Use your results from parts E, H, and
a conjecture about translations.

ESSENTIAL QUESTION CHECK-IN

Essential Question Check-in and **Reflect** in every lesson ask you to evaluate statements, explain relationships, apply mathematical principles, make conjectures, construct arguments, and justify your reasoning.

MP.4.1 Model with mathematics.

Mathematically proficient students can apply… mathematics… to… problems… in everyday life, society, and the workplace.


EXAMPLE 1 Real World FL 8.F.2.4

The table shows the temperature of a fish tank during an experiment. Graph the data, and find the slope and y-intercept from the graph. Then write the equation for the graph in slope-intercept form.

Time (h)	0	1	2	3	4	5
Temperature (°F)	82	80	78	76	74	72

STEP 1 Graph the ordered pairs from the table (time, temperature).

STEP 2 Draw a line through the points.

STEP 3 Choose two points on the graph to find the slope: for example, choose (0, 82) and (1, 80).

$m = \frac{y_2 - y_1}{x_2 - x_1}$ Use the slope formula.

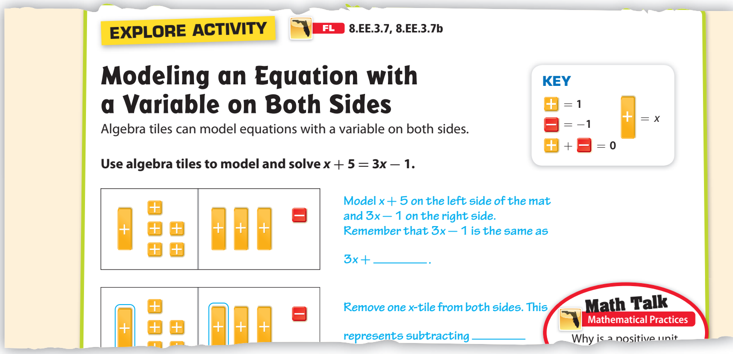
$m = \frac{80 - 82}{1 - 0}$ Substitute (0, 82) for (x_1, y_1) and (1, 80) for (x_2, y_2).

$m = \frac{-2}{1} = -2$ Simplify.

Real-world examples and **mathematical modeling** apply mathematics to other disciplines and real-world contexts such as science and business.

MP.5.1 Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a… problem… [and] are… able to use technological tools to explore and deepen their understanding…


EXPLORE ACTIVITY FL 8.EE.3.7, 8.EE.3.7b

Modeling an Equation with a Variable on Both Sides

Algebra tiles can model equations with a variable on both sides.

Use algebra tiles to model and solve $x + 5 = 3x - 1$.

Model $x + 5$ on the left side of the mat and $3x - 1$ on the right side. Remember that $3x - 1$ is the same as $3x +$ ______.

Remove one x-tile from both sides. This represents subtracting ______

Exploration Activities in lessons use concrete and technological tools, such as manipulatives or graphing calculators, to explore mathematical concepts.

MP.6.1 Attend to precision.

Mathematically proficient students… communicate precisely… with others and in their own reasoning… [They] give carefully formulated explanations…

19. Communicate Mathematical Ideas Explain how you can fir
height of a cylinder if you know the diameter and the volum
an example with your explana

straight line.

Key Vocabulary

slope *(pendiente)*
A measure of the steepness of a line on a graph; the rise

Precision refers not only to the correctness of calculations but also to the proper use of mathematical language and symbols. **Communicate Mathematical Ideas** exercises and **Key Vocabulary** highlighted for each module and unit help you learn and use the language of math to communicate mathematics precisely.

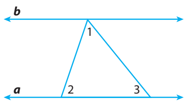
MP.7.1 Look for and make use of structure.

Mathematically proficient students… look closely to discern a pattern or structure… They can also step back for an overview and shift perspectives.

Follow the steps to informally prove the Triangle Sum Theorem. You should draw each step on your own paper. The figures below are provided for you to check your work.

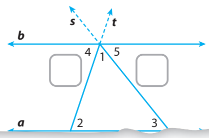
A Draw a triangle and label the angles as $\angle 1$, $\angle 2$, and $\angle 3$ as shown.

B Draw line *a* through the base of the triangle.



C The Parallel Postulate states that through a point not on a line ℓ, there is exactly one line parallel to line ℓ. Draw line *b* parallel to line *a*, through the vertex opposite the base of the triangle.

D Extend each of the non-base sides of the triangle to form transversal *s* and transversal *t*. Transversals *s* and *t* intersect parallel lines *a* and *b*.



E Label the angles formed by line *b* and the transversals as $\angle 4$ and $\angle 5$.

F Because $\angle 4$ and ________ are alternate interior

Throughout the lessons, you will observe regularity in mathematical structures in order to make generalizations and make connections between related problems. For example, you can apply your knowledge of geometric theorems to determine when an auxiliary line would be helpful.

MP.8.1 Look for and express regularity in repeated reasoning.

Mathematically proficient students… look both for general methods and for shortcuts… [and] maintain oversight of the process, while attending to the details.

Use your pattern to complete this equation: $(7^2)^4 = 7^{\square}$.

B Describe any patterns you see. Use your pattern to deterr
of 1 pencil.

20. Look for a Pattern Describe the pattern in the equation. The
equation.

$$0.3x + 0.03x + 0.003x + 0.0003x + \ldots = 3$$

You will look for repeated calculations and mathematical patterns in examples and exercises. Recognizing patterns can help you make generalizations and obtain a better understanding of the underlying mathematics.

FL **8.EE.1.1**

Know and apply the properties of integer exponents to generate equivalent numerical expressions.

Key Vocabulary

integer *(entero)*
The set of whole numbers and their opposites.

exponent *(exponente)*
The number that indicates how many times the base is used as a factor.

What It Means to You

You will use the properties of integer exponents to find equivalent expressions.

UNPACKING EXAMPLE 8.EE.1.1

Evaluate two different ways.

$\frac{5^4}{5^4}$

$$\frac{5^4}{5^4} = \frac{5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5 \cdot 5 \cdot 5} = \frac{1}{1} = 1$$

$$\frac{5^4}{5^4} = 5^{(4-4)} = 5^0 = 1$$

$\frac{8^3}{8^5}$

$$\frac{8^3}{8^5} = \frac{8 \cdot 8 \cdot 8}{8 \cdot 8 \cdot 8 \cdot 8 \cdot 8} = \frac{1}{8 \cdot 8} = \frac{1}{64}$$

$$\frac{8^3}{8^5} = 8^{(3-5)} = 8^{-2} = \frac{1}{8^2} = \frac{1}{8 \cdot 8} = \frac{1}{64}$$

$2^3 \cdot 2^4$

$$2^3 \cdot 2^4 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 128$$

$$2^3 \cdot 2^4 = 2^{(3+4)} = 2^7 = 128$$

$(3^2)^4$

$$(3^2)^4 = (3^2)(3^2)(3^2)(3^2) = 3^{2+2+2+2} = 3^8 = 6{,}561$$

$$(3^2)^4 = 3^{(2 \cdot 4)} = 3^8 = 6{,}561$$

FL 8.EE.1.2

Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

Key Vocabulary

square root *(raíz quadrada)*
A number that is multiplied by itself to form a product is called a square root of that product.

cube root *(raíz cúbica)*
A number, written as $\sqrt[3]{x}$, whose cube is x.

perfect square *(cuadrado perfecto)*
A square of a whole number.

perfect cube *(cubo perfecto)*
A cube of a whole number.

rational number *(número racional)*
Any number that can be expressed as a ratio of two integers.

irrational number *(número irracional)*
A number that cannot be expressed as a ratio of two integers or as a repeating or terminating decimal.

What It Means to You

You will solve simple equations by finding square roots and cube roots. You will use square root and cube root symbols to represent irrational solutions.

UNPACKING EXAMPLE 8.EE.1.2

Solve $x^2 = 25$.

$x^2 = 25$ Read "x squared equals 25."

$x = \pm\sqrt{25}$ Represent the solutions using the square root symbol.

$x = \pm 5$ Evaluate the square root.

There are two solutions because $5 \cdot 5$ and $-5 \cdot (-5)$ both equal 25.

Solve $x^3 = 64$.

$x^3 = 64$ Read "x cubed equals 64."

$x = \sqrt[3]{64}$ Represent the solution using the cube root symbol.

$x = 4$ Evaluate the cube root.

Solve $x^2 = 2$.

$x^2 = 2$ Read "x squared equals 2."

$x = \pm\sqrt{2}$ Represent the solutions using the square root symbol.

Because 2 is not a perfect square, $\sqrt{2}$ is an irrational number.

Solve $x^3 = 4$.

$x^3 = 4$ Read "x cubed equals 4."

$x = \sqrt[3]{4}$ Represent the solution using the cube root symbol.

Because 4 is not a perfect cube, $\sqrt[3]{4}$ is an irrational number.

FL **8.EE.1.3**

Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.

Key Vocabulary

scientific notation *(notación científica)*
A method of writing very large or very small numbers by using powers of 10.

What It Means to You

You will convert very large numbers to scientific notation.

UNPACKING EXAMPLE 8.EE.1.3

There are about 55,000,000,000 cells in an average-sized adult. Write this number in scientific notation.

Move the decimal point to the left until you have a number that is greater than or equal to 1 and less than 10.

5.5 0 0 0 0 0 0 0 0 0 0 *Move the decimal point 10 places to the left.*

5.5 *Remove the extra zeros.*

You would have to multiply 5.5 by 10^{10} to get 55,000,000,000.

$55{,}000{,}000{,}000 = 5.5 \times 10^{10}$

FL **8.EE.1.4**

Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Key Vocabulary

scientific notation *(notación científica)*
A method of writing very large or very small numbers by using powers of 10.

What It Means to You

You will perform operations with very large and very small quantities that are written in scientific notation.

UNPACKING EXAMPLE 8.EE.1.4

It makes sense to use kilograms rather than grams or milligrams to measure the mass of a planet.

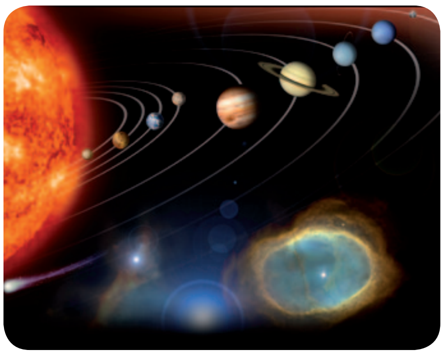
The mass of Jupiter is 1.89×10^{27} kg, and the mass of Earth is 5.97×10^{24} kg. About how many times greater is the mass of Jupiter than the mass of Earth? Write your answer in scientific notation.

$$\frac{1.89 \times 10^{27}}{5.97 \times 10^{24}} = \frac{1.89}{5.97} \times \frac{10^{27}}{10^{24}}$$

$$\approx 0.3166 \times 10^{3}$$

$$\approx 3.166 \times 10^{2}$$

The mass of Jupiter is about 3.166×10^{2} times the mass of Earth.



If you performed the calculations above on a calculator, your answer might look like this: 3.166E2.

FL 8.EE.2.5

Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

Key Vocabulary

proportional relationship *(relación proporcional)*
A relationship between two quantities in which the ratio of one quantity to the other quantity is constant.

slope *(pendiente)*
A measure of the steepness of a line on a graph; the rise divided by the run.

unit rate *(tasa unitaria)*
A rate in which the second quantity in the comparison is one unit.

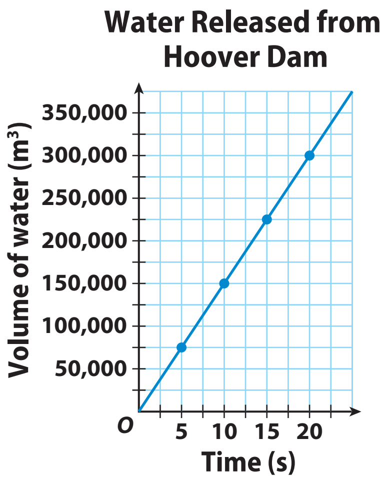
What It Means to You

You will use data from a table and a graph to apply your understanding of rates to analyzing real-world situations.

UNPACKING EXAMPLE 8.EE.2.5

The table shows the volume of water released by Hoover Dam over a certain period of time. Use the data to make a graph. Find the slope of the line and explain what it shows.

Water Released from Hoover Dam	
Time (s)	**Volume of water (m^3)**
5	75,000
10	150,000
15	225,000
20	300,000



The slope of the line is 15,000. This means that for every second that passed, 15,000 m^3 of water was released from Hoover Dam.

Suppose another dam releases water over the same period of time at a rate of 180,000 m^3 per minute. How do the two rates compare?

180,000 m^3 per minute is equal to 3,000 m^3 per second. This rate is one fifth the rate released by the Hoover Dam over the same time period.

FL **8.EE.2.6**

Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.

Key Vocabulary

similar *(semejantes)*
Figures with the same shape but not necessarily the same size.

slope *(pendiente)*
A measure of the steepness of a line on a graph; the rise divided by the run.

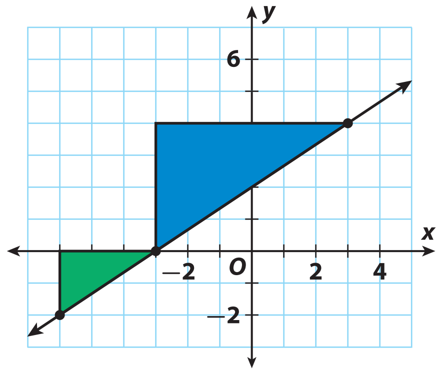
What It Means to You

You will use similar triangles to understand why the slope of a line is the same between any two points on the line and then derive one form of an equation of a line.

UNPACKING EXAMPLE 8.EE.2.6

The green triangle and the blue triangle are constructed between points on the same line. The triangles are similar.

Show that the ratio of the vertical height to the horizontal length is the same for both triangles.



Green triangle: $= \dfrac{\text{vertical height}}{\text{horizontal length}} = \dfrac{2}{3}$

Blue triangle: $= \dfrac{\text{vertical height}}{\text{horizontal length}} = \dfrac{4}{6} = \dfrac{2}{3}$

The ratio of the vertical height to the horizontal length is $\frac{2}{3}$ for both triangles. It will be the same no matter where these two triangles are positioned along the line. This constant ratio is the slope of the line.

To show that an equation of the line through $(0, b)$ and (x, y) is $y = mx + b$, express the slope using x, y, and b and solve for y.

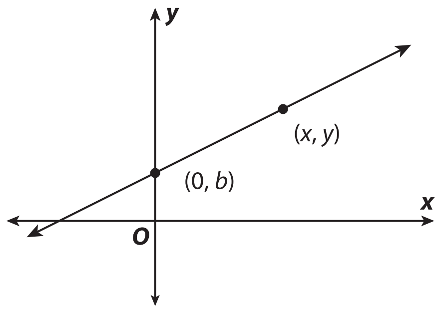
$$m = \frac{\text{rise}}{\text{run}}$$

$$m = \frac{y - b}{x - 0}$$

$$m = \frac{y - b}{x}$$

$$y - b = mx$$

$$y = mx + b$$



When $b = 0$, the line passes through the origin $(0, 0)$ and the equation becomes $y = mx$.

FL 8.EE.3.7a

Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).

Key Vocabulary

linear equation in one variable *(ecuación lineal en una variable)*
An equation that can be written in the form $ax = b$ where a and b are constants and $a \neq 0$.

What It Means to You

You will identify the number of solutions an equation has.

UNPACKING EXAMPLE 8.EE.3.7a

Your gym charges \$50 per month. Find the number of months for which your costs will equal the cost of membership at each gym shown.

A: \$40 per month plus \$100 one-time fee
$50x = 40x + 100 \rightarrow x = 10$
Equal in 10 months $\rightarrow$ one solution

B: \$50 per month plus \$25 one-time fee
$50x = 50x + 25 \rightarrow 0 = 25$
Never equal $\rightarrow$ no solution

C: \$40 per month plus \$10 monthly garage fee
$50x = 40x + 10x \rightarrow x = x$
Equal for any number of months $\rightarrow$ infinitely many solutions

FL 8.EE.3.7b

Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

Key Vocabulary

solution *(solución)*
In an equation, the value for the variable that makes the equation true.

What It Means to You

You can write and solve an equation that has a variable on both sides of the equal sign.

UNPACKING EXAMPLE 8.EE.3.7b

Yellow Taxi has no pickup fee but charges \$0.25 per mile. AAA Taxi charges \$3 for pickup and \$0.15 per mile. Find the number of miles for which the cost of the two taxis is the same.

$$\begin{aligned} 0.25x &= 3 + 0.15x \\ 100(0.25x) &= 100(3) + 100(0.15x) \\ 25x &= 300 + 15x \\ 10x &= 300 \\ x &= 30 \end{aligned}$$

The cost is the same for 30 miles.

FL 8.EE.3.8a

Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

FL 8.EE.3.8b

Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.

Key Vocabulary

solution of a system of equations *(solución de un sistema de ecuaciones)* A set of values that make all equations in a system true.

system of equations *(sistema de ecuaciones)* A set of two or more equations that contain two or more variables.

What It Means to You

You will understand that the points of intersection of two or more graphs represent the solution to a system of linear equations.

UNPACKING EXAMPLE 8.EE.3.8a, 8.EE.3.8b

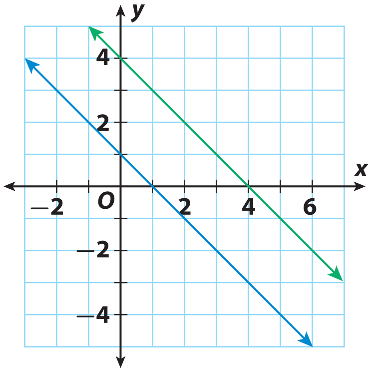
Use the elimination method.

A.

$$\begin{aligned} -x &= -1 + y \\ \underline{x + y} &= \underline{4 \quad\quad} \\ y &= y + 3 \end{aligned}$$

This is never true, so the system has no solution.

The lines never intersect.



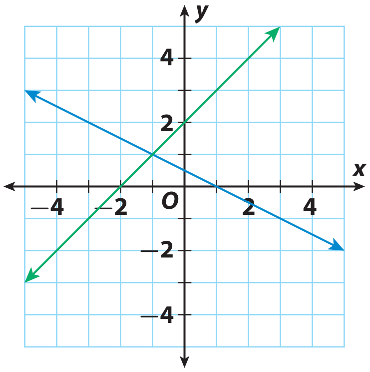
B.

$$2y + x = 1$$
$$y - 2 = x$$

Use the substitution method.

$$\begin{aligned} 2y + (y - 2) &= 1 \\ 3y - 2 &= 1 \\ y &= 1 \end{aligned}$$

$$\begin{aligned} x &= y - 2 \\ x &= 1 - 2 \\ &= -1 \end{aligned}$$



There is only one solution: $x = -1, y = 2$

The lines intersect at a single point: $(-1, 2)$

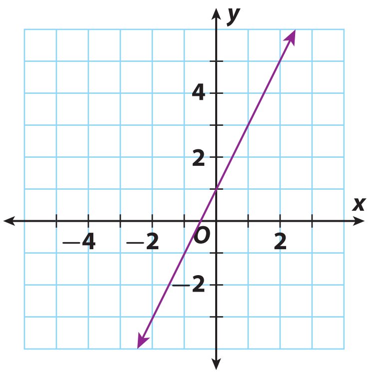
C.

$$3y - 6x = 3$$
$$y - 2x = 1$$

Use the multiplication method.

$$\begin{aligned} 3y - 6x &= 3 \\ \underline{3y - 6x} &= \underline{3} \\ 0 &= 0 \end{aligned}$$

This is always true. So the system has infinitely many solutions.



The graphs overlap completely. They are the same line.

FL **8.EE.3.8c**

Solve real-world and mathematical problems leading to two linear equations in two variables.

Key Vocabulary

linear equation *(ecuación lineal)*
An equation whose solutions form a straight line on a coordinate plane.

What It Means to You

You will solve a real-world problem by writing and solving a system of linear equations.

UNPACKING EXAMPLE 8.EE.3.8c

The admission fee at a petting zoo is \$1.50 for children and \$4.00 for adults. On Sunday, 1,100 people entered the petting zoo and \$2,525 was collected. How many children and how many adults were at the petting zoo on Sunday?

Step 1: Choose variables and write a system of equations.

Let x represent the number of children.
Let y represent the number of adults.

Admission fee: $1.50x + 4.00y = 2{,}525$
Attendance: $x + y = 1{,}100$

Step 2: Solve one of the two equations for one variable, such as y.

$$x + y = 1{,}100$$
$$y = 1{,}100 - x$$

Step 3: Substitute the expression for y in the other equation and solve for x.

$$\begin{aligned} 1.50x + 4.00y &= 2{,}525 \\ 1.50x + 4.00(1{,}100 - x) &= 2{,}525 \\ 1.50x + 4{,}400 - 4x &= 2{,}525 \\ -2.5x + 4{,}400 &= 2{,}525 \\ -2.5x &= -1{,}875 \\ x &= 750 \end{aligned}$$

Step 4: Substitute for x in one of the original equations and solve for y.

$$x + y = 1{,}100$$
$$750 + y = 1{,}100$$
$$y = 350$$

FL **8.F.1.1**

Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

Key Vocabulary

function *(función)*
An input-output relationship that has exactly one output for each input.

What It Means to You

You will identify sets of ordered pairs that are functions. A function is a rule that assigns exactly one output to each input.

UNPACKING EXAMPLE 8.F.1.1

Does the following table of inputs and outputs represent a function?

Input	Output
14	110
20	130
22	120
30	110

Yes, it is a function because each number in the input column is assigned to only one number in the output column.

The graph of the function is the set of ordered pairs (14, 110), (20, 130), (22, 120), and (30, 110).

FL **8.F.1.2**

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

What It Means to You

You will learn to identify and compare functions expressed as equations and tables.

UNPACKING EXAMPLE 8.F.1.2

A spider descends a 20-foot drainpipe at a rate of 2.5 feet per minute. Another spider descends a drainpipe as shown in the table. Find and compare the rates of change and initial values of the linear functions in terms of the situations they model.

Spider #1: $f(x) = -2.5x + 20$

Spider #2:

Time (min)	0	1	2
Height (ft)	32	29	26

For Spider #1, the rate of change is -2.5, and the initial value is 20. For Spider #2, the rate of change is -3, and the initial value is 32.

Spider #2 started at 32 feet, which is 12 feet higher than Spider #1. Spider #1 is descending at 2.5 feet per minute, which is 0.5 foot per minute slower than Spider #2.

FL 8.F.1.3

Interpret the equation $y = mx + b$ as defining a linear function whose graph is a straight line.

Key Vocabulary

slope *(pendiente)*
A measure of the steepness of a line on a graph; the rise divided by the run.

y-intercept *(intersección con el eje y)*
The y-coordinate of the point where the graph of a line crosses the y-axis.

What It Means to You

You will identify the slope and the y-intercept of a line by looking at its equation and use them to graph the line.

UNPACKING EXAMPLE 8.F.1.3

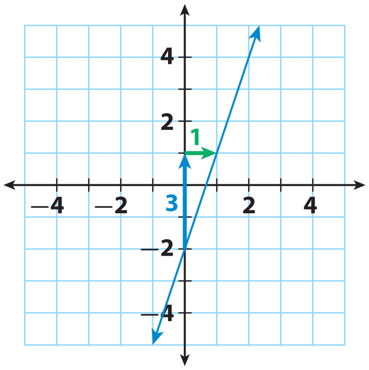
Graph $y = 3x - 2$ using the slope and the y-intercept.

$y = mx + b$

slope y-intercept

The slope m is 3, and the y-intercept is -2.

Plot the point $(0, -2)$. Use the slope $3 = \frac{3}{1}$ to find another point by moving *up* 3 and to the *right* 1. Draw the line through the points.



FL 8.F.1.3

Give examples of functions that are not linear.

Key Vocabulary

function *(función)*
An input-output relationship that has exactly one output for each input.

linear function *(función lineal)*
A function whose graph is a straight line.

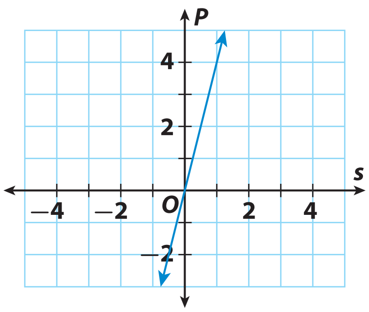
What It Means to You

You will distinguish linear relationships from nonlinear relationships by looking at graphs.

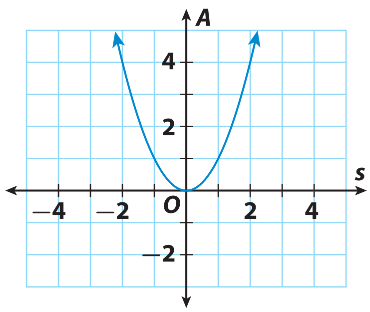
UNPACKING EXAMPLE 8.F.1.3

Which relationship is linear and which is nonlinear?

$P = 4s$



$A = s^2$



$P = 4s$ is linear because its graph is a line.

$A = s^2$ is not linear because its graph is not a line.

FL **8.F.2.4**

Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

Key Vocabulary

rate of change *(tasa de cambio)*
A ratio that compares the amount of change in a dependent variable to the amount of change in an independent variable.

What It Means to You

You will learn how to write an equation based on a situation that models a linear relationship.

UNPACKING EXAMPLE 8.F.2.4

In 2006 the fare for a taxicab was an initial charge of \$2.50 plus \$0.30 per mile. Write an equation in slope-intercept form that can be used to calculate the total fare.

The initial value, \$2.50, is the charge when the number of miles is 0. The rate of change is \$0.30 per mile.

The input variable, x, is the number of miles driven. So $0.3x$ is the cost for the miles driven.

The equation for the total fare, y, is $y = 0.3x + 2.5$.

The initial value, 2.5, is the y-intercept of the graph of the equation, and the rate of change is its slope.

FL **8.F.2.5**

Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Key Vocabulary

linear function *(función lineal)*
A function whose graph is a straight line.

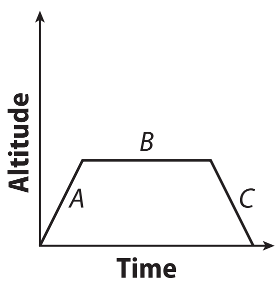
nonlinear function *(función no lineal)*
A function whose graph is not a straight line.

What It Means to You

You will analyze a graph and describe the function that it represents in words.

UNPACKING EXAMPLE 8.F.2.5

The graph shows the altitude of an airplane over time. Describe what each segment *A*–*C* of the graph shows.



Segment *A* shows the altitude from liftoff until the time the airplane reaches cruising altitude. Segment *B* shows the altitude during the time at cruising altitude. Segment *C* shows the altitude from beginning of descent to touchdown. If the rates of ascent or descent changed, the slopes of segments *A* and *B* would change.

FL 8.G.1.1

Verify experimentally the properties of rotations, reflections, and translations.

a. Lines are taken to lines, and line segments to line segments of the same length.

b. Angles are taken to angles of the same measure.

c. Parallel lines are taken to parallel lines.

Key Vocabulary

rotation *(rotación)*
A transformation in which a figure is turned around a point.

reflection *(reflexión)*
A transformation of a figure that flips the figure across a line.

translation *(traslación)*
A movement (slide) of a figure along a straight line.

What It Means to You

You will see that translations, reflections, and rotations do not change the size or shape of a figure.

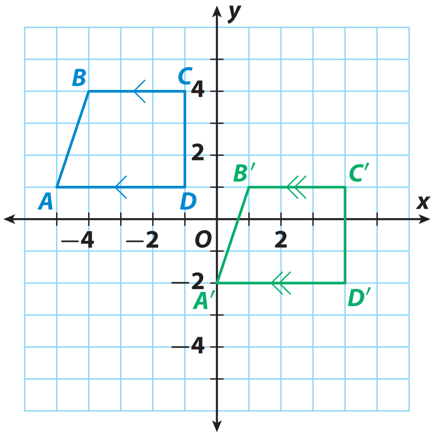
UNPACKING EXAMPLE 8.G.1.1

Amelia drew a trapezoid on a coordinate grid. Then she drew a translation, a reflection, and a rotation of the trapezoid. Describe each transformation and how the sides and angles of the preimage relate to those of the image.

The translation slides the trapezoid 5 units right and 3 units down.

Corresponding sides of the trapezoids are the same length. Corresponding angles of the trapezoids are the same measure.

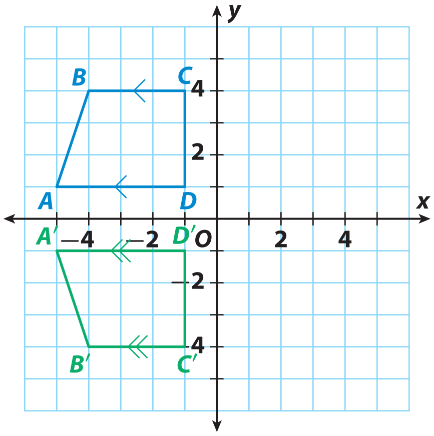
The parallel sides remain parallel.



The reflection flips the trapezoid across the horizontal axis.

Corresponding sides of the trapezoids are the same length. Corresponding angles of the trapezoids are the same measure.

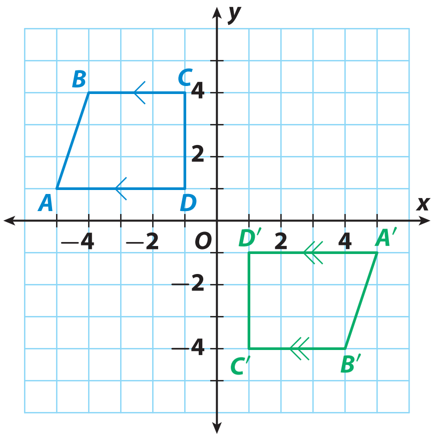
The parallel sides remain parallel.



The rotation turns the trapezoid 180° about the origin.

Corresponding sides of the trapezoids are the same length. Corresponding angles of the trapezoids are the same measure.

The parallel sides remain parallel.



FL 8.G.1.2

Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

What It Means to You

You will identify a rotation, a reflection, a translation, and a sequence of transformations, and understand that the image has the same shape and size as the preimage.

UNPACKING EXAMPLE 8.G.1.2

The figure shows triangle *ABC* and its image after three different transformations. Identify and describe the translation, the reflection, and the rotation of triangle *ABC*.

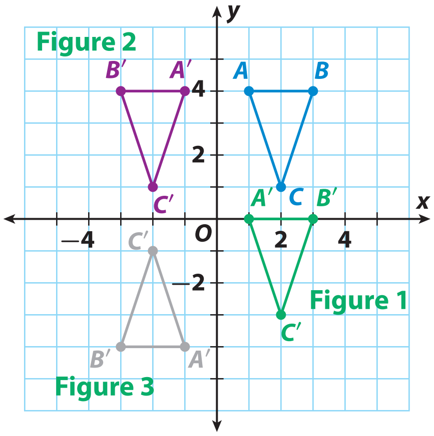


Figure 1 is a translation 4 units down. Figure 2 is a reflection across the *y*-axis. Figure 3 is a rotation of 180°.

FL 8.G.1.3

Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

What It Means to You

You can use an algebraic representation to translate, reflect, or rotate a two-dimensional figure.

UNPACKING EXAMPLE 8.G.1.3

Rectangle *RSTU* with vertices (−4, 1), (−1, 1), (−1, −3), and (−4, −3) is reflected across the *y*-axis. Find the coordinates of the image.

The rule to reflect across the *y*-axis is to change the sign of the *x*-coordinate.

Coordinates	Reflect across the *y*-axis (−*x*, *y*)	Coordinates of image
(−4, 1), (−1, 1), (−1, −3), (−4, −3)	(−(−4), 1), (−(−1), 1), (− (−1), −3), (−(−4), −3)	(4, 1), (1, 1), (1, −3), (4, −3)

The coordinates of the image are (4, 1), (1, 1), (1, −3), and (4, −3).

If *RSTU* is translated right 5 units and down 1 unit, the coordinates of the image are (1, 0), (4, 0), (4, −4), and (1, −4).

If *RSTU* is rotated 180°, the coordinates of the image are (4, −1), (1, −1), (1, 3), and (4, 3).

FL 8.G.1.3

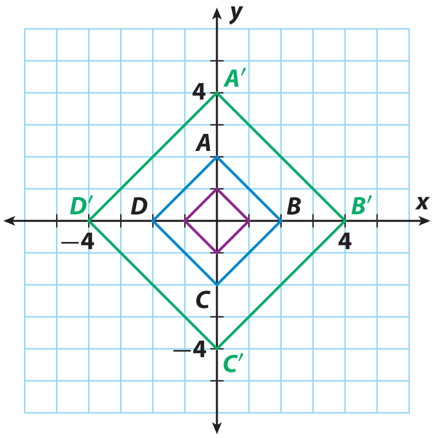
Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

What It Means to You

You will use an algebraic representation to describe a dilation.

UNPACKING EXAMPLE 8.G.1.3

The blue square *ABCD* is the preimage. Write two algebraic representations, one for the dilation to the green square and one for the dilation to the purple square.



The coordinates of the vertices of the original image are multiplied by 2 for the green square.

Green square: $(x, y) \rightarrow (2x, 2y)$

The coordinates of the vertices of the original image are multiplied by $\frac{1}{2}$ for the purple square.

Purple square: $(x, y) \rightarrow \left(\frac{1}{2}x, \frac{1}{2}y\right)$

FL 8.G.1.4

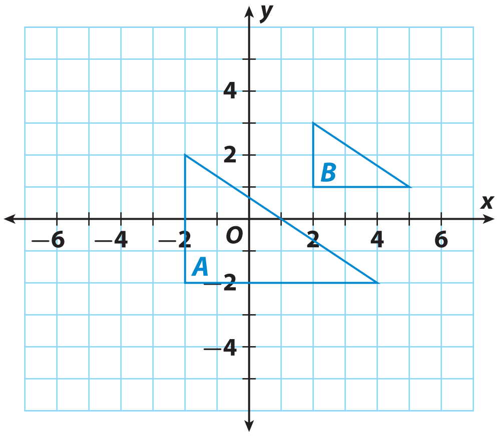
Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

What It Means to You

You will describe a sequence of transformations between two similar figures.

UNPACKING EXAMPLE 8.G.1.4

Identify a sequence of two transformations that will transform figure *A* into figure *B*.



Dilate with center at the origin by a scale factor of $\frac{1}{2}$.

Then translate right 3 units and up 2 units.

FL **8.G.1.5**

Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.

Key Vocabulary

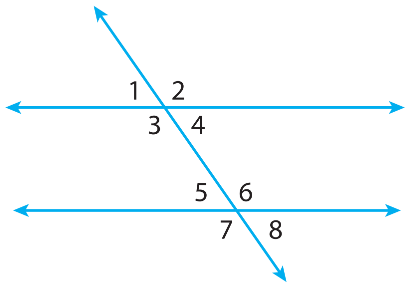
transversal *(transversal)*
A line that intersects two or more lines.

What It Means to You

You will learn about the special angle relationships formed when parallel lines are intersected by a third line called a transversal.

UNPACKING EXAMPLE 8.G.1.5

Which angles formed by the transversal and the parallel lines seem to be congruent?



It appears that the angles below are congruent.

$\angle 1 \cong \angle 4 \cong \angle 5 \cong \angle 8$

$\angle 2 \cong \angle 3 \cong \angle 6 \cong \angle 7$

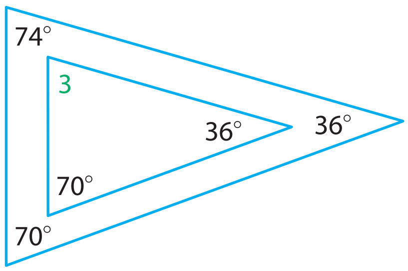
FL **8.G.1.5**

Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.

What It Means to You

You will observe that if two angles of one triangle are congruent to two angles of another triangle, then the angles are similar.

UNPACKING EXAMPLE 8.G.1.5



Use the fact that the sum of the measures of the angles of a triangle is 180° to explain whether the triangles are similar.

Two angles in the large triangle are congruent to two angles in the smaller triangle, so the third pair of angles must also be congruent, which makes the triangles similar.

$70° + 36° + m\angle 3 = 180°$

$m\angle 3 = 74°$

FL 8.G.2.6

Explain a proof of the Pythagorean Theorem and its converse.

Key Vocabulary

Pythagorean Theorem
(Teorema de Pitágoras)
In a right triangle, the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the legs.

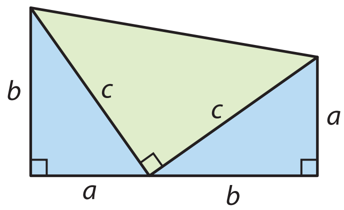
What It Means to You

The Pythagorean Theorem and its converse are very useful in the study of right triangles. You can use mathematics you have learned to explain proofs of these theorems.

UNPACKING EXAMPLE 8.G.2.6

The Pythagorean Theorem states that the sides lengths a, b, and c of a right triangle are related by the equation $a^2 + b^2 = c^2$, where c is the hypotenuse, or side opposite the right angle.

One proof of the Pythagorean Theorem uses area formulas and a figure made up of right triangles like the one shown. The key steps of the proof are shown.



Area of trapezoid = Sum of areas of triangles

$$\frac{1}{2}(a + b)(a + b) = \frac{1}{2}ab + \frac{1}{2}ab + \frac{1}{2}c^2$$

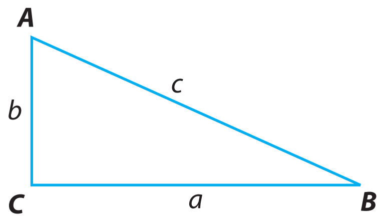
$$a^2 + b^2 = c^2$$

To justify this proof, you would explain why the figure is a trapezoid, why the green triangle is a right triangle, and how algebraic properties can be used to transform the first equation into the second.

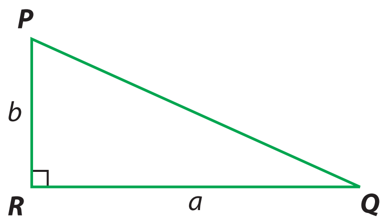
The converse of the Pythagorean Theorem states that any triangle whose side lengths a, b, and c have the relationship $a^2 + b^2 = c^2$ is a right triangle.

A proof of the converse of the Pythagorean Theorem begins as follows:

1. Start with $\triangle ABC$ such that $a^2 + b^2 = c^2$.
2. Draw another triangle $\triangle PQR$ such that $\angle R$ is a right angle, $RQ = a$, and $PR = b$.



To complete this proof, you would use the Pythagorean Theorem to show that $PQ = c$. Then show that $\triangle ABC \cong \triangle PQR$, making $\triangle ABC$ a right triangle like $\triangle PQR$.



FL 8.G.2.7

Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

Key Vocabulary

Pythagorean Theorem

(Teorema de Pitágoras)

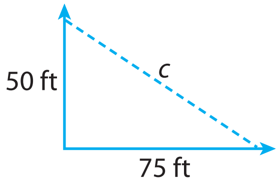
In a right triangle, the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the legs.

What It Means to You

You will find a missing length in a right triangle, or use side lengths to see whether a triangle is a right triangle.

UNPACKING EXAMPLE 8.G.2.7

Mark and Sarah start walking at the same point, but Mark walks 50 feet north while Sarah walks 75 feet east. How far apart are Mark and Sarah when they stop?



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

$$50^2 + 75^2 = c^2 \quad \text{Pythagorean Theorem}$$

$$2500 + 5625 = c^2 \quad \text{Substitute.}$$

$$8125 = c^2$$

$$90.1 \approx c$$

Mark and Sarah are approximately 90.1 feet apart.

Given the edge length of a cube, you can use this method twice to find the length of a diagonal of the cube. First find the length of a diagonal of a face. Then use that length and the edge length to find the length of the diagonal.

FL 8.G.2.8

Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Key Vocabulary

coordinate plane

(plano cartesiano)

A plane formed by the intersection of a horizontal number line called the *x*-axis and a vertical number line called the *y*-axis.

What It Means to You

You can use the Pythagorean Theorem to find the distance between two points.

UNPACKING EXAMPLE 8.G.2.8

Find the distance between points *A* and *B*.

$$(AC)^2 + (BC)^2 = (AB)^2$$

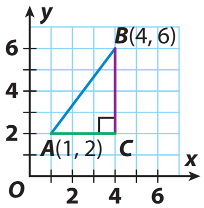
$$(4 - 1)^2 + (6 - 2)^2 = (AB)^2$$

$$3^2 + 4^2 = (AB)^2$$

$$9 + 16 = (AB)^2$$

$$25 = (AB)^2$$

$$5 = AB$$



The distance is 5 units.

FL **8.G.3.9**

Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Key Vocabulary

volume *(volumen)*
The number of cubic units needed to fill a given space.

cylinder *(cilindro)*
A three-dimensional figure with two parallel, congruent circular bases connected by a curved lateral surface.

What It Means to You

You will learn the formula for the volume of a cylinder.

UNPACKING EXAMPLE 8.G.3.9

The Asano Taiko Company of Japan built the world's largest drum in 2000. The drum's diameter is 4.8 meters, and its height is 4.95 meters. Estimate the volume of the drum.

$d = 4.8 \approx 5$

$h = 4.95 \approx 5$

$r = \frac{d}{2} \approx \frac{5}{2} = 2.5$

$V = (\pi r^2)h$ — Volume of a cylinder

$\approx (3)\,(2.5)^2 \cdot 5$ — Use 3 for π.

$= (3)\,(6.25)\,(5)$

$= 18.75 \cdot 5$

$= 93.75 \approx 94$

The volume of the drum is approximately 94 m^3.

FL **8.G.3.9**

Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Key Vocabulary

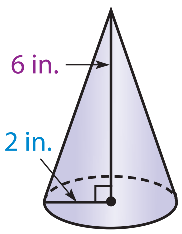
cone *(cono)*
A three-dimensional figure with one vertex and one circular base.

sphere *(esfera)*
A three-dimensional figure with all points the same distance from the center.

What It Means to You

You will learn formulas for the volume of a cone and a sphere.

UNPACKING EXAMPLE 8.G.3.9



Find the volume of the cone. Use 3.14 for π.

$B = \pi(2^2) = 4\pi \text{ in}^2$

$V = \frac{1}{3} \cdot 4\pi \cdot 6$ — $V = \frac{1}{3}Bh$

$V = 8\pi$ — Use 3.14 for π.

$\approx 25.1 \text{ in}^3$

The volume of the cone is approximately 25.1 in^3.

The volume of a sphere with the same radius is $V = \frac{4}{3}\pi r^3 \approx \frac{4}{3}(3)(2)^3 = 32 \text{ in}^3$.

FL **8.NS.1.1**

Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

Key Vocabulary

rational number *(número racional)*
A number that can be expressed as a ratio of two integers.

irrational number *(número irracional)*
A number that cannot be expressed as a ratio of two integers or as a repeating or terminating decimal.

What It Means to You

You will recognize a number as rational or irrational by looking at its fraction or decimal form.

UNPACKING EXAMPLE 8.NS.1.1

Classify each number as rational or irrational.

$0.\overline{3} = \frac{1}{3}$ $\qquad$ $0.25 = \frac{1}{4}$

These numbers are rational because they can be written as ratios of integers or as repeating or terminating decimals.

$\pi \approx 3.141592654\ldots$ $\qquad$ $\sqrt{5} \approx 2.236067977\ldots$

These numbers are irrational because they cannot be written as ratios of integers or as repeating or terminating decimals.

To write the repeating decimal 0.555… as a decimal, note that there is 1 repeating decimal. Let $x = 5.555\ldots$ by 10, then subtract x from $10x$.

$$\begin{aligned} 10x &= 5.555\ldots \\ -x &= -0.555\ldots \\ \hline 9x &= 5 \end{aligned}$$

Solving the equation, $x = \frac{5}{9}$.

FL **8.NS.1.2**

Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).

What It Means to You

You will learn to estimate the values of irrational numbers.

UNPACKING EXAMPLE 8.NS.1.2

Estimate the value of $\sqrt{8}$.

8 is not a perfect square. Find the two perfect squares closest to 8.

8 is between the perfect squares 4 and 9.
So $\sqrt{8}$ is between $\sqrt{4}$ and $\sqrt{9}$.
$\sqrt{8}$ is between 2 and 3.

8 is close to 9, so $\sqrt{8}$ is close to 3.
$2.8^2 = 7.84$ $\qquad$ $2.85^2 = 8.1225$ $\qquad$ $2.9^2 = 8.41$
$\sqrt{8}$ is between 2.8 and 2.9, but closer to 2.8.
A good estimate for $\sqrt{8}$ is 2.8.

On a number line, $\sqrt{8}$ is between 2 and 3, and is closer to 3.

FL 8.SP.1.1

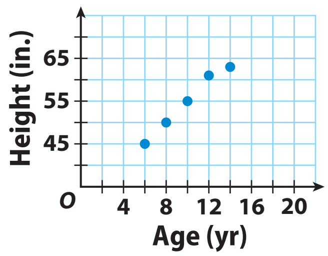
Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

What It Means to You

You will describe how the data in a scatter plot are related.

UNPACKING EXAMPLE 8.SP.1.1

The scatter plot shows Bob's height at various ages. Describe the type(s) of association between Bob's age and his height. Explain.



As Bob gets older, his height increases roughly along a straight line on the graph, so the association is positive and basically linear.

FL 8.SP.1.2

Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

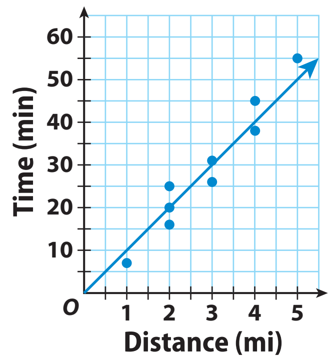
What It Means to You

You will use a trend line to show the relationship between two quantities.

UNPACKING EXAMPLE 8.SP.1.2

Joyce is training for a 10K race. For each of her training runs, she recorded the distance she ran and the time she ran. She made a scatter plot of her data and drew a trend line. Use the trend line to predict how long it would take Joyce to run 4.5 miles.

Distance (mi)	Time (min)
4	38
2	25
1	7
2	16
3	26
5	55
2	20
4	45
3	31



For a distance of 4.5 miles, the trend line shows a time of 45 minutes. So, it will take Joyce about 45 minutes to run 4.5 miles.

FL **8.SP.1.3**

Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.

Key Vocabulary

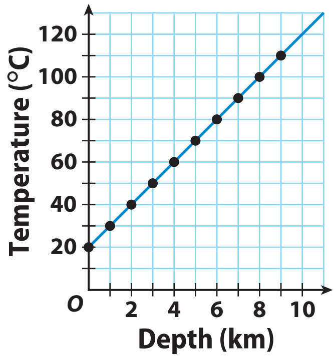
bivariate data *(datos bivariados)*
A set of data that is made up of two paired variables.

What It Means to You

You will see how to use a linear relationship between sets of data to make predictions.

UNPACKING EXAMPLE 8.SP.1.3

The graph shows the temperatures in degrees Celsius inside Earth at certain depths in kilometers. Interpret the slope and y-intercept. Then use the graph to find the temperature at 8 km.



The slope, 10 °C/km, means that the temperature increases 10 °C for each kilometer of depth. The y-intercept, 20, means that the temperature at Earth's surface is 20 °C. From the graph, you can see that at 8 km, the temperature is 100 °C.

FL **8.SP.1.4**

Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Key Vocabulary

two-way table *(tabla de doble entrada)* A table that shows the frequencies of data categorized in two ways.

What It Means to You

You will use two-way tables to find relative frequencies.

UNPACKING EXAMPLE 8.SP.1.4

Soojinn counted the vehicles in the school parking lot and recorded the data in the two-way table shown.

	During School Day	After School Day	Total
Cars	36	14	50
Trucks	19	6	25
Total	55	20	75

What percent of the vehicles parked after school were trucks?

$$\frac{\text{trucks after school}}{\text{total vehicles after school}} = \frac{6}{20} = 0.3\text{, or } 30\%$$

30% of the vehicles in the school parking lot after school were trucks.

FL 8.SP.1.4

Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Key Vocabulary

conditional relative frequency *(frecuencia relativa condicional)* The ratio of a joint relative frequency to a related marginal relative frequency in a two-way table.

What It Means to You

You will use two-way tables to find conditional relative frequencies.

UNPACKING EXAMPLE 8.SP.1.4

Soojinn determined the gender of the driver for each of the 55 vehicles parked in the school parking lot during the day.

	Male	Female	Total
Cars	8	25	33
Trucks	15	7	22
Total	23	32	55

What is the conditional relative frequency that a driver is female given that the vehicle is a car?

$$\frac{\text{female car drivers}}{\text{total cars}} = \frac{25}{33} \approx 0.758, \text{ or about } 76\%$$

There is a 76% likelihood that a driver is female given that the vehicle is a car.