Georgia Standards of Excellence

Algebra I

Student Workbook

Unit 1

WALCH®
HIGH SCHOOL MATH

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HIGH SCHOOL MATH

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Introduction

The *Georgia Standards of Excellence Algebra I Student Workbook* includes all of the student pages from the Teacher Resource necessary for day-to-day classroom instruction. This includes:

- Warm-Ups
- Problem-Based Tasks
- Practice Problems
- Station Activity Worksheets

In addition, it provides Scaffolded Guided Practice examples that parallel the examples in the TRB. This supports:

- Students taking notes during class
- Students working problems for preview or additional practice
- Teachers using the TRB to review Guided Practice

The workbook includes the first Guided Practice example with step-by-step prompts for solving, and the remaining Guided Practice examples without prompts, available for various instruction and practice options. Sections for taking notes are provided at the end of each sub-lesson. Additionally, blank coordinate planes are included at the end of the full lesson, should graphing be required. And directly following this introduction, useful formulas are provided for student reference.

The workbook is printed on perforated paper to facilitate submission of assignments and three-hole punched to allow for storage in a binder.

Student Workbooks with Scaffolded Practice save time for teachers as well as copying expenses, ensure that students have the materials they need, and provide an additional, flexible instructional resource.

Lesson 1.1.1: Working with Radicals and Properties of Real Numbers

Warm-Up 1.1.1

The length of the diagonal of a square, *d*, is related to the length of a side, *s*, by the following formula: $d = \sqrt{2} \bullet s$.

1. What is the perimeter, in terms of *s*, of the triangle formed by two adjacent sides and the diagonal of the square?

2. What is the perimeter of the triangle if $s = 3$ feet? Round your answer to the nearest hundredth.

Scaffolded Practice 1.1.1

Example 1

Reduce the radical expression $\sqrt{\frac{80}{5^4}}$. If the result has a root in the denominator, rationalize it. Is the result rational or irrational?

1. Rewrite each number in the expression as a product of prime numbers.

2. Cancel where possible to reduce the resulting expression.

3. Use the properties of radicals to rewrite the reduced expression.

4. Rationalize the denominator of the resulting fraction.

5. Determine whether the resulting expression is rational or irrational.

continued

Example 2

Reduce the radical expression $\sqrt{16a^2} + \sqrt{32a^4}$. Assuming a is a whole number, is the result rational or irrational?

Example 3

Evaluate the radical expression $\sqrt{\frac{2^6}{45}}\left(\sqrt{\frac{64}{5^3}} + \sqrt{\frac{18}{250}}\right)$. Then, determine whether the answer is rational or irrational.

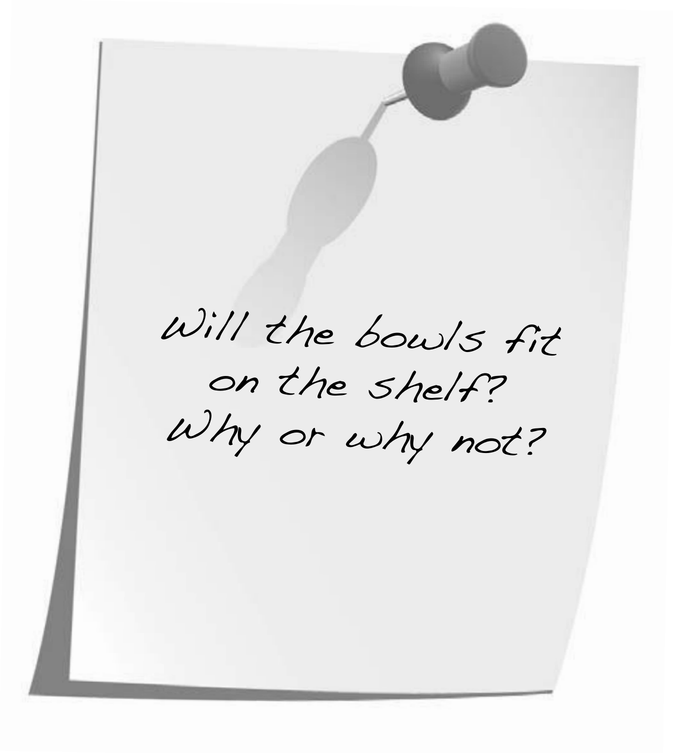
Example 4

Professor Oak is building a new paddock in the back of his research facility so his pets can stay outside while he's at work. According to his calculations, the amount of fencing required will be $2\sqrt{4800} + \left(160 - 8\sqrt{300}\right)$ feet. If fencing is sold in 5-foot lengths, how many pieces of fencing will he need to purchase to complete the paddock?

Problem-Based Task 1.1.1: Measuring Madness

SMP	
1 ✓	2 ✓
3 ✓	4
5	6
7 ✓	8

Roxanne wants to display her fancy nested measuring bowls in a line on a shelf. No bowl can be wider than the shelf, and the length of the line must be shorter than the shelf. When full, the bowls can hold 480 cm^3, 240 cm^3, 120 cm^3, 80 cm^3, and 60 cm^3. The heights of the bowls are 6 cm, 5 cm, 4 cm, 3.5 cm, and 3.5 cm, respectively. The shelf is 45 cm long and 15 cm wide. Roxanne has determined that the diameter of each bowl can be approximated by the formula $d=2\sqrt{\frac{V}{3h}}$, where V represents the volume of the bowl and h represents the height of the bowl. Use the formula to find the diameter of each bowl. Give an exact answer and a decimal approximation for each diameter, and state whether the length of each diameter is rational or irrational. Will the bowls fit on the shelf? Why or why not?



Practice 1.1.1: Working with Radicals and Properties of Real Numbers A

For problems 1–3, use the properties of radicals to rewrite and reduce each expression.

1. $\sqrt{a^9b^2}$

2. $\sqrt{\frac{130}{26}}\bullet\sqrt{\frac{45}{36}}$

3. $\sqrt{\frac{m^5}{n^6}}$

For problems 4–8, reduce each expression, then determine whether each expression is rational or irrational. Round decimal approximations to the nearest hundredth, if needed.

4. $\sqrt{54}+\sqrt{600}$

5. $\sqrt{\frac{4}{3}}\left(\sqrt{\frac{49}{12}}-\sqrt{\frac{32}{3}}\right)$

6. $2+\sqrt{576}$

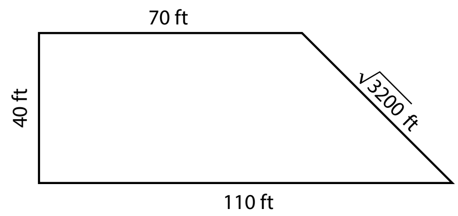
7. $\sqrt{\frac{7}{2}}\left(5+\sqrt{\frac{63}{288}}\right)-\sqrt{\frac{700}{8}}$

8. $\frac{\sqrt{6}\bullet\sqrt{3}-\sqrt{2}}{\sqrt{3}}$

continued

Use the given information to solve problems 9 and 10.

9. Belinda is fencing a new area for her cattle. Using the given figure, find the perimeter of the area she wants to fence. If the fence is to be made of four strands of barbed wire, minus an 8-foot gate, how many feet of wire does she need? Round your answer to the nearest foot.



10. Malcolm is an artist. He bought a single square canvas with an area of 3 square meters. What is the perimeter of the canvas? Is the perimeter rational or irrational? Note that the length of one side of the square is the square root of the area.

Practice 1.1.1: Working with Radicals and Properties of Real Numbers B

For problems 1–3, use the properties of radicals to rewrite and reduce each expression.

1. $\sqrt{5^6 \bullet 24^3}$

2. $\sqrt{\frac{a^3}{b^2}} \bullet \sqrt{\frac{a^7}{b}}$

3. $\sqrt{\frac{30^3}{14^5}}$

For problems 4–8, reduce each expression, then determine whether each expression is rational or irrational. Round decimal approximations to the nearest hundredth, if needed.

4. $\frac{\sqrt{8} \bullet \sqrt{6} + \sqrt{7}}{\sqrt{14}}$

5. $9 - \sqrt{955}$

6. $\sqrt{\frac{1}{5}}\left(\sqrt{\frac{242}{10}} + \sqrt{\frac{147}{15}}\right)$

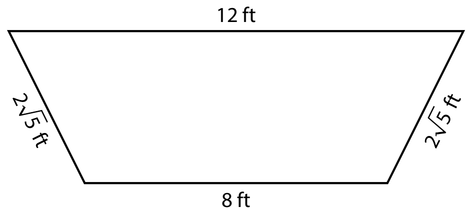
7. $\sqrt{\frac{24}{7}}\left(1 + \sqrt{\frac{9}{56}}\right) - \sqrt{\frac{64}{63}}$

8. $\sqrt{64} + \sqrt{544}$

continued

Use the given information to solve problems 9 and 10.

9. Alisha is building a wall around her garden. The wall is to be made of three rows of bricks, layered lengthwise. Using the given figure, find the perimeter of the wall. If each brick is 6 inches long, how many bricks does she need to complete the wall? Round your answer to the nearest whole number.



10. Mr. Ammad bought a circular playground parachute for gym class, with a total combined area A of 4π square meters. What is the radius of the parachute? Round your answer to the nearest hundredth. Is the radius rational or irrational? *Note*: $r=\sqrt{\frac{A}{\pi}}$.

Name: **Date:**

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Name: Date:

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Lesson 1.2.1: Converting Units

Warm-Up 1.2.1

Miranda ran 2 miles in 20 minutes.

1. How many feet did Miranda run?

2. How many seconds are there in 20 minutes?

3. What was Miranda's speed in feet per second?

Scaffolded Practice 1.2.1

Example 1

Kolya wants to find out how many textbooks his class has in total. He has discovered that each student has an average of 5 textbooks. There are 30 people in his class. How many textbooks does his class have in total?

1. Identify important quantities and their associated units.

2. Identify the units of the answer being sought.

3. Convert the units.

continued

Example 2

How many seconds are there in 1 day?

Example 3

Gemma is visiting friends in the U.S. She wants to make her famous mince pies, but her recipe lists most of the ingredients in grams. Use the chart to convert all the given measurements to U.S. units.

Ingredients:

225 grams cold butter, diced

340 grams plain flour

110 grams golden caster sugar

300 grams mincemeat

1 small egg

5 grams powdered sugar

Conversion Factors

U.S.	Metric
1 stick butter	113 grams
1 cup	225 grams
1 pound	455 grams
1 teaspoon	5 grams

continued

Example 4

The owners of a company that makes electric heaters would like to upgrade the company's production equipment to become more profitable. They have asked two separate financial analysts to help them plan the upgrade schedule. Each analyst devised a different plan, which resulted in different profit predictions. Below are visual representations of the analysts' predictions for yearly net profit after the upgrade. Which prediction predicts a higher profit in 2021?

Chart 1

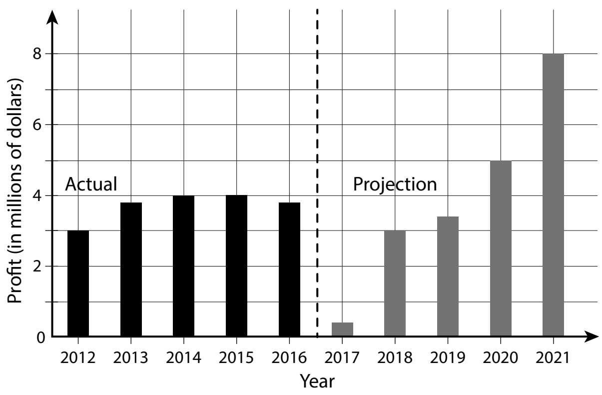
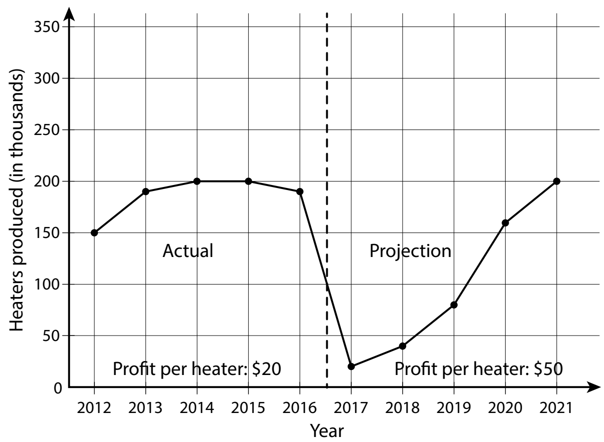


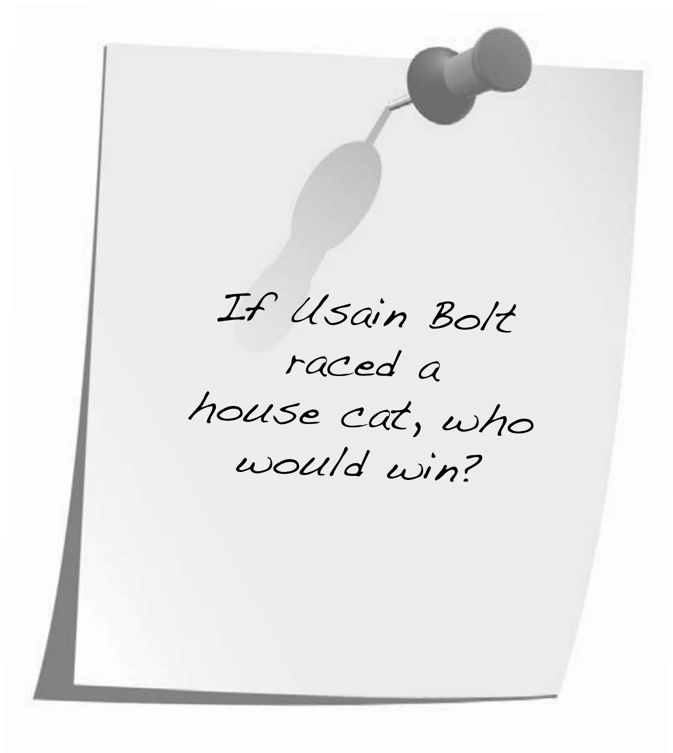
Chart 2



Problem-Based Task 1.2.1: Man Versus Cat

SMP	
1 ✓	2 ✓
3	4 ✓
5	6
7 ✓	8 ✓

During the 100-meter sprint final in the 2009 IIAF World Championships in Athletics in Berlin, Usain Bolt ran the last 20 meters of the race in 1.61 seconds. How fast is this in miles per hour? Round your answer to the nearest whole number. If Usain Bolt raced a house cat, who would win? *Note*: One mile is approximately 1.6 kilometers, and a house cat can run up to 30 miles per hour for short distances.



Practice 1.2.1: Converting Units A

For problems 1–3, convert the units as directed.

1. The moon travels 3,683 kilometers in an hour, and it takes 27.32 days to complete its orbit. How far does the moon travel in that time?

2. Convert 40 square centimeters to square meters.

3. If Hari and Don each have two cases of cotton candy spools, and each case has 5 spools of cotton candy inside, how many spools of cotton candy do they have in total?

Use the information given in the following table to solve problems 4–7.

U.S. customary	1 inch	1 gallon	1 pound
Metric	2.54 centimeters	3.79 liters	454 grams

4. A particular species of bamboo can grow up to 91 centimeters in a day. How fast is this in inches per hour?

5. King cobras can grow to be more than 4 meters long. How long is this in feet?

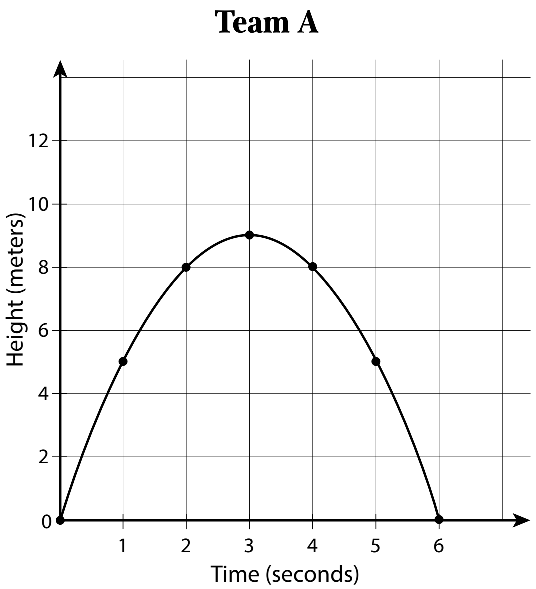
6. The average swallow weighs 5 ounces. An average coconut weighs 1.44 kilograms. How many swallows would it take to outweigh the coconut? Round your answer up to the nearest whole number.

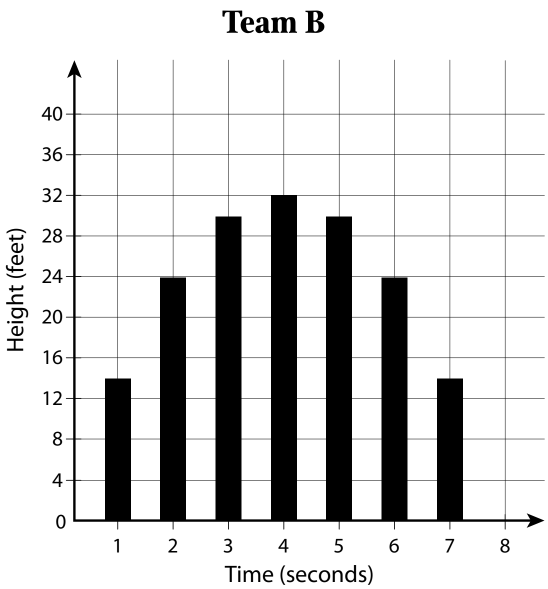
7. Mount Everest is 8,848 meters above sea level at its peak. How high is this in miles?

continued

Use the given information to solve problems 8–10.

Two different teams have each built a bottle rocket as part of a science project. The following graphs show data for the two rocket launches.





8. Which team's rocket stayed in the air longer?

9. Which team's rocket attained a greater height during its flight?

10. Between the time stamps of 3 seconds and 4 seconds, Team A's rocket had an average speed of 1 meter per second, while Team B's rocket had an average speed of 2 feet per second. Which team's rocket was moving faster over this period of time?

Practice 1.2.1: Converting Units B

For problems 1–3, convert the units as directed.

1. Earth completes its 584-million-mile orbit of the sun in about 365 days. How fast is Earth moving through its orbit in miles per hour?

2. Convert 42 square yards to square feet.

3. Desmond and Molly each purchased 5 boxes of tangerines, and each box contains 60 tangerines. How many tangerines do they have in total?

Use the information in the following table to solve problems 4–7.

U.S. customary	1 inch	1 gallon	1 pound
Metric	2.54 centimeters	3.79 liters	454 grams

4. Joseph grew 2 centimeters in 12 weeks. How much is this in inches per year?

5. A Siberian tiger can grow to 350 centimeters long, excluding the tail. How long is this in feet?

6. The average Mallard duck weighs about 1 kilogram. The average English citizen weighs about 170 pounds. How many ducks would it take to outweigh a single English person? Round your answer up to the nearest whole number.

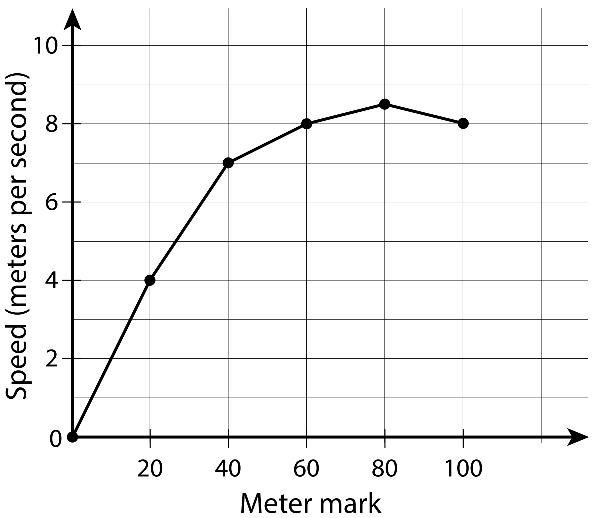
7. Mt. Denali in Alaska measures about 5,500 meters from its base to its highest peak. How high is this in feet? Round your answer to the nearest thousand.

continued

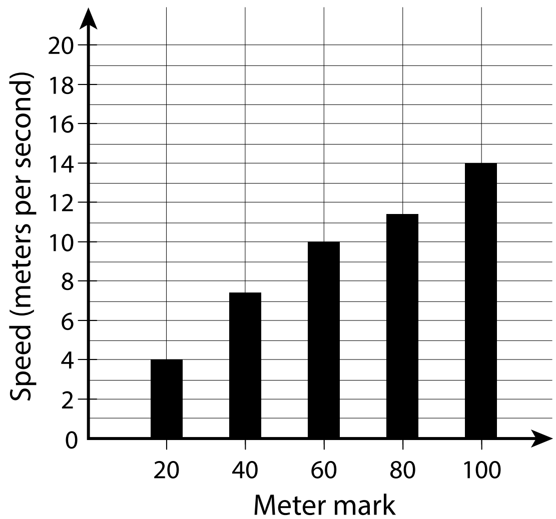
Use the given information to solve problems 8–10.

The track team is gathering data about its runners. All runners have been separated into 2 groups. The members of Group 1 recorded the time it took to run each of the 20-meter segments and converted the measurements to speed. The members of Group 2 used a timer to record each runner's total time every 20 meters. The following graphs show the average data for each group.

Group 1



Group 2



8. What was the average time it took for runners in Group 1 to run the first 20 meters?

9. On average, how long did it take for runners in Group 2 to run the last 20 meters?

10. On average, how fast were the runners in Group 2 over the last 20 meters? How does this compare to the average speed of runners in Group 1 at the 100-meter mark?

Name: Date:

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Name: Date:

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Lesson 1.2.2: Modeling with Units and Precision in Modeling

Warm-Up 1.2.2

Ralph is making angel food cake and meringue cookies. The angel food cake recipe calls for 12 egg whites, while the meringue cookies call for 3 egg whites. Ralph has only 4 eggs at home, so he went to buy more eggs at the store.

1. How many eggs does Ralph need to buy?

2. If the store sells only half-dozen egg cartons, how many cartons does Ralph need to buy?

Scaffolded Practice 1.2.2

Example 1

Nonia is making pizza with fresh tomatoes. The recipe she is using calls for 4 small tomatoes per pizza. Nonia wants to make enough for five people, so she is making 2 pizzas. This means she needs 8 tomatoes. Tomatoes are sold in packs of 6 at the grocery store. How many packs should she buy?

1. Identify the final units and set up the problem.

2. Solve the problem.

3. Use the context to round your answer.

continued

Example 2

How much would you have to pay for 12.5 gallons of gasoline at $2.19 per gallon? Round your answer based on the problem context.

Example 3

Josephine is carpeting the floor of her living room with carpet squares. The area she is carpeting measures 15×15 square feet, and each square measures 2×2 square feet. How many carpet tiles does Josephine need? Considering that carpet tiles can be halved or quartered if necessary, how many carpet tiles should she buy?

Problem-Based Task 1.2.2: Beating Back the Blight

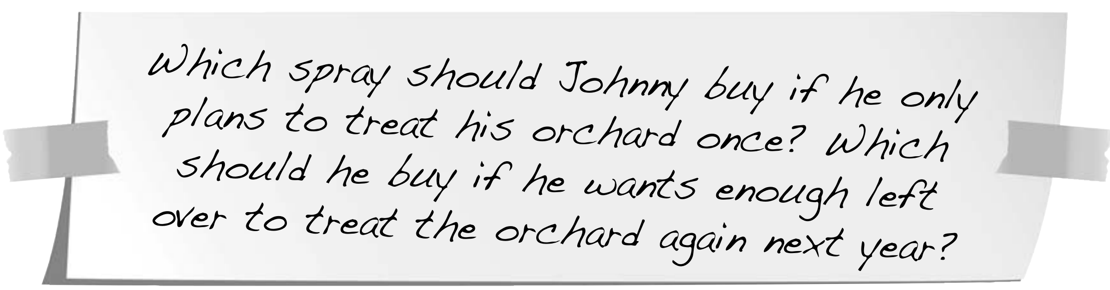
SMP
1 ✓ 2 ✓
3 4 ✓
5 6 ✓
7 ✓ 8 ✓

Fire blight is a bacterial plant disease that damages the plant's fruit and eventually kills the entire plant. To prevent fire blight in apple orchards, a special copper solution is sprayed on the trees before the leaf buds open. Copper treatments are available in both liquid and powder form, and are equally effective.

Johnny has a small apple orchard he wants to protect from fire blight. Blight is not a huge problem in his area, so he plans to apply just one treatment. It will take 20 gallons of spray to cover his orchard. Johnny is considering the following two options:

Treatment option	Price	Quantity	Instructions
Liquid	$19.99	16 fl oz (bottled)	Dilute 2 tablespoons per 1 gallon of water.
Powder	$49.99	4 lbs (bagged)	Mix 1 ounce powder per 2 gallons of water.

Which spray should Johnny buy if he only plans to treat his orchard once? Which should he buy if he wants enough left over to treat the orchard again next year?



Practice 1.2.2: Modeling with Units and Precision in Modeling A

Use the given information to solve problems 1–4. Round your answers based on the problem context.

1. Every month, Lisa's savings account pays 0.063% interest on the amount in the account. If she has $900.00 in the account at the beginning of the month and doesn't withdraw any of it, what will the interest payment be for this month?

2. Rima wants to bake a giant batch of cookies. The recipe calls for $2\frac{1}{4}$ cups of brown sugar, which Rima intends to scale up by 4. Rima currently has a 2-pound bag of brown sugar. If 1 pound of brown sugar is approximately $2\frac{1}{3}$ cups, will Rima need to buy more to make her cookies? If so, how many more 2-pound bags should she buy?

3. Fleur is in a bookstore browsing fantasy novels. Each book costs $7.42, including tax. If she has $50 to spend, how many books can she buy?

4. Henry has found that he can cover 204 ceramic bowls with 1 gallon of clear glaze. The glaze comes in 1-gallon pails. If he has a batch of 745 bowls to coat, how many gallons of clear glaze should he buy?

continued

Use the given information to solve problems 5–7. Round your answers based on the problem context.

Angie is tiling her kitchen with linoleum squares. The area she is tiling measures 120.0 inches by 120.0 inches, and each square measures 9×9 square inches.

5. How many tiles will Angie need for one row?

6. How many tiles will Angie need to cover the entire floor?

7. How many whole tiles should Angie buy?

Use the given information to solve problems 8–10. Round your answers based on the problem context.

Bartholomew wants to paint the walls, door, and ceiling of his bedroom black. His room is 9 feet wide and 11 feet long with an 8-foot ceiling. There is also a window in one wall that measures 2 feet by 3 feet.

8. What is the area of the walls and ceiling?

9. What is the area of the window?

10. If 1 can of paint covers about 400 square feet, how many cans should he buy?

Practice 1.2.2: Modeling with Units and Precision in Modeling B

Use the given information to solve problems 1–4. Round your answers based on the problem context.

1. Every month, Katie's savings account pays 0.059% interest on the amount in the account. If she has $1,201.53 in the account at the beginning of the month and doesn't withdraw any of it, what will the interest payment be for this month?

2. A recipe calls for 3 eggs. If Murphy wants to scale the recipe back to produce $\frac{3}{4}$ of the original amount, how many eggs should he use?

3. The Challenger Deep in the Mariana Trench is the deepest known point on the surface of the earth. The maximum depth of the Challenger Deep is 35,814 feet. If an Olympic swimming pool is 7 feet deep, how many pools stacked on top of each other would it take to exceed the depth of the Challenger Deep?

4. Mt. Mitchell in North Carolina is the tallest mountain east of the Mississippi. It is 6,684 feet tall. How many Mt. Mitchells stacked on top of each other would it take to exceed the depth of the Challenger Deep? *Note*: 1 meter ≈ 3.28 feet.

continued

Use the given information to solve problems 5–7. Round your answers based on the problem context.

Roger is tiling the floor of his bathroom with ceramic squares. The floor measures 84.0 inches by 84.0 inches, and each tile covers 4.00×4.00 square inches. He will need to leave a gap of 24.0×10.0 square inches in the tiling for the toilet. Gaps around the edge will be covered later with trim. Assume the tiling will be done with whole tiles only.

5. How many whole tiles will Roger need for 1 row?

6. How many whole tiles would he need for the entire floor without leaving a gap?

7. How many tiles should he remove from this estimate to account for the gap?

Use the given information to solve problems 8–10. Round your answers based on the problem context.

Connie wants to paint her deck. The main deck is 12 feet wide and 20 feet long. There are also 2 progressively lower levels running parallel to the house that are connected with a single solid riser. Each lower deck is 4 feet wide and 10 feet long. There is also a border along the edge of the deck with an area of 28 square feet. Assume that 1 can of paint covers about 350 square feet.

8. What is the total area Connie has to paint?

9. How many cans of paint should Connie buy?

10. If she also paints a small side porch that is 4×4 square feet with 6 square feet of edge trim, how many cans of paint should Connie buy?

Name: Date:

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Lesson 1.3.1: Identifying Terms, Factors, and Coefficients

Warm-Up 1.3.1

Ella purchased 2 DVDs and 3 CDs from Tyler's Electronics at the prices listed in the given table. After taxes, her total cost increased by $5.60. Use this information and the table to complete each problem.

Item	Cost ($)
CD	c
DVD	d

1. How can you write the cost of 2 DVDs as an algebraic expression?

2. How can you write the cost of 2 DVDs and 3 CDs as an algebraic expression?

3. How can you write the cost of 2 DVDs and 3 CDs, increased by $5.60 for taxes, as an algebraic expression?

Scaffolded Practice 1.3.1

Example 1

Simplify the expression $2(3 + x) + x(1 - 4x) + 5$, then identify each term, coefficient, and constant, and name the factors of each term of the polynomial.

1. Simplify the expression.

2. Identify each term in the simplified expression.

3. Identify any factors of the non-constant term(s).

4. Identify any coefficients of the non-constant term(s).

5. Identify any constant terms.

continued

Example 2

A smartphone is on sale for 25% off its regular price. The sale price of the smartphone is $149.25. What expression can be used to represent the regular price of the smartphone? Identify each term, the constant term, and the factors and coefficients of the terms that contain a variable.

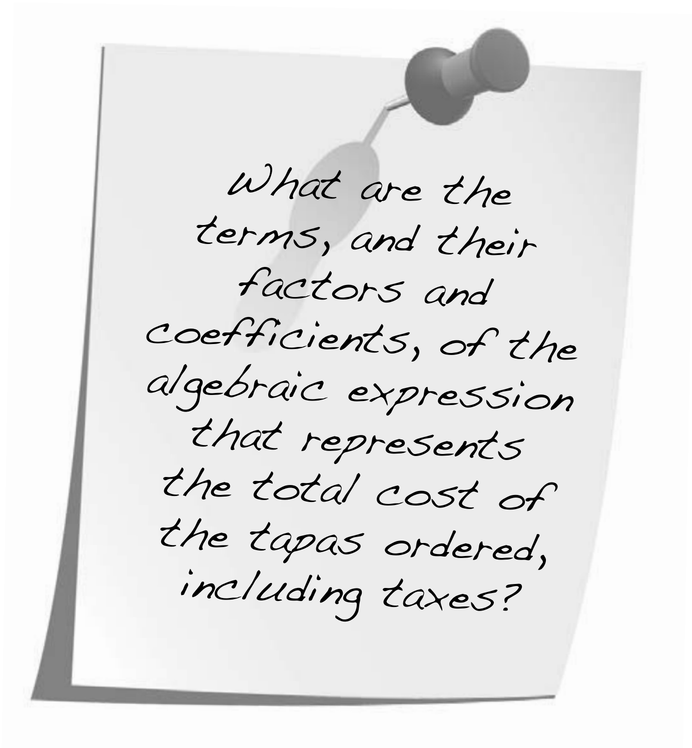
Example 3

Helen purchased 3 books from an online bookstore and received a 20% discount on her total order. Each book cost the same amount. The shipping cost was $10 and was not discounted. Write an expression that can be used to represent the total amount Helen paid for 3 books plus the shipping cost. Simplify the expression, and then identify each term, the constant term, and the factors and coefficients of the terms that contain a variable.

Problem-Based Task 1.3.1: Identifying Parts of an Expression in Context

SMP	
1 ✓	2 ✓
3	4 ✓
5	6
7	8

Tara and two friends had dinner at a Spanish tapas restaurant that charged $6 per tapa, or appetizer. The three of them shared several tapas. The total bill included taxes of $4.32. What are the terms, and their factors and coefficients, of the algebraic expression that represents the total cost of the tapas ordered, including taxes?



Practice 1.3.1: Identifying Terms, Factors, and Coefficients A

For problems 1 and 2, simplify each expression if possible, and then list the terms of the simplified expression. Identify the constant term and the factors and coefficients of non-constant terms.

1. $12a^3 + 16a + 4$

2. $21x^2 + 3x - 15x^2 + 9$

For problems 3 and 4, translate each verbal expression into an algebraic expression. Then, list the terms of the given expressions, and identify the constant term and the factors and coefficients of non-constant terms.

3. half the sum of *x* and *y,* decreased by one-third *y*

4. the product of 5 and the cube of *x*, increased by the difference of 6 and x^3

For problem 5, write an expression that has the given terms and coefficients.

5. Write an expression with 4 terms, containing the coefficients 3, 6, and 9.

continued

For problems 6–10, write an algebraic expression to describe each situation. Then, list the terms of the expressions. Identify the constant term and the factors and coefficients of non-constant terms.

6. Gavin agrees to buy a 6-month package deal of monthly gym passes, and in turn receives a 15% discount. Write an algebraic expression to represent the total cost of the monthly passes with the discount, if x represents the cost of each monthly pass.

7. Andre purchased 10 packs of trading cards online and received a 20% discount off each pack. Shipping cost $3.99. Write an algebraic expression to represent the total cost of the trading cards with the shipping cost, if x represents the cost of each pack of cards.

8. Nadia and some friends went to a movie. Their total cost was $30.24, which included taxes of $2.24. Write an algebraic expression to represent the price of each movie ticket, not including taxes. Let x represent the number of Nadia's friends who went to the movies.

9. Write an expression to represent the area of a trapezoid, which can be found by multiplying the height of the trapezoid by half of the sum of base_1 and base_2.

10. The surface area of a cylinder with radius r and height h is twice the product of π and the square of the radius plus twice the product of π, the radius, and the height.

Practice 1.3.1: Identifying Terms, Factors, and Coefficients B

For problems 1–3, simplify each expression if possible, and then list the terms of the simplified expression. Identify the constant term and the factors and coefficients of non-constant terms.

1. $8x^2 - 3x + 6x^2 + 5x - 9$

2. $5(2x + 4) + 3x$

3. $\frac{4x^3}{5} + 9x$

For problems 4 and 5, translate each verbal expression into an algebraic expression. Then, list the terms of the given expressions, and identify the constant term and the factors and coefficients of non-constant terms.

4. 4 more than the quotient of *x* squared and 3

5. the sum of *x* to the sixth power and 3 times *x*

For problem 6, write an expression that has the given terms and coefficients.

6. Write an expression with 5 terms, containing the coefficients 12, 15, 18, and 21.

continued

For problems 7–10, write an algebraic expression to describe each situation, and then list the terms of the expressions. Identify the constant term and the factors and coefficients of non-constant terms.

7. Colin bought 2 theater tickets and paid a service charge of 5% for buying them from a ticket broker. Write an algebraic expression to represent the total cost of the tickets. Let *x* represent the cost of each ticket.

8. Eddie purchased 4 packages of light bulbs and received a 15% discount. He also paid $4.85 in taxes on his purchase. Write an algebraic expression to represent the total amount Eddie paid. Let *x* represent the cost of each package purchased.

9. The perimeter of a rectangle is found by finding the sum of all the sides. Write an algebraic expression to represent the perimeter of a rectangle with length *x* meters and width 4 meters shorter.

10. Write an algebraic expression that represents $\frac{5}{9}$ of the difference of a given Fahrenheit temperature and 32.

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Name: Date:

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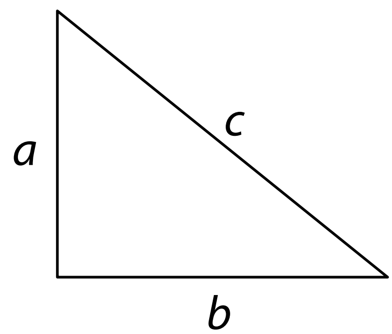
Lesson 1.3.2: Adding and Subtracting Polynomials

Warm-Up 1.3.2

Penelope is a playground designer. She's considering different sizes of a triangular climbing wall for her latest project. Penelope has drawn up three potential designs for the climbing wall, each with different side lengths. For each design, she needs to determine the perimeter of the climbing wall in order to know how much material will be needed to build it. The perimeter of a triangle is the sum of the lengths of the three sides. Help Penelope by finding the perimeter of a climbing wall with each of the given side lengths. Write the perimeter in the simplest expression possible. All side lengths are in feet.



1. $a = 5$, $b = 12$, and $c = 20$

2. $a = 8$, $b = x$, and $c = 15$

3. $a = x$, $b = 1$, and $c = 6$

Scaffolded Practice 1.3.2

Example 1

Find the sum of $(4 + 3x) + (2 + x)$.

1. Rewrite the sum so that like terms are together.

2. Find the sum of any numeric quantities.

3. Find the sum of any terms with the same variable raised to the same power.

continued

Example 2

Find the sum of $(7x^2 - x + 15) + (6x + 12)$.

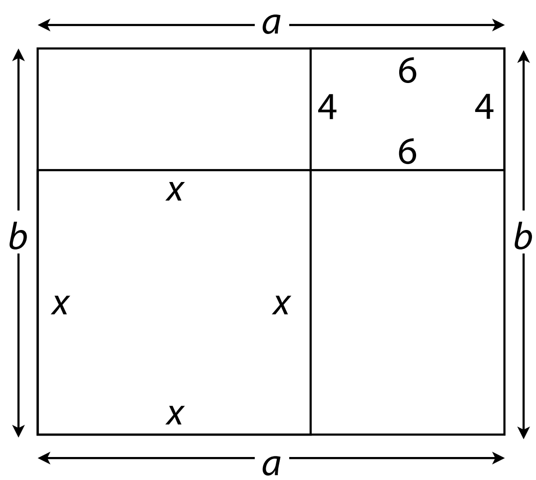
Example 3

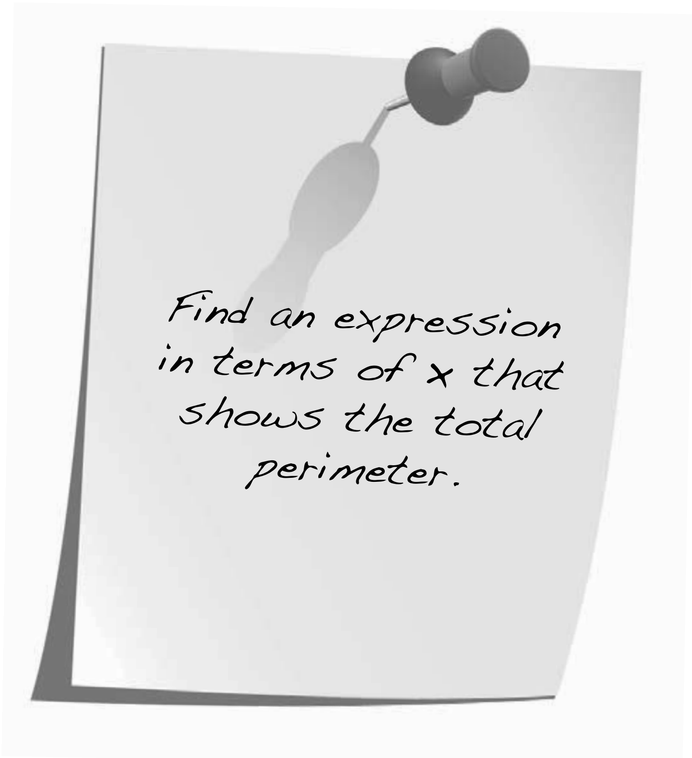
Find the difference of $(x^5 + 8) - (3x^5 + 5x)$.

Problem-Based Task 1.3.2: Cabin Perimeter

SMP	
1 ✓	2
3	4
5	6
7 ✓	8 ✓

Soren has been hired to design a small cabin. He has drawn a blueprint for the cabin, as shown. His client is still determining the overall size of the cabin, but Soren has labeled the known lengths in feet. He wants to find an expression to represent the perimeter of the entire space. The perimeter of the cabin is the sum of all four sides and can be written as $P = 2a + 2b$. Find an expression in terms of x that shows the total perimeter.





Practice 1.3.2: Adding and Subtracting Polynomials A

Find each sum or difference.

1. $(x^3 - 5) + (6x^3 + 2)$

2. $(x^3 - 4x + 2) + (x^4 + 12x)$

3. $(-3x^2 + 16) - (x^2 - 22x - 4)$

4. $(5x^5 - 2x) - (4x^4 + 3x^2)$

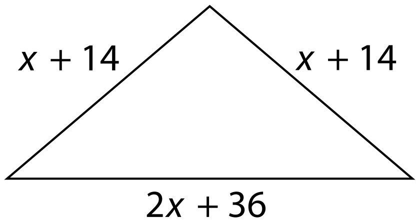
5. $(10x - 9) - (-x^2 + 22x)$

6. $(6x^4 + 8) + (x^4 - 2x^3 + 1)$

continued

The perimeter of a polygon is the sum of the lengths of the sides of the polygon. For problems 7–10, find the perimeter of each shape in terms of x. All lengths are given in centimeters.

7.



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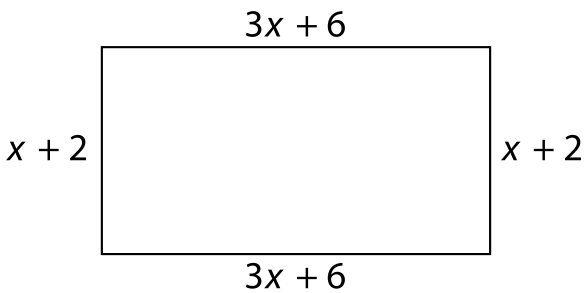

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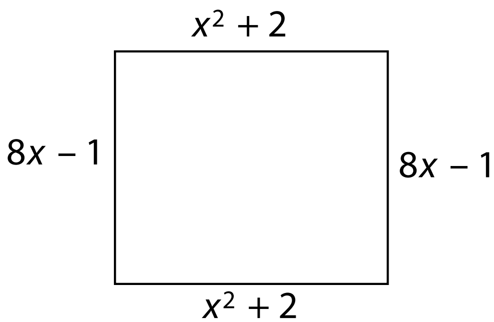

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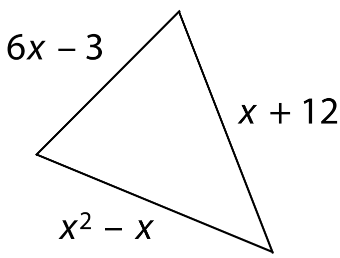


Practice 1.3.2: Adding and Subtracting Polynomials B

Find each sum or difference.

1. $(x + 18) + (-x + 4)$

2. $(-7x^3 + 3) - (x^2 + 9)$

3. $(x^2 - 2) + (-x^3 + 2x - 12)$

4. $(x^6 + x^3) - (-3x^6 + x^2)$

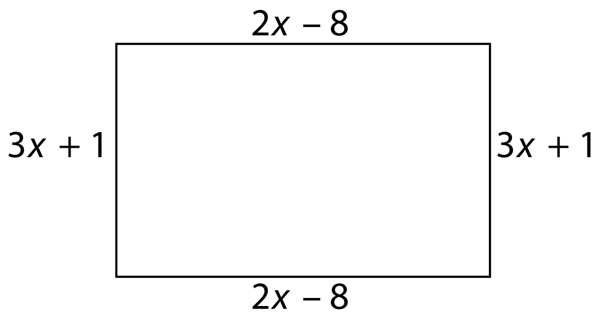
5. $(6x^2 - 6) - (x^3 - x)$

6. $(8x^3 + x^2 - 3) + (x^2 - 4)$

continued

The perimeter of a polygon is the sum of the lengths of the sides of the polygon. For problems 7–10, find the perimeter of each shape in terms of x. All lengths are given in centimeters.

7.



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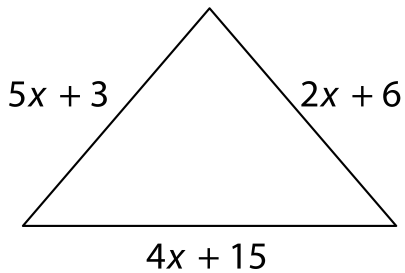

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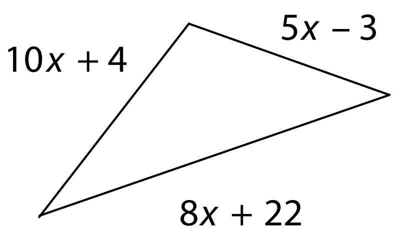

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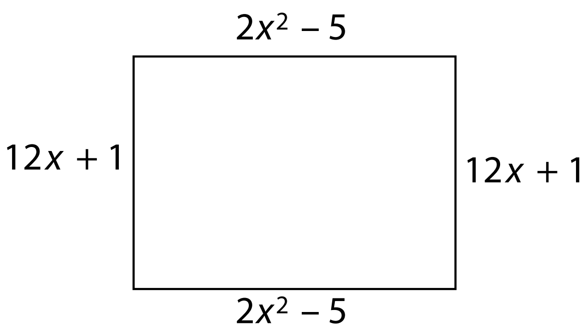

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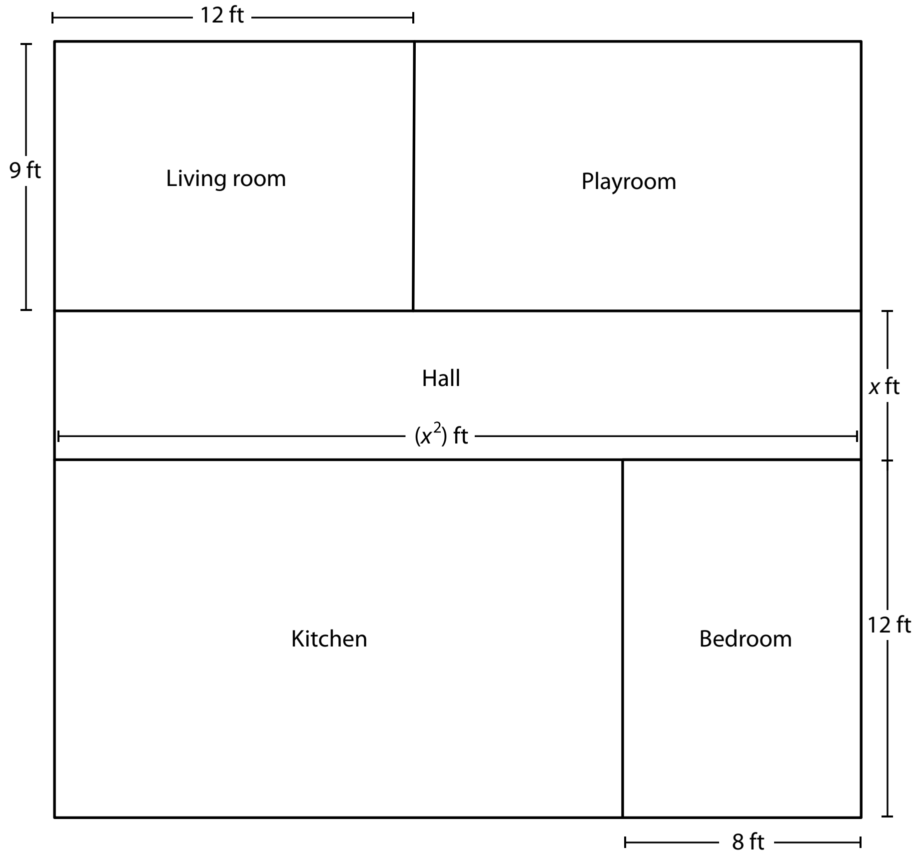
Lesson 1.3.3: Multiplying Polynomials

Warm-Up 1.3.3

A carpet installer charges different prices based on the size of the room where the carpet is being installed. Iskra wants to have the same carpet installed in her bedroom, living room, and hall. To determine the cost, she first needs to determine the area of each rectangular room. The area of a rectangle is the product of the rectangle's length, l, and width, w: $A = lw$. Find the area in simplest form for each of the three rooms Iskra wants to have carpeted.



1. The bedroom has a length of 12 feet and a width of 8 feet.

2. The living room has a length of 12 feet and a width of 9 feet.

3. The hall has a length of x^2 feet and a width of x feet.

Scaffolded Practice 1.3.3

Example 1

Find the product of $(2x - 1)(x + 18)$.

1. Distribute the first polynomial over the second.

2. Use properties of exponents to simplify any expressions.

3. Simplify any remaining products.

4. Combine any like terms.

continued

Example 2

Find the product of $(x^3 + 9x)(-x^2 + 11)$.

Example 3

Find the product of $(3x + 4)(x^2 + 6x + 10)$.

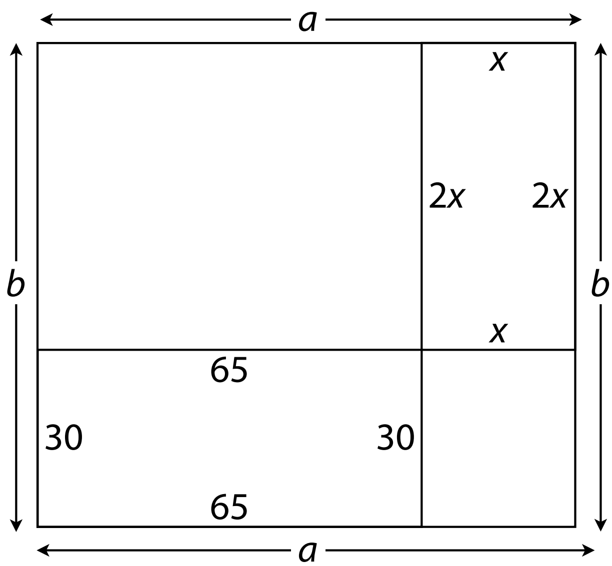
Example 4

Find the product of $(x + y + 1)(x^2 + 4y - 5)$.

Problem-Based Task 1.3.3: Architectural Area

SMP	
1 ✓	2
3	4 ✓
5	6
7	8

An architect is creating a template, or reusable pattern, of the design of a bathroom. One part of the bathroom has a standard size in order to fit a standard bathtub, and one part of the bathroom can vary based on what the customer wants. The architect's template is shown, and all units are in inches. The formula for finding the area of a rectangle is $A = lw$, or in this case, $A = ab$. Find an expression to determine the total area of the bathroom for any value of x.



Practice 1.3.3: Multiplying Polynomials A

Find each product.

1. $(x + 10)(x - 7)$

2. $(3x + 5)(x^3 + 4x)$

3. $(2x + 1)(x^4 - 6x + 3)$

4. $(x^5 - 2)(x^2 + 2x + 4)$

5. $(2x^2 + x - 6)(10x + 4)$

6. $(-x^3 - x^2 + 2)(x^3 + 3x^2 + 2)$

The area of a rectangle is found using the formula $A = lw$, where l is the length of the rectangle and w is the width. Multiply each pair of factors and express the area of each rectangle as a single polynomial in terms of x.

7. $l = x + 14$; $w = 3x + 1$

8. $l = x^2 - 8$; $w = -x + 12$

9. $l = x^2 - 4$; $w = 5x + 10$

10. $l = 4x^2 + 8$; $w = 2x^2 - 3$

Practice 1.3.3: Multiplying Polynomials B

Find each product.

1. $(x + 3)(x + 8)$

2. $(x^2 - 9)(x^3 + 3)$

3. $(x + 10)(2x^2 + x - 6)$

4. $(-3x^4 + 1)(-x^2 - 8x + 5)$

5. $(x^3 + x^2 + 2)(x^2 + x - 3)$

6. $(4x^2 + x)(3x^2 - x + 4)$

The area of a rectangle is found using the formula $A = lw$, where l is the length of the rectangle and w is the width. Multiply each pair of factors and express the area of each rectangle as a single polynomial in terms of x.

7. $l = 2x - 15$; $w = x - 4$

8. $l = -x^3 + 2$; $w = x^2 + x$

9. $l = 5x + 2$; $w = x^2 + 1$

10. $l = 8x - 7$; $w = 3x - 3$

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Lesson 1.3.4: Interpreting Complicated Expressions

Warm-Up 1.3.4

Javier deposited $750 in a bank account that earns interest at a rate of 3% of his initial deposit each year. He left the money in the account for 5 years. Use this information to complete the problems that follow. Explain your answers.

1. How much interest did Javier earn in 5 years?

2. How much money was in Javier's account after 5 years?

Scaffolded Practice 1.3.4

Example 1

A new car loses an average value of $1,800 per year. When Nia bought her new car, she paid $25,000. The expression 25,000 – 1800*y* represents the current value of the car, where *y* represents the number of years since Nia bought it. What effect, if any, does the change in the number of years since Nia bought the car have on the original price of the car?

1. Refer to the expression given: 25,000 – 1800*y*.

2. Determine the effect that the number of years has on the original price of the car.

continued

Example 2

Money deposited in a bank account earns interest on the initial amount deposited as well as any interest earned as time passes. This compound interest can be described by the expression $P(1 + r)^n$, where P represents the initial amount deposited, r represents the interest rate, and n represents the number of years that pass. How does a change in each variable affect the value of the expression?

Example 3

The length of each side of a square is increased by 2 centimeters. How does the perimeter change? How does the area change?

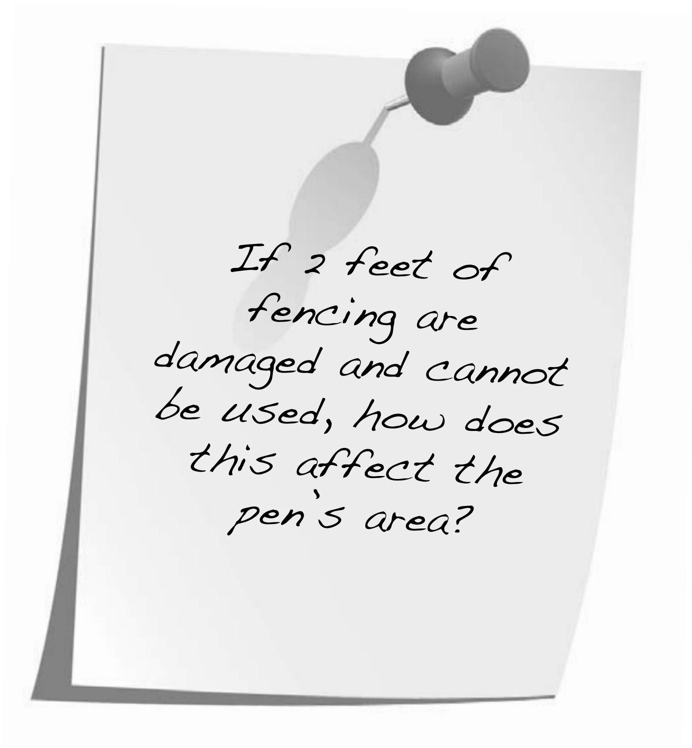
Example 4

A car's total stopping distance in feet depends on many factors, but can be approximated by the expression $\frac{11}{10}x+\frac{1}{19}x^2$, where x is the speed of the car in miles per hour. Is this expression quadratic? What effect does doubling the car's speed from 10 mph to 20 mph have on the total stopping distance?

Problem-Based Task 1.3.4: Puppy Pen

SMP	
1 ✓	2
3	4 ✓
5	6
7 ✓	8

Oscar has 20 feet of fencing. He wants to build a rectangular pen for his new puppy. Write an expression for the area of the puppy's pen and show that the expression is quadratic. If 2 feet of fencing are damaged and cannot be used, how does this affect the pen's area?



Practice 1.3.4: Interpreting Complicated Expressions A

For problems 1–4, use what you know about expressions to answer the questions.

1. Is the expression $\frac{5 + 3x}{2}$ always equal to the expression $4x$? Explain your answer.

2. What values of x make the expression $(2x + 1)(x - 3)$ positive?

3. Is the expression $2 \bullet 4^x$ equal to the expression 8^x? Explain your answer.

4. Is the expression $(5 \bullet 2)^x$ equal to the expression 10^x? Explain your answer.

For problems 5 and 6, determine whether each expression is a quadratic expression. Explain your reasoning.

5. $(x + 4)(5x - 11)$

6. $(2x^2 + 9)(x - 2)$

continued

For problems 7–10, translate any verbal expressions into algebraic expressions, and then answer the questions.

7. A transfer station charges $15 for a waste disposal permit and an additional $5 for each cubic yard of garbage it disposes of. This relationship can be described using the expression $15 + 5x$. What effect, if any, does changing the value of x have on the cost of the permit?

8. A bank account balance for an account with an initial deposit of P dollars earns interest at an annual rate of r. The amount of money in the account after n years is described using the following expression: $P(1 + r)^n$. What effect, if any, does decreasing the value of r have on the amount of money after n years?

9. A tire can hold C cubic feet of air. It loses a percentage of its air during each period of time, t. This rate of loss, written as a decimal, is r. This situation can be described using the following formula: $C(1 - r)^t$. What effect, if any, does increasing the value of r have on the value of C?

10. The surface area of a cube is the product of 6 and the square of the side length. How does the surface area of a cube change when the side of a cube doubles in length?

Practice 1.3.4: Interpreting Complicated Expressions B

For problems 1–4, use what you know about expressions to answer the questions.

1. Explain why the expression $7 \bullet 3^x$ is not equal to the expression 21^x.

2. What values of x make the expression $(5x + 7)(2x - 8)$ positive?

3. Explain why the expression $(5 \bullet 2)^x$ is equal to the expression 10^x.

4. Julio and his sister bought 8 books and m magazines for $1 each, and then they split the cost. The amount of money that Julio spent is represented by the expression $\frac{1}{2}(8+m)$. Does the number of books purchased affect the value of m?

For problems 5 and 6, determine whether each expression is a quadratic expression. Explain your reasoning.

5. $(x - 1)^2 + 10$

6. $(x + 4)(x + 1)(x - 1)$

continued

For problems 7–10, translate any verbal expressions into algebraic expressions, and then answer the questions.

7. Satellite Cell Phone company bills on a monthly basis. Each bill includes a \$19.95 service fee for 500 minutes plus a \$3.95 communication tax and \$0.15 for each minute over 500 minutes. The following expression describes the cost of the cellphone service per month: $23.90 + 0.15m$. If Satellite Cell Phone lowers its service fee, how will the expression change?

8. The effectiveness of an initial dose, *d*, of a particular medicine decreases over a period of time, *t*, at a certain percentage rate, *r*, written as a decimal. This situation can be described using the expression: $d(1 - r)^t$. What effect, if any, does decreasing the value of *r* have on the value of *d*?

9. The fine print on the back of a gift card states that a 1% inactivity fee will be deducted each month from the remaining balance if the card has never been used. The expression $x(0.99)^y$ describes this situation. Does the number of months that the gift card remains inactive affect the rate at which the amount is deducted?

10. The surface area of a sphere is the product of 4π and the square of the radius. How does the surface area change when the radius is halved?

Name: Date:

Notes

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Station 1

You will be given 12 index cards with the following written on them:

10 millimeters, 12 inches, 3 feet, 2 pints, 4 quarts, 1 ton, 1 centimeter, 1 foot, 1 yard, 1 quart, 1 gallon, 2,000 pounds

Shuffle the index cards and deal a card to each student in your group until all the cards are gone. As a group, show your cards to each other and match the cards that are an equivalent unit of measurement.

1. Write your answers on the lines. The first match is shown:

10 mm = 1 cm ____________ ____________

____________ ____________

____________ ____________

2. Find the number of pints in a gallon. Explain how you can use your answers in problem 1 to find the number of pints in a gallon.

3. Find the number of inches in half of a yard. Explain how you can use your answers in problem 1 to find the number of inches in half of a yard.

continued

Perform the following unit conversions by filling in the blanks.

4. 2.5 tons = ______ pounds

5. 85 cm = _______ mm

6. 4.5 yd = _______ ft

7. 6 pints = _______ quarts = _______ gallons

8. When would you use unit conversions in the real world?

Station 2

You will be given a calculator to help you solve the problems. Work as a group to solve these real-world applications of unit conversions.

1. Evan has a friend in England. His friend said the temperature was very hot at 35°. Evan thought he heard his friend incorrectly since 35° is cold. What caused his misunderstanding? (*Hint*: $C = (F - 32)\frac{5}{9}$)

   Find the equivalent temperature in the United States that would make the claim of Evan's friend valid.

2. Anna is going to build a patio. She wants the patio to be 20 feet by 35 feet. What is the perimeter of the patio in yards?

   What is the perimeter of the patio in inches?

   What is the area of the patio in yards?

continued

What is the area of the patio in inches?

3. Tim claims he can run the 100-yard dash in 12 seconds. Jeremy claims he can run 400 feet in 12 seconds. Martin claims he can run 70 meters in 12 seconds. (*Hint*: 1 yard = 0.9144 meters and 1 yard = 3 feet.)

   Fill in the table to create equivalent units of measure.

	Feet	**Yards**	**Meters**	**Time (seconds)**
Tim				
Jeremy				
Martin				

   List the three boys in order from fastest to slowest.

   How fast did each boy run in feet/second?

Station 3

You will be given a bag containing 24 green marbles and 16 yellow marbles. You will use the marbles to create ratios and percents. You will then solve percent problems. Work together as a group to solve the following problems.

1. Shake the bag of green and yellow marbles so that the colors are mixed. Have each student select 2 marbles from the bag without looking. Group all your marbles together by color.

   How many green marbles did you draw?

   How many yellow marbles did you draw?

   What was the total number of marbles drawn?

   How can you determine the percentage of marbles that were green?

   Find the percentage of marbles you drew that were green.

   Name two ways you can find the percentage of marbles you drew that were yellow.

   Find the percentage of marbles you drew that were yellow.

continued

2. Take all the marbles out of the bag. How can you determine what percentage of all the marbles are green?

   How can you determine what percentage of all the marbles are yellow?

3. Place 12 green marbles on the table. How many yellow marbles do you need to have 75% as many yellow marbles as green marbles on the table?

   Draw a picture of the number of green marbles and yellow marbles you have placed on the table.

4. Use equations to show two ways that you can find 25% of 24.

5. Use equations to show two ways that you can find 200% of 17.

6. Real-world application: Bryan is a photographer. He has a 5 inch by 7 inch photo that he wants to enlarge by 200%. What is the area of the new photo? Explain your answer.

Station 4

You will be given 8 large blue algebra tiles and 20 small yellow algebra tiles.

1. Work as a group to arrange the algebra tiles so they visually depict the ratio of the number of blue tiles to yellow tiles. What is this ratio?

2. Rearrange the tiles to visually depict the following ratios:

   $\frac{2\text{ blue}}{3\text{ yellow}}$ $\frac{1\text{ blue}}{10\text{ yellow}}$ $\frac{4\text{ blue}}{6\text{ yellow}}$ $\frac{1\text{ blue}}{1\text{ yellow}}$

   Which ratios are equivalent ratios?

3. If there are 100 yellow algebra tiles, and the ratio of yellow to blue tiles is the same as your original set of tiles, how many blue algebra tiles are there? Use a proportion to solve this problem. Show your work. (*Hint*: A proportion is two ratios that are equal to each other.)

4. Keeping the same ratio of yellow to blue tiles, if there are 15 yellow algebra tiles, how many blue algebra tiles are there? Use a proportion to solve this problem. Show your work.

continued

Work together to solve the following proportions for the variable.

5. $\frac{2}{7} = \frac{x}{14}$; $x =$

6. $\frac{8}{x} = \frac{2}{10}$; $x =$

Use the following information to answer problem 7.

Allison has 6 blue pencils and 10 yellow pencils. Sadie has 24 pencils that are either blue or yellow. The ratio of blue pencils to yellow pencils is the same for both Allison and Sadie.

7. How many blue pencils and yellow pencils does Sadie have? Set up a proportion using the variable *x* to solve this problem. Show your work.

Station 1

At this station, you will find 20 blue algebra tiles, 20 red algebra tiles, 20 green algebra tiles, and 20 yellow algebra tiles. Work as a group to model each polynomial by placing the tiles next to the polynomials. Then find the sum. Write your answer in the space provided below each problem.

- Use the blue algebra tiles to model the x^2 term.
- Use the red algebra tiles to represent the xy term.
- Use the green algebra tiles to represent the y^2 term.
- Use the yellow algebra tiles to represent the constant.

1. Given: $\begin{array}{r} 3x^2 + 2xy + 2y^2 \\ + \quad 5x^2 - xy + 3y^2 \\ \hline \end{array}$. Model the polynomial and find the sum.

2. How did you use the algebra tiles to model the problem?

3. How did you model the $-xy$ term?

4. What property did you use on the xy terms?

5. Model the following problem using the algebra tiles. Show your work, and write your answer in the space provided.

   $(4y^2 - 12xy + 5x^2) + (-10x^2 + 8y^2 - 4)$

continued

6. How did you use the algebra tiles to model problem 5?

7. How did you deal with negative terms during addition?

Work together to add each polynomial. Show your work, and write your answer in the space below each problem.

8. Given:

$$\begin{array}{r} 2a^3 + a^2b^2 + 3b^3 \\ +\quad 3a^3 - 4a^2b^2 + 7b^3 \\ \hline \end{array}$$

9. $-10xy - 3 + 2x^2 - 5y^2 + 4y^2 + 8x^2 - 5xy + 7$

10. $8c^3 + 3ac^2 + 4a^3 + 8c^3 - 12a^3 - 7$

Station 2

At this station, you will find 20 blue algebra tiles, 20 red algebra tiles, 20 green algebra tiles, and 20 yellow algebra tiles. Work as a group to model each polynomial by placing the tiles next to the polynomials. Then find the difference. Write your answer in the space provided below each problem.

- Use the blue algebra tiles to model the x^2 term.
- Use the red algebra tiles to represent the xy term.
- Use the green algebra tiles to represent the y^2 term.
- Use the yellow algebra tiles to represent the constant.

1. Given: $\begin{array}{r} 8x^2 + 7xy + 6y^2 \\ -\,(3x^2 + 2xy + 2y^2) \\ \hline \end{array}$. Model the polynomial and find the difference.

2. How did you use the algebra tiles to model the problem?

3. To what terms in the bottom polynomial does the subtraction sign apply?

4. Find the difference: $\begin{array}{r} 3x^2 + 2xy + 2y^2 \\ -\;(8x^2 + 7xy + 6y^2) \\ \hline \end{array}$. Write your answer in the space provided.

continued

5. Is your answer from problem 1 the same as your answer from problem 4? Why or why not?

6. Model the following subtraction problem using the algebra tiles, then solve. Show your work, and write your answer in the space provided.

$$\begin{array}{r} 2x^2 + 5y^2 + 9xy \\ -\ (4xy - 5x^2 - 6y^2) \\ \hline \end{array}$$

7. How did you arrange the algebra tiles to model problem 6?

8. How did you deal with negative terms during subtraction?

For problems 9 and 10, work together to subtract each polynomial. Show your work, and write your answer in the space provided.

9.
$$\begin{array}{r} a^4 - a^2b^2 + 4b^3 + 8 \\ -\ (3a^4 + 3a^2b^2 - 2b^3 + 2) \\ \hline \end{array}$$

10. Subtract $8c^2 + 2bc + 10$ from $-4bc + 14c^2 - 8$.

Station 3

At this station, you will find a number cube. As a group, roll the number cube. Write the result in the box.

Given: $\square\, x(3x + y - 2)$

1. Identify the two polynomials you've created.

2. What property can you use to multiply these polynomials?

3. Multiply the polynomials. Show your work.

As a group, roll the number cube. Write the result in the box.

Given: $-\square\, x^2(-4x + 7xy - 8)$

4. Identify the two polynomials you've created.

5. Multiply the polynomials. Show your work.

6. What happened to the signs of each term of the polynomial in the parentheses? Explain your answer.

continued

Use the given information to complete problems 7–10.

Given: $(x + 3)(x - 4)$

7. Identify the two polynomials given.

8. What method can you use to multiply these polynomials?

9. Multiply the polynomials. Show your work.

10. What extra steps did you take when multiplying $(x + 3)(x - 4)$ versus $-\square x^2(-4x + 7xy - 8)$?

Station 4

At this station, you will find six index cards with the following polynomials written on them:

$x - 1$; $6x^2 - 3x + 1$; $3x^2 - 2x + 5$; $3 + x$; $2x^2 + 3x - 1$; $-6x^2 + 5x - 8$

You will also find three operation cards, each with an addition, subtraction, or multiplication symbol written on them: +, –, •.

Work as a group to find the two polynomials and corresponding operation that yield the results that follow by using the cards to set up a problem.

1. $x^2 - 5x + 6$

   Problem:

   What strategies did you use to determine the problem?

2. $x^2 + 2x - 3$

   Problem:

   What strategies did you use to determine the problem?

continued

3. $2x - 7$

   Problem:

   What strategies did you use to determine the problem?

4. $2x + 2$

   Problem:

   What strategies did you use to determine the problem?

5. $-3x^2 + 3x - 3$

   Problem:

   What strategies did you use to determine the problem?

continued

Place the polynomial cards in a pile and shuffle them.

6. Pick the top two cards from the polynomial pile and add the two expressions. Write the problem and the solution in the space provided.

7. Pick the top two cards from the polynomial pile and subtract one expression from the other. Write the problem and the solution in the space provided.

ALGEBRA

Functions	
$f(x)$	Function notation, "*f* of *x*"
$f^{-1}(x)$	Inverse function notation
$f(x) = mx + b$	Linear function
$f(x) = b^x + k$	Exponential function
$(f + g)(x) = f(x) + g(x)$	Addition
$(f - g)(x) = f(x) - g(x)$	Subtraction
$(f \bullet g)(x) = f(x) \bullet g(x)$	Multiplication
$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$	Division
$\frac{f(b) - f(a)}{b - a}$	Average rate of change
$f(-x) = -f(x)$	Odd function
$f(-x) = f(x)$	Even function
$f(x) = \lfloor x \rfloor$	Floor/greatest integer function
$f(x) = \lceil x \rceil$	Ceiling/least integer function
$f(x) = a\sqrt[3]{(x-h)} + k$	Cube root function
$f(x) = a\sqrt[n]{(x-h)} + k$	Radical function
$f(x) = a\lvert x - h \rvert + k$	Absolute value function
$f(x) = \frac{p(x)}{q(x)};\ \ q(x) \neq 0$	Rational function

Symbols	
$\approx$	Approximately equal to
$\neq$	Is not equal to
$\lvert a \rvert$	Absolute value of *a*
$\sqrt{a}$	Square root of *a*
∞	Infinity
[	Inclusive on the lower bound
]	Inclusive on the upper bound
(	Non-inclusive on the lower bound
)	Non-inclusive on the upper bound

Linear Equations	
$m = \frac{y_2 - y_1}{x_2 - x_1}$	Slope
$y = mx + b$	Slope-intercept form
$ax + by = c$	General form
$y - y_1 = m(x - x_1)$	Point-slope form

Exponential Equations	
$A = P\left(1 + \frac{r}{n}\right)^{nt}$	Compounded interest formula
Compounded...	*n* (number of times per year)
Yearly/annually	1
Semi-annually	2
Quarterly	4
Monthly	12
Weekly	52
Daily	365

Quadratic Functions and Equations	
$x=\frac{-b}{2a}$	Axis of symmetry
$x=\frac{p+q}{2}$	Axis of symmetry using the midpoint of the x-intercepts
$\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$	Vertex
$f(x) = ax^2 + bx + c$	General form
$f(x) = a(x - h)^2 + k$	Vertex form
$f(x) = a(x - p)(x - q)$	Factored/intercept form
$b^2 - 4ac$	Discriminant
$x^2+bx+\left(\frac{b}{2}\right)^2$	Perfect square trinomial
$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$	Quadratic formula
$(ax)^2-b^2=(ax+b)(ax-b)$	Difference of squares
$(x - h)^2 = 4p(y - k)$	Standard form for a parabola that opens up or down
$(y - k)^2 = 4p(x - h)$	Standard form for a parabola that opens right or left
$F(h, k + p)$	Focus for a parabola that opens up or down
$F(h + p, k)$	Focus for a parabola that opens right or left
$y = k - p$	Directrix for a parabola that opens up or down
$x = h - p$	Directrix for a parabola that opens right or left

Formulas

Exponential Functions	
$1 + r$	Growth factor
$1 - r$	Decay factor
$f(t) = a(1+r)^t$	Exponential growth function
$f(t) = a(1-r)^t$	Exponential decay function
$f(x) = ab^x$	Exponential function in general form

General	
(x, y)	Ordered pair
$(x, 0)$	x-intercept
$(0, y)$	y-intercept

Equations of Circles	
$(x - h)^2 + (y - k)^2 = r^2$	Standard form
$x^2 + y^2 = r^2$	Center at (0, 0)
$Ax^2 + By^2 + Cx + Dy + E = 0$	General form

Properties of Radicals
$\sqrt{ab} = \sqrt{a} \bullet \sqrt{b}$
$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

Imaginary Numbers
$i = \sqrt{-1}$
$i^2 = -1$
$i^3 = -i$
$i^4 = 1$

Radicals to Rational Exponents
$\sqrt[n]{a} = a^{\frac{1}{n}}$
$\sqrt[n]{x^m} = x^{\frac{m}{n}}$

Multiplication of Complex Conjugates
$(a + bi)(a - bi) = a^2 + b^2$

Properties of Exponents	
Property	General rule
Zero Exponent	$a^0 = 1$
Negative Exponent	$b^{-\frac{m}{n}} = \frac{1}{b^{\frac{m}{n}}}$
Product of Powers	$a^m \bullet a^n = a^{m+n}$
Quotient of Powers	$\frac{a^m}{a^n} = a^{m-n}$
Power of a Power	$\left(b^m\right)^n = b^{mn}$
Power of a Product	$(bc)^n = b^n c^n$
Power of a Quotient	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

DATA ANALYSIS

Rules and Equations	
$P(E)=\frac{\text{\# of outcomes in } E}{\text{\# of outcomes in sample space}}$	Probability of event E
$P(A\cup B)=P(A)+P(B)-P(A\cap B)$	Addition rule
$P(\overline{A})=1-P(A)$	Complement rule
$P(B\|A)=\frac{P(A\cap B)}{P(A)}$	Conditional probability
$P(A\cap B)=P(A)\bullet P(B\|A)$	Multiplication rule
$P(A\cap B)=P(A)\bullet P(B)$	Multiplication rule if A and B are independent
${}_nC_r=\frac{n!}{(n-r)!r!}$	Combination
${}_nP_r=\frac{n!}{(n-r)!}$	Permutation
$n!=n\bullet(n-1)\bullet(n-2)\bullet\cdots\bullet 1$	Factorial

Symbols	
$\varnothing$	Empty/null set
$\cap$	Intersection, "and"
$\cup$	Union, "or"
$\subset$	Subset
$\overline{A}$	Complement of Set A
!	Factorial
${}_nC_r$	Combination
${}_nP_r$	Permutation

GEOMETRY

Symbols	
$\overset{\frown}{ABC}$	Major arc length
$\overset{\frown}{AB}$	Minor arc length
$\angle$	Angle
$\odot$	Circle
$\cong$	Congruent
$\overleftrightarrow{PQ}$	Line
$\overline{PQ}$	Line segment
$\overrightarrow{PQ}$	Ray
$\parallel$	Parallel
$\perp$	Perpendicular
$\bullet$	Point
$\triangle$	Triangle
$\square$	Parallelogram
A'	Prime
$^\circ$	Degrees
θ	Theta
ϕ	Phi
π	Pi

Area	
$A = lw$	Rectangle
$A=\frac{1}{2}bh$	Triangle
$A=\pi r^2$	Circle
$A=\frac{1}{2}(b_1+b_2)h$	Trapezoid

Trigonometric Ratios		
$\sin\theta=\frac{\text{opposite}}{\text{hypotenuse}}$	$\cos\theta=\frac{\text{adjacent}}{\text{hypotenuse}}$	$\tan\theta=\frac{\text{opposite}}{\text{adjacent}}$
$\csc\theta=\frac{\text{hypotenuse}}{\text{opposite}}$	$\sec\theta=\frac{\text{hypotenuse}}{\text{adjacent}}$	$\cot\theta=\frac{\text{adjacent}}{\text{opposite}}$

Trigonometric Identities
$\sin\theta=\cos(90^\circ-\theta)$
$\cos\theta=\sin(90^\circ-\theta)$
$\tan\theta=\frac{\sin\theta}{\cos\theta}$
$\csc\theta=\frac{1}{\sin\theta}$
$\sec\theta=\frac{1}{\cos\theta}$
$\cot\theta=\frac{1}{\tan\theta}$
$\cot\theta=\frac{\cos\theta}{\sin\theta}$
$\sin^2\theta+\cos^2\theta=1$

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

Volume	
$V=lwh$	Rectangular prism
$V=Bh$	Prism
$V=\frac{1}{3}\pi r^2 h$	Cone
$V=\frac{1}{3}Bh$	Pyramid
$V=\pi r^2 h$	Cylinder
$V=\frac{4}{3}\pi r^3$	Sphere

Distance Formula
$d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

Dilation
$D_k(x,y)=(kx,ky)$

Pi Defined
$\pi=\frac{\text{circumference}}{\text{diameter}}=\frac{\text{circumference}}{2\bullet\text{radius}}$

Circumference of a Circle	
$C = 2\pi r$	Circumference given the radius
$C = \pi d$	Circumference given the diameter

Converting Between Degrees and Radians
$\frac{\text{radian measure}}{\pi} = \frac{\text{degree measure}}{180}$

Midpoint Formula
$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Inverse Trigonometric Functions
Arcsin $\theta = \sin^{-1}\theta$
Arccos $\theta = \cos^{-1}\theta$
Arctan $\theta = \tan^{-1}\theta$

Arc Length	
$s = \theta r$	Arc length (θ in radians)

MEASUREMENTS

Length
Metric
1 kilometer (km) = 1000 meters (m)
1 meter (m) = 100 centimeters (cm)
1 centimeter (cm) = 10 millimeters (mm)
Customary
1 mile (mi) = 1760 yards (yd)
1 mile (mi) = 5280 feet (ft)
1 yard (yd) = 3 feet (ft)
1 foot (ft) = 12 inches (in)

Volume and Capacity
Metric
1 liter (L) = 1000 milliliters (mL)
Customary
1 gallon (gal) = 4 quarts (qt)
1 quart (qt) = 2 pints (pt)
1 pint (pt) = 2 cups (c)
1 cup (c) = 8 fluid ounces (fl oz)

Weight and Mass
Metric
1 kilogram (kg) = 1000 grams (g)
1 gram (g) = 1000 milligrams (mg)
1 metric ton (MT) = 1000 kilograms
Customary
1 ton (T) = 2000 pounds (lb)
1 pound (lb) = 16 ounces (oz)

English	Unit/Lesson	Español
	A	
accuracy closeness of a measurement to the actual value of the dimension being measured. For example, a measurement of 1.99999 cm for an object that is 2 cm wide has a high level of accuracy.	1.2	**exactitud** la proximidad de una medida al valor real de la dimensión que se está midiendo. Por ejemplo, una medida de 1.99999 cm para un objeto de 2 cm de ancho tiene un alto nivel de precisión.
algebraic expression a mathematical statement that includes numbers, operations, and variables to represent a number or quantity	1.3	**expresión algebraica** declaración matemática que incluye números, operaciones y variables para representar un número o una cantidad
	B	
base the factor being multiplied together in an exponential expression; in the expression a^b, a is the base	1.3	**base** factor que se multiplica en forma conjunta en una expresión exponencial; en la expresión a^b, a es la base
binomial a polynomial with two terms	1.3	**binomio** polinomio con dos términos
	C	
closure a system is closed, or shows closure, under an operation if the result of the operation is within the system	1.3	**cierre** un sistema es cerrado, o tiene cierre, en una operación si el resultado de la misma está dentro del sistema
coefficient the number multiplied by a variable in an algebraic expression	1.3	**coeficiente** número multiplicado por una variable en una expresión algebraica
constant a quantity that does not change	1.3	**constante** cantidad que no cambia
constant term a term whose value does not change	1.3	**término constante** término cuyo valor no cambia
conversion factor a ratio of quantities given in different units that are equivalent. For example, the ratio $\frac{12\text{ inches}}{1\text{ foot}}$ is a conversion factor.	1.2	**factor de conversión** una relación de cantidades dadas en diferentes unidades que son equivalentes. Por ejemplo, la relación $\frac{12\text{ inches}}{1\text{ foot}}$ es un factor de conversión.
	E	
exponent the number of times a factor is being multiplied together in an exponential expression; in the expression a^b, b is the exponent	1.3	**exponente** cantidad de veces que se multiplica un factor en forma conjunta en una expresión exponencial; en la expresión a^b, b es el exponente

English	Unit/Lesson	Español
	F	
factor one of two or more numbers or expressions that when multiplied produce a given product	1.3	**factor** uno de dos o más números o expresiones que cuando se multiplican generan un producto determinado
	I	
integers the set of positive and negative whole numbers and 0; the set {... –3, –2, –1, 0, 1, 2, 3, ...}	1.1	**enteros** el conjunto de números enteros positivos y negativos y 0; el conjunto {... –3, –2, –1, 0, 1, 2, 3, ...}
irrational number a real number that cannot be written as $\frac{m}{n}$, where both m and n are integers and $n \neq 0$; a non-terminating or non-repeating decimal	1.1	**número irracional** un número real que no puede ser escrito como $\frac{m}{n}$, donde m y n son números enteros y $n \neq 0$; un no-terminación o no repetitivo decimal
irreducible radical a radical whose radicand contains no perfect square factors. In other words, the radical cannot be further reduced. For example, $\sqrt{7}$ is an irreducible radical because the radicand, 7, does not have any perfect square factors.	1.1	**radical irredutíble** un radical cuya radicand no contiene factores cuadrados perfectos. En otras palabras, el radical no puede ser más reducido. Por ejemplo, $\sqrt{7}$ es un radical irreducible porque la radicand, 7, no tiene ningún factor cuadrado perfecto.
	L	
like terms terms that contain the same variables raised to the same power	1.3	**términos semejantes** términos que contienen las mismas variables elevadas a la misma potencia
	M	
monomial an expression with one term, consisting of a number, a variable, or the product of a number and variable(s)	1.3	**monomio** expresión con un solo término, que consiste en un número, una variable, o el producto de un número y una o más variables
	O	
order of operations the order in which expressions are evaluated from left to right (grouping symbols, evaluating exponents, completing multiplication and division, completing addition and subtraction)	1.3	**orden de las operaciones** orden en el que se evalúan las expresiones de izquierda a derecha (con agrupación de símbolos, evaluación de exponentes, realización de multiplicaciones y divisiones, realización de sumas y sustracciones)

English	Unit/Lesson	Español
	P	
perfect square the product of an integer and itself. For example, 9 is a perfect square because $9 = 3^2$.	1.1	**cuadrado perfecto** el producto de un número entero multiplicado por sí mismo. Por ejemplo, 9 es un cuadrado perfecto porque $9 = 3^2$.
polynomial a monomial or a sum of monomials	1.3	**polinomio** monomio o suma de monomios
precision the degree to which the accuracy of a measurement is known. In measurement systems, precision also refers to the reproducibility of a result upon repetition.	1.2	**precisión** el grado en que se conoce la exactitud de una medición. En los sistemas de medición, la precisión también se refiere a la reproducibilidad de un resultado en la repetición.
	Q	
quadratic expression an algebraic expression that can be written in the form $ax^2 + bx + c$, where x is the variable, a, b, and c are real numbers, and $a \neq 0$	1.3	**expresión cuadrática** expresión algebraica que se puede expresar en la forma $ax^2 + bx + c$, donde x es la variable, a, b, y c son constantes, y $a \neq 0$
quantify to find, describe, or measure the total amount or number of something	1.2	**cuantificar** para encontrar, describir o medir la cantidad total o el número de algo
quantity a number that describes the total amount or number of something	1.2	**cantidad** un número que describe el monto total o el número de algo
	R	
radical expression an expression containing a root, such as $\sqrt{5}$	1.1	**expresión radical** expresión que contiene una raíz, tal como $\sqrt{5}$
radicand in a radical expression, the number under the root sign; in the expression $\sqrt{5}$, the radicand is 5	1.1	**radicand** en una expresión radical, el número bajo el signo de la raíz; en la expresión $\sqrt{5}$, la radicand es 5
rational number a real number that can be written as $\frac{m}{n}$, where both m and n are integers and $n \neq 0$; a terminating or repeating decimal	1.1	**número racional** en los que m y n son enteros y $n \neq 0$; cualquier número que puede escribirse como decimal finito o periódico
real numbers the set of all rational and irrational numbers	1.1	**números reales** conjunto de todos los números racionales e irracionales

English	Unit/Lesson	Español
	S	
square root For any real numbers a and b, if $a^2 = b$, then a is a square root of b. The square root of b is written using a radical: $\sqrt{b}$.	1.1	**raíz cuadrada** Para cualquier número real a y b, si $a^2 = b$, entonces a es la raíz cuadrada de b. La raíz cuadrada de b se expresa con un radical: $\sqrt{b}$.
standard units a widely accepted unit of measurement. Standard units are usually defined by law.	1.2	**unidades estándar** una unidad de medida ampliamente aceptada. Normalmente, las unidades estándar se definen por ley.
system of measurement a collection of units of measurement, with rules relating the measurements to each other. The metric system, or SI, is an example of a system of measurement.	1.2	**sistema de medida** una colección de unidades de medida, con reglas que relacionan las mediciones entre sí. El sistema métrico, o SI, es un ejemplo de un sistema de medición.
	T	
term a number, a variable, or the product of a number and variable(s)	1.3	**término** número, variable o producto de un número y una o más variables
trinomial a polynomial with three terms	1.3	**trinomio** polinomio con tres términos
	U	
unit of measurement a defined quantity of the subject being measured. For example, the current formal definition of a meter is "the length of the path traveled by light in a vacuum during a time interval of $\frac{1}{299,792,458}$ of a second."	1.2	**unidad de medida** una cantidad definida del sujeto que se está midiendo. Por ejemplo, la definición formal actual de un metro es "la longitud del camino recorrido por la luz en un vacío durante un intervalo de tiempo de $\frac{1}{299,792,458}$ de un segundo".
	V	
variable a letter used to represent a value or unknown quantity that can change or vary	1.3	**variable** letra utilizada para representar un valor o una cantidad desconocida que puede cambiar o variar
	W	
whole numbers the set of positive integers and 0: {0, 1, 2, 3, …}	1.1	**números enteros** conjunto de enteros positivos que incluye el 0: {0, 1, 2, 3, …}