LESSONS
1–30

UNIT
1

Simply Good and Beautiful

PRE-ALGEBRA

COURSE BOOK 1

MATH
8



The Good and the Beautiful
CURRICULUM

COURSE BOOK 1

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Reference Chart 169

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About the Course

SUPPLIES NEEDED

- *Simply Good and Beautiful Pre-Algebra Course Books 1, 2, 3,* and *4*
- *Simply Good and Beautiful Pre-Algebra Answers and Solutions*
- *Simply Good and Beautiful Math Scratch Pad* or other scratch paper
- Device to access videos
- Scientific calculator
- 2 standard dice
- Colored pencils
- Highlighter
- Protractor
- Ruler
- Tape or glue
- Compass
- Scissors

COURSE OVERVIEW

Pre-Algebra consists of Course Books 1, 2, 3, and 4. There are 120 total lessons divided into four units. Each unit ends with a unit review, assessment, and enrichment activity. The course is designed to be completed by the student independently, but the parent/teacher can choose to be as involved in the lessons as he or she would like.

GETTING STARTED

Simply open the first course book. The student may choose to watch the video lesson or just read the lesson overview if he or she feels confident in the lesson topic. Please note that videos may contain material not included in the written lesson overview. After completing the video and/or lesson overview, the student should complete the lesson practice and review sections.

The parent/teacher should check the student's work daily and provide immediate help and feedback. Students who struggle with the lesson practice should be encouraged to review the lesson overview or video for help.

Note: If printing at home, print pages at actual size.

LESSON DETAILS

Most lessons consist of a warm-up, video lesson, lesson overview, practice, and review.

WARM-UP: An activity that applies to the lesson topic or that reviews mental math skills.

VIDEO LESSON: Provides detailed teaching and interactive, guided practice of the lesson topic. Videos are about 12–15 minutes in length.

The Good and Beautiful Homeschool app can be used to access and watch the lesson videos. Use the QR code below to access app download information.

Alternatively, the videos can be accessed at goodandbeautiful.com/pre-algebra.

LESSON OVERVIEW: A concise written lesson on the topic.

PRACTICE: Practice that is dedicated to the lesson topic.

REVIEW: Daily review of topics from previous lessons.

A Reference Chart can be found at the back of each book.

IMPORTANT SAFETY NOTICE

Adult supervision is recommended for all activities as some require sharp objects, heat sources, or small objects that could be a choking hazard for young children.

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Frequently Asked Questions

How many lessons should my student do each week?

There are 120 lessons in the course. If the student completes four lessons per week, he or she will complete the course in a standard school year with typical breaks for vacation or sickness.

How long do lessons take?

The average time to complete a lesson is 50–60 minutes. This includes time to watch the video and complete the course book sections.

What if my child does not do well on an assessment?

Each assessment question has a lesson number indicating where the content was first introduced. If your student misses an assessment question, he or she is encouraged to do one or more of the following:

- Reread the corresponding lesson overview.
- Rewatch the corresponding video.
- Complete the Extra Practice Worksheet for the corresponding lesson (available for purchase).
- Rework the problem given the answer. It can be helpful to know the answer when reworking a problem so mistakes can be found.

Do you include any specific doctrine?

No, the goal of our curriculum is not to teach doctrines specific to any particular Christian denomination but to teach general principles, such as honesty, hard work, and kindness. All Bible references in our curriculum are from the King James Version.

Does my student have to watch the videos?

The videos contain the bulk of the teaching and are highly recommended. However, if your student feels confident in the topic being taught, he or she can skip the video and read the lesson overview instead. A student who struggles with the lesson practice should be encouraged to go back and watch the video.

Some families prefer to have the parent/teacher facilitate the lesson using the lesson overview rather than have the child watch the video lesson independently.

Is Pre-Algebra completed independently by the child?

Yes, Pre-Algebra is designed for your student to complete independently, though at times the student may need parent/teacher assistance to understand a concept. The parent/teacher will need to check the student's work and should do so on a daily basis when possible, providing immediate feedback.

What if there isn't room to complete the work?

Pre-Algebra is designed to give students room to work in their course book. At times, additional paper may be needed. Students should always keep scratch paper on hand while completing the lessons. The *Simply Good and Beautiful Math Scratch Pad* is available for purchase.

Is a calculator used in Pre-Algebra? 

This course is designed to be completed with a scientific calculator on hand for specific problems. Problems that allow the use of a calculator are marked with the calculator icon shown above. Any brand of scientific calculator is acceptable. Please note that calculators may vary, and your student is encouraged to read the manual for the specific calculator to understand how it functions.

Lesson Topics

UNIT 1

1 Place Value and Estimation
2 Decimals and Fractions
3 Addition and Subtraction with Integers
4 Addition and Subtraction with Fractions and Decimals
5 Multiplication with Integers, Fractions, and Decimals
6 Division with Integers, Fractions, and Decimals
7 Properties of Real Numbers: Part 1
8 Properties of Real Numbers: Part 2
9 Exponents
10 Factors and Multiples
11 Order of Operations
12 Combining Like Terms
13 Exponent Rules: Part 1
14 Exponent Rules: Part 2
15 Logic Lesson 1
16 Square and Cube Roots
17 Estimating Roots
18 Number Sets
19 Negative Exponents
20 Operations with Roots
21 Simplifying Complex Expressions
22 Introduction to Scientific Notation
23 Adding and Subtracting in Scientific Notation
24 Multiplying and Dividing in Scientific Notation
25 Writing Expressions, Equations, and Inequalities
26 Solving One-Step Equations
27 Solving Two-Step Equations
28 Unit 1 Review
29 Unit 1 Assessment
30 Enrichment: Repeating Decimals

UNIT 2

31 Solving Multi-Step Equations
32 Modeling Real-World Situations with Equations
33 Solving for a Specific Variable
34 The Coordinate Plane
35 Relations and Functions
36 Domain and Range
37 Graphing Relations and Functions
38 Linear Functions
39 Slope as Rate of Change
40 Calculating Slope
41 Slope-Intercept Form
42 Writing Linear Equations Using Slope and a Point
43 Writing Linear Equations Using Multiple Points
44 Proportional Relationships
45 Logic Lesson 2
46 Graphing from Standard Form
47 Standard Form to Slope-Intercept Form
48 Linear Models
49 Parallel and Perpendicular Lines
50 Solving Equations with Radicals
51 Solving Equations with Exponents
52 The Pythagorean Theorem
53 Using the Pythagorean Theorem
54 Distance on a Coordinate Plane
55 Parts and Wholes with Fractions
56 Fractions, Decimals, and Percents
57 Parts and Wholes with Percents
58 Unit 2 Review
59 Unit 2 Assessment
60 Enrichment: Collatz Conjecture

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UNIT 3

61 Percent Increase and Decrease
62 Calculating Interest
63 Simple Probability
64 Compound Probability
65 Ratios and Unit Rates
66 Proportions
67 Measurement Systems
68 Unit Conversions and Unit Multipliers
69 Scales and Scale Factors
70 Basic Geometry Terms
71 Angle Relationships and Transversals
72 Properties of Triangles
73 Polygons and Interior Angles
74 Congruence and Similarity in Figures
75 Logic Lesson 3
76 Proportions with Similar Figures
77 Drawings and Constructions
78 Circles, Circumference, and Perimeter
79 Arcs, Sectors, and Angles in a Circle
80 Area of Polygons and Circles
81 Area of Composite Figures
82 Surface Area of Polyhedra
83 Surface Area of Other Solids
84 Volume of Prisms and Cylinders
85 Volume of Pyramids, Cones, and Spheres
86 Volume of Composite Solids
87 Solving One-Step and Two-Step Inequalities
88 Unit 3 Review
89 Unit 3 Assessment
90 Enrichment: Tessellations

UNIT 4

91 Advanced Inequalities
92 Graphing Linear Inequalities
93 Types of Solutions
94 Systems of Equations
95 Solving Systems by Substitution
96 Solving Systems by Elimination
97 Practice Solving Systems
98 Translations on the Coordinate Plane
99 Reflections on the Coordinate Plane
100 Rotations and Symmetry
101 Dilations
102 Transformations
103 Polynomials
104 Multiplying Polynomials
105 Logic Lesson 4
106 Dividing Polynomials
107 Factoring
108 Visual Representations of Data: Part 1
109 Visual Representations of Data: Part 2
110 Measures of Central Tendency
111 Box Plots
112 Scatter Plots
113 Line of Best Fit
114 Frequency Tables and Histograms
115 Two-Way Tables
116 Data and Surveys
117 Unit 4 Review
118 Course Review
119 Course Assessment
120 Enrichment: Pascal's Triangle

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Unit 1 Overview

LESSONS 1–30

CONCEPTS COVERED

- Adding and subtracting decimals
- Adding and subtracting fractions
- Adding and subtracting in scientific notation
- Adding and subtracting integers
- Adding and subtracting roots
- Applications of properties of real numbers
- Combining like terms
- Commutative and associative properties
- Comparing and ordering fractions
- Converting decimals to fractions
- Converting fractions to decimals
- Distributive property
- Divisibility rules
- Estimating before performing operations
- Estimating cube roots
- Estimating square roots
- Evaluating expressions
- Evaluating expressions with roots
- Expanded notation
- Expanded notation with exponents
- Exponents
- Expressing unknowns in terms of the same variable
- Greatest common factors
- Identity and inverse properties
- Integer operations on a number line
- Inverse operations
- Least common multiples
- Multiplying and dividing in scientific notation
- Multiplying and dividing integers
- Multiplying and dividing signed fractions and decimals
- Multiplying roots
- Negative exponents
- Number sets
- Opposites and absolute value
- Order of operations
- Perfect squares and perfect cubes
- Place value
- Power of a product rule
- Power of a quotient rule
- Power rule for exponents
- Powers of 10
- Prime and composite numbers
- Prime factorization
- Principal square roots
- Product rule for exponents
- Quotient rule for exponents
- Radicals
- Rational and irrational numbers
- Reading and writing decimal numbers
- Reflexive property
- Relatively prime numbers
- Rounding to any place value
- Scientific notation
- Set notation
- Simplifying complex expressions
- Solving one-step equations
- Solving two-step equations
- Symmetric property
- Terms, constants, and coefficients
- Transitive property
- Upside down division
- Using inequalities to represent situations
- Venn diagrams
- Writing expressions and equations from word problems
- Zero product property

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Exponents

SUPPLIES: item to use as a game pawn (button, cereal, bead, etc.)

WARM-UP

Use the distributive property to rewrite each expression.

a. $-3(a+4b-17)$

b. $j(k+km-5n)$

_____ _____

LESSON

Use the app to watch the video lesson. Complete problems when instructed during the video in the Video Practice section. Optionally, read the Lesson Overview in place of the video or after the video if more instruction is needed.

App Video

VIDEO PRACTICE

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LESSON OVERVIEW

When multiplication is repeated, it is helpful and efficient to have a notation for representing repeated multiplication. This is done using powers.

POWERS

A power is written with an exponent and a base. The ***base*** is the number that is multiplied by itself when using an exponent. The ***exponent*** is the number showing how many times to multiply the base number by itself.

In 5^3, 5 is the base and 3 is the exponent. The whole expression is referred to as a power and is read "5 to the third power" or "5 cubed." It can be written in factored form as $5 \bullet 5 \bullet 5$, which can be evaluated by multiplying the fives: $5^3 = 5 \bullet 5 \bullet 5 = 25 \bullet 5 = 125$.

Example 1: Evaluate 1.2^2.

1.2^2 Multiply 1.2 by itself.

$= 1.2 \bullet 1.2$

$= 1.44$

A number raised to the second power is referred to as "squared."

Example 2: Evaluate $\left(\frac{4}{5}\right)^3$.

$\left(\frac{4}{5}\right)^3$ Multiply the fraction three times.

$= \frac{4}{5} \bullet \frac{4}{5} \bullet \frac{4}{5}$

$= \frac{64}{125}$

Example 3: Evaluate 1^{10}.

1^{10}

$= 1 \bullet 1 \bullet 1 \bullet 1 \bullet 1 \bullet 1 \bullet 1 \bullet 1 \bullet 1 \bullet 1$

$= 1$ Note: 1 raised to any power is just 1.

Example 4: Evaluate $(-2)^4$.

$(-2)^4$ Multiply –2 four times.

$= (-2)(-2)(-2)(-2)$

$= 16$

Notice that the answer to Example 4 is positive. The problem $(-2)^4$ is not the same as -2^4, which has a negative answer. In -2^4, the exponent only applies to the 2, not the negative sign. In $(-2)^4$, the number –2 is multiplied four times. In -2^4, the number 2 is multiplied four times, and then the result is made negative. The exponent applies to whatever it is right next to. When the exponent is right next to a number, it applies only to that number. When the exponent is right next to a parenthesis, it applies to whatever is inside the parentheses.

$$-2^4 = -(2 \bullet 2 \bullet 2 \bullet 2) = -16$$

Any number (except zero) raised to the zero power is 1.

$8^0 = 1$ $\quad (-11)^0 = 1$

Variables can also be written as the base with an exponent.

$a^7 = a \bullet a \bullet a \bullet a \bullet a \bullet a \bullet a$

$z^0 = 1$ for $z \neq 0$

Why can't $0^0 = 1$?

Any multiple of zero will always be zero, so 0^0 can't follow the rule above.

Since 0^0 can't equal both zero and one, 0^0 is *undefined*.

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Expressions with repeated multiplication can be rewritten with exponents. An expression may contain different bases. For example, the expression below is a product involving three different bases. Each base can be written with an exponent.

$$2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 \cdot 8 \cdot 8 \cdot 8 = 2^3 \cdot 5^2 \cdot 8^3$$

Example 5: Rewrite the expression with exponents.

$x \cdot x \cdot y \cdot y \cdot x \cdot z$ Because of the commutative property, variables can be rearranged so all common variables are together.

$= x^3y^2z$

EXPONENTS AND POWERS OF 10

Positive powers of 10 can be evaluated quickly by looking at the exponent. The exponent tells how many zeros are in the final answer.

For example, the power 10^3 can be evaluated by multiplying 10 three times. Notice that there are three zeros in the answer.

$$10^3 = 10 \cdot 10 \cdot 10 = 1000$$

Knowing the pattern for powers of 10 helps with mental math.

Similarly, when a number is multiplied by a positive power of 10, the exponent tells how many places to move the decimal point to the right. Zeros are written at the end of the number when necessary.

Example 6: Evaluate $21.378 \cdot 10^5$.

$21.378 \cdot 10^5$ The decimal point is moved five places to the right.

$= 2{,}137{,}800$ Two zeros must be added to move a total of five places.

EXPANDED NOTATION WITH EXPONENTS

Numbers in expanded notation can be written using exponents. Look at the expanded notation for 12,689 below.

$$12{,}689 = (1 \cdot 10{,}000) + (2 \cdot 1000) + (6 \cdot 100) + (8 \cdot 10) + (9 \cdot 1)$$

The powers of 10 representing the place value of each digit can be written using exponents as shown below. Remember that $10^0 = 1$, so the last number in parentheses can be written with an exponent as well.

$$12{,}689 = (1 \cdot 10^4) + (2 \cdot 10^3) + (6 \cdot 10^2) + (8 \cdot 10^1) + (9 \cdot 10^0)$$

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PRACTICE

1. Choose a power to evaluate from the box below. Move a game pawn the number of spaces on the track based on the answer. For example, if the answer is 81, move the pawn 81 spaces. Any negative answer moves the pawn backward. Continue choosing powers and see how quickly you can make it to the end of the track. Play at least twice to see if you can make it to the end by completing fewer problems.

✦ Hint: Not everything with a negative sign ends up being negative! To make counting spaces easier, the same colored squares are always spaced 10 spaces apart. For example, if you have to move 34 spaces and are currently on red, move to the next red three times, and then move four extra spaces.

-3^4	$(-3)^4$	$(-4)^3$	4^3	145^0	2^6	6^2	10^2	$(-2)^6$	$(-2)^5$	-2^4	2^7	7^2	5^3	3^5	37^1

START

For Problems 2–5, circle the letter for the correct answer.

2. What is 5^3 in factored form?

a. $5 \cdot 3$ c. $5 \cdot 5 \cdot 5$

b. $5 + 3$ d. $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$

3. What is $1.4 \cdot 1.4 \cdot 1.4 \cdot 1.4 \cdot 1.4$ with exponents?

a. $1.4 \cdot 5$ c. $5^{1.4}$

b. 5.37824 d. 1.4^5

4. What is x^3y^2 in factored form?

a. $x \cdot x \cdot x \cdot y \cdot y$ c. $3x \cdot 2y$

b. $6xy$ d. $(xy)^5$

5. What is $\left(\frac{2}{3}\right)^4$ when evaluated?

a. $\frac{2 \cdot 2 \cdot 2 \cdot 2}{3}$ c. $\frac{16}{81}$

b. $\frac{2 \cdot 2 \cdot 2 \cdot 2}{3 \cdot 3 \cdot 3 \cdot 3}$ d. $2\frac{2}{3}$

6. Rewrite each expression using exponents.

a. $3 \cdot 3 \cdot 5 \cdot 7 \cdot 7 \cdot 7$

_____

b. $x \cdot y \cdot y \cdot z \cdot z \cdot z$

_____

7. Evaluate each power.

a. $\left(\frac{3}{5}\right)^3$ b. $\frac{3^3}{5}$ c. $\left(\frac{3}{5}\right)^0$

_____ _____ _____

8. Evaluate.

a. 10^6 _____

b. $4.32 \cdot 10^3$ _____

9. Write 750,002 in expanded notation with exponents.

_____

_____

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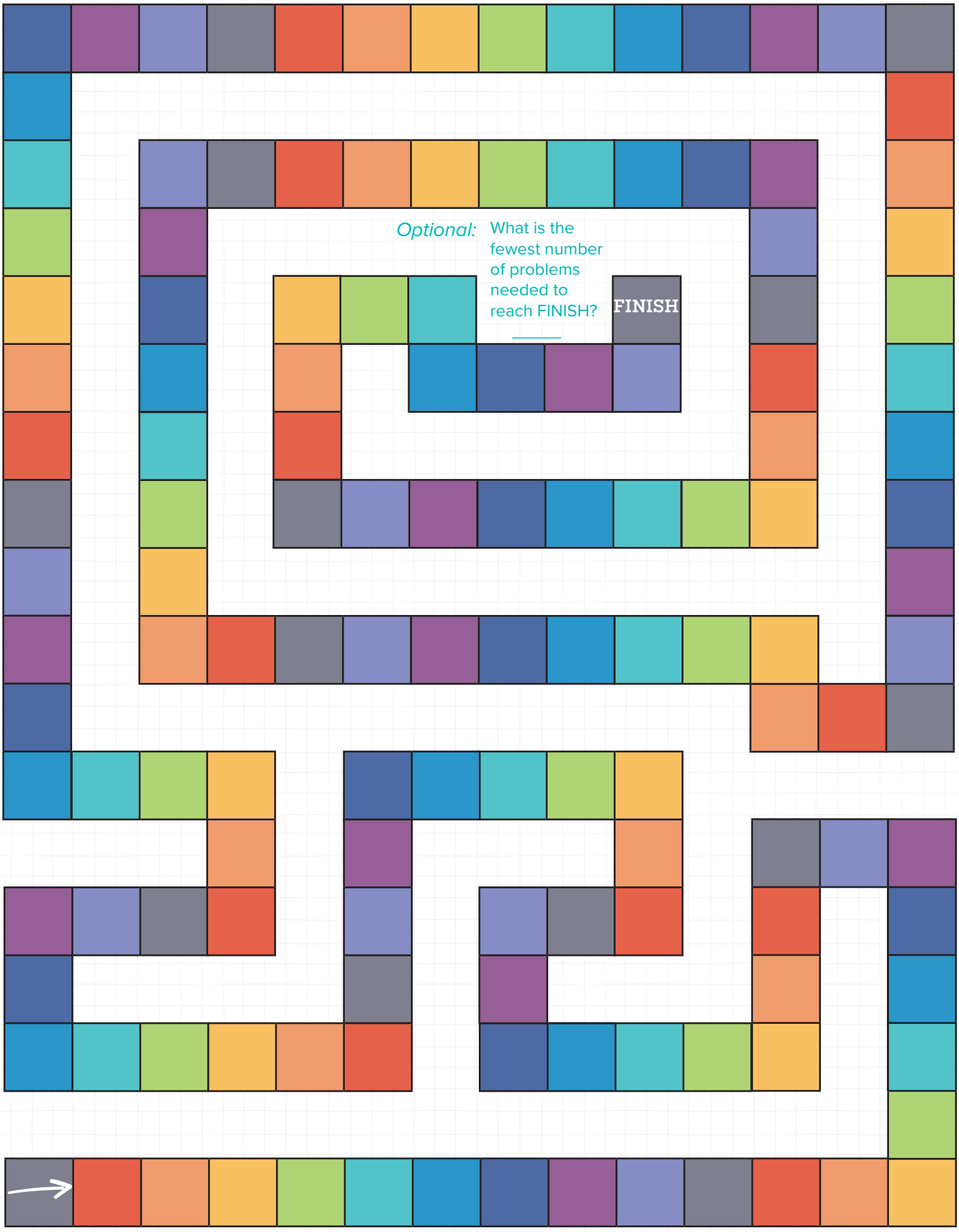

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REVIEW

1. Use expanded form and the distributive property to multiply 7 by 545. L8

_____

2. Find the value of the variable in each equation using inverse operations and fact families. L8

a. $g - 135 = 45$

$g =$ _____

b. $10 \bullet d = 125$

$d =$ _____

3. One strategy for subtracting mentally when the number being subtracted (the subtrahend) is near a multiple of 10 is to round the subtrahend to the multiple of 10 that it is close to and then compensate. For example, to find 72 – 19, subtract 20 from 72 to get 52. Then compensate for taking away too many (20 instead of 19) by adding one to 52 to get 53. Use this strategy to complete each problem mentally.

a. 154 – 29 _____

b. 87 – 38 _____

c. 295 – 69 _____

d. 351 – 99 _____

4. Write S next to statements that are sometimes true, A next to statements that are always true, and N next to statements that are never true. L3

a. ____ The sum of a number and its opposite is zero.

b. ____ The sum of a negative number and a positive number is negative.

c. ____ The opposite of a number is positive.

d. ____ The absolute value of a positive number is a negative number.

e. ____ Subtracting is the same as adding the opposite of the subtrahend.

5. Write three numbers not equal to 6.5 that round to 6.5. L1

_____ _____ _____

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Combining Like Terms

WARM-UP

Simplify.

$$\frac{\left(10+\left(7-12\right)^{3}\right)}{\left|45-53\right|\bullet 5}$$

_____

LESSON

Use the app to watch the video lesson. Complete problems when instructed during the video in the Video Practice section. Optionally, read the Lesson Overview in place of the video or after the video if more instruction is needed.

App Video

VIDEO PRACTICE

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LESSON OVERVIEW

A fundamental skill in algebra is knowing how to simplify and evaluate expressions. An ***expression*** is a number, variable, or combination of numbers and variables joined by operations. An example of an expression is $3x^2 + 4xy + 5$. A ***term*** is one part of an expression, which may be a number, a variable, or a product of numbers and variables. Terms are separated by plus or minus signs. In the expression example, $3x^2$ is a term, $4xy$ is a term, and 5 is a term. A ***constant*** is a term with no variable, so 5 is a constant in that expression. A ***coefficient*** is a number that is multiplied by a variable or product of variables. The coefficient of x^2 is 3, and the coefficient of xy is 4. The chart below shows two additional expressions and their parts.

Expression	Number of Terms	Coefficients	Constants
$6ax^2 + by^2 - 18$	3	6, 1	–18
$65m^3 - 9k^2 + 7j + 34$	4	65, –9, 7	34

SIMPLIFYING EXPRESSIONS

Like terms are terms with the same variables raised to the same power. Below are some examples of like terms.

$7ab$ and $-12ab$ $\quad$ $243z^2$ and z^2 $\quad$ $35xy^3$ and $26xy^3$

Simplifying an expression involves combining all like terms and performing any possible operations. When combining like terms, add coefficients and keep the same variable.

$$3a + 2a = a + a + a + a + a = 5a$$

Example 1: Simplify the expression $83xy + 21x - 45xy + 18x$.

$83xy + 21x - 45xy + 18x$	$83xy$ and $-45xy$ are like terms. $21x$ and $18x$ are like terms.
$= 83xy - 45xy + 21x + 18x$	Rearrange to write like terms next to each other using the commutative property of addition.
$= 38xy + 39x$	Combine like terms by adding or subtracting the coefficients. The expression is simplified.

Note: The remaining two terms are not like terms because they do not have the exact same variable part.

Example 2: Simplify the expression $4.78t^3 + 3.21st - 0.5t^3 + 2.9 + 5.49st$.

$4.78t^3 + 3.21st - 0.5t^3 + 2.9 + 5.49st$	The like terms are in matching colors.
$= 4.78t^3 - 0.5t^3 + 3.21st + 5.49st + 2.9$	Rearrange to write like terms next to each other.
$= 4.28t^3 + 8.7st + 2.9$	Combine like terms.

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EVALUATING EXPRESSIONS

An expression can be evaluated when values are given for the variables. Substitute the value provided for each variable, and simplify using the order of operations. Substituting values for variables is often referred to as "plugging in" values. When plugging in values, it can help to write parentheses around the numbers that are substituted into the expression.

Example 3: Evaluate the expression $6a + 4b$ when $a = 5$ and $b = -3$.

$6a + 4b$	Substitute the values of a and b into the expression.
$6(5) + 4(-3)$	Multiply.
$= 30 + (-12)$	Add.
$= 18$	

Example 4: Evaluate the expression $3f - 2g^2$ when $f = 2$ and $g = -2$.

$3f - 2g^2$	Substitute the values of f and g into the expression.
$3(2) - 2(-2)^2$	Evaluate the exponent.
$= 3(2) - 2(4)$	Multiply.
$= 6 - 8$	Subtract.
$= -2$	

Example 5: Evaluate the expression $12z - 24w + 15zw$ when $z = \frac{1}{2}$ and $w = \frac{2}{3}$.

$12z - 24w + 15zw$	Substitute the values of z and w into the expression.
$12\left(\frac{1}{2}\right) - 24\left(\frac{2}{3}\right) + 15\left(\frac{1}{2}\right)\left(\frac{2}{3}\right)$	Multiply.
$= 6 - 16 + 5$	Subtract.
$= -10 + 5$	Add.
$= -5$	

Example 6: Evaluate the expression $cd + de$ when $c = 1.2$, $d = 2.3$, and $e = 3.4$.

$cd + de$	Substitute the values of c and d and e into the expression.
$(1.2)(2.3) + (2.3)(3.4)$	Multiply.
$= 2.76 + 7.82$	Add.
$= 10.58$	

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When an expression is written as a fraction, substitute given values and simplify the numerator and denominator separately. Then divide.

Example 7: Evaluate the expression below when $x=-2$, $y=4$, and $z=7$.

$$\frac{xy+yz}{xz}$$

Substitute the values of x and y and z into the expression.

$$\frac{(-2)(4)+(4)(7)}{(-2)(7)}$$

Multiply in the numerator and denominator.

$$=\frac{-8+28}{-14}$$

Simplify the numerator.

$$=\frac{20}{-14}=-1\frac{6}{14}=-1\frac{3}{7}$$

Write as a mixed number and simplify.

PRACTICE

Complete each problem below. Find the answer in the table on the next page and cross off the phrase next to it. Once all problems have been completed, write the remaining phrases, from top to bottom, at the bottom of the page to discover a neat fact about God's creation!

For Problems 1–6, simplify the expressions by combining like terms. Tip: Highlighting like terms in the same color can help when combining like terms!

1. $3x+5-4x$

_____

2. $2ab-ab+3a+2a$

_____

3. $4c^2+3c-7c^2-c$

_____

4. $-2.5p-q+1.3p-1.1q$

_____

5. $\frac{1}{2}u^2v-\frac{2}{3}u+u-\frac{1}{6}u^2v$

_____

6. $j^2l-(-5j)-2j^2l+j$

_____

For Problems 7–12, evaluate the expressions for the given values.

7. $t+2s-1$ Values: $t=3$, $s=1$

_____

8. $ab+b^2$ Values: $a=2$, $b=-1$

_____

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9. $3e + 4f - 1.5g^3$ Values: $e = 1.5$, $f = 2.5$, $g = -2$

10. $\dfrac{nm - m}{n^2 + m^2}$ Values: $n = 2$, $m = 4$

11. $\dfrac{-w - (-2x)}{w}$ Values: $w = 3$, $x = \dfrac{1}{2}$

12. $\dfrac{q + 1.4p}{-r}$ Values: $p = 2$, $q = 6$, $r = -1$

8.8	More than 71% of
$\frac{2}{3}$	Although only about 3% of
4	Less than 36% of
$-3c^2 + 2c$	Only about 7% of
$-1.2p - 2.1q$	the earth's water is underground,
-1	the earth's water is salt water,
1.45	the earth's water is fresh water,
$-\frac{2}{3}$	the earth's surface is water,
1	more than 100,000 species of plants and animals
$-x + 5$	more than 40,000 species of plants and animals
$-j^2l + 6j$	fewer than 20,000 species of plants and animals
$\frac{1}{5}$	fewer than 10,000 species of plants and animals
$\frac{1}{3}u^2v + \frac{1}{3}u$	have their homes in saltwater habitats.
26.5	have their homes in underground habitats.
$ab + 5a$	have their homes in aquatic habitats.
$x - 7$	have their homes in freshwater habitats.

Fact:

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UNIT 1 | LESSON 15

Logic Lesson 1

A-MAZE-ing Mazes

In the United States, England, and other countries, mazes made by cutting paths through fields of tall cornstalks are a traditional fall destination. Corn maze venues often include hayrides, pumpkin picking, petting zoos, and other farm experiences. Some corn mazes have puzzles or riddles to solve along the way in order to receive clues about how to get out of the maze. Complete the corn maze logic puzzles in this lesson. This lesson has no video or review problems.

Tips for Solving Logic Puzzles:

Logic puzzles can be approached in different ways. The following tips can help when solving logic puzzles.

- When there are several options, assume something is true and continue until it doesn't work. Then start over, assuming something different is true.
- Guess and check and try various combinations.
- Find a pattern.
- Make a list showing all options.
- Draw a diagram or picture.
- Do not work until the point of frustration. Take a break or move to another problem. It's OK to look at the solutions and gain understanding for logic puzzles in this way.

KETTLE CORN

Mae bought a bag of kettle corn for $1 at a corn maze concession stand. She paid using exactly 50 coins. Which coins, and how many of each, did Mae use to pay for the kettle corn?

_____

_____



PIE PARTNERS

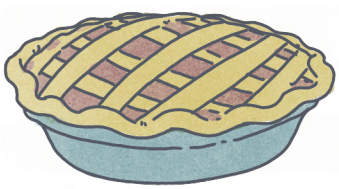
Blake and Nellie sell slices of homemade pies at a corn maze. At the end of a day, they had $\frac{1}{4}$ of a blueberry pie, $\frac{1}{3}$ of a pumpkin pie, $\frac{1}{2}$ of an apple pie, $\frac{2}{3}$ of a cherry pie, $\frac{3}{4}$ of a banana cream pie, and 1 whole chocolate pie left over. Find a way to divide the leftover pies, without making any more cuts, so that Blake and Nellie take equal amounts of pie home to share with their families. On the lines below, list which pies each partner should take.

Blake: _____

_____

Nellie: _____

_____



HELPFUL HINT

Hattie and Henry were in a corn maze when they met a worker who said he'd tell them which way they needed to turn next if they correctly solved the following puzzle: "A spider is building a web. Every 10 minutes, the web doubles in size. If the web is completely finished in 50 minutes, when was the web 25% complete?" Write the answer to the puzzle on the line below.

_____

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HUMDINGER HAYRIDES

Ree and Piper offer hayrides at a corn maze. During one ride, they noticed that if 5 of Ree's passengers moved to Piper's wagon, each would have the same number of passengers, but if 5 of Piper's passengers moved to Ree's wagon, Ree would have twice as many passengers as Piper. How many passengers did each have on that ride?

Ree: _____ passengers

Piper: _____ passengers



DAY DEBATE

Five siblings work at their family-owned corn maze and are debating about which day of the week it is during their lunch break. The maze is closed on Sundays. If only one of the following statements is true, what day of the week is it?

Hank: I know for sure we're in the last half of the work week.

Joe: No, we're not because yesterday was Monday.

Cathy: No, the day before yesterday was Monday.

Olive: All I know is that tomorrow is not Friday.

Max: Everything has gone wrong for me today, so today is definitely Monday.

_____

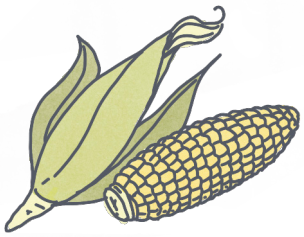
SPEEDY SHUCKING

Removing the husks from ears of corn is called husking or shucking the corn.

Dan and Delaney competed in a timed corn-shucking contest. Together, they shucked 75 ears of corn. Of all the contestants, Dan was randomly selected to get a 3-minute head start. He shucked 4 ears of corn per minute. Three minutes later, Delaney began, and she shucked at a rate of 5 ears per minute. When they finished, how many ears of corn had Dan and Delaney each shucked?

Dan: _____ ears of corn

Delaney: _____ ears of corn



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FAMILY FARM ASSIGNMENTS

The Duncan family owns a farm that they transform into a corn maze attraction after the harvest each year. Mrs. Duncan assigned each of her children an area to manage and a day of the week to be in charge of closing up the corn maze for the day, but she has misplaced the list of assignments. Use what she does remember (the statements at the right) to figure out each child's assigned area and closing day.

✦ Hints: Once you know something for certain, put a ✓ in that square and fill in the rest of the row and column of that 5 x 5 box with Xs. You may need to go through the clues more than once.

1. Only Cathy and Max are old enough to give hayrides.
2. Joe is allergic to hay, so he avoids hayrides and the petting zoo.
3. The girls, Olive and Cathy, have volleyball practice on Tuesday, Thursday, and Saturday mornings, so they don't close the nights before.
4. The person assigned to the pumpkin patch closes on Fridays, and the person who gives hayrides closes on Thursdays.
5. Boys are assigned to the petting zoo and the maze.
6. Joe does not close on Friday nights.
7. Max is not assigned to the pumpkin patch and does not close on Mondays.

		Assigned Area					Closing Day				
		Maze	Pumpkin Patch	Concession Stands	Hayrides	Petting Zoo	Monday	Tuesday	Wednesday	Thursday	Friday
Children	Hank										
	Joe										
	Cathy										
	Olive										
	Max										
Closing Day	Monday										
	Tuesday										
	Wednesday										
	Thursday										
	Friday										

a. Hank is assigned to the _____ and closes on _____.

b. Joe is assigned to the _____ and closes on _____.

c. Cathy is assigned to the _____ and closes on _____.

d. Olive is assigned to the _____ and closes on _____.

e. Max is assigned to the _____ and closes on _____.



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Simplifying Complex Expressions

WARM-UP

Simplify the expression.

$$3\sqrt{2} \cdot \sqrt{\frac{64}{4}} + \sqrt{2}$$

_____

LESSON

Use the app to watch the video lesson. Complete problems when instructed during the video in the Video Practice section. Optionally, read the Lesson Overview in place of the video or after the video if more instruction is needed.

App Video

VIDEO PRACTICE

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LESSON OVERVIEW

Complex expressions can be simplified using a combination of rules learned in previous lessons. Expressions are unique, and each expression must be examined to determine the methods of simplifying that apply. Remember to follow the order of operations when simplifying any expression.

Roots are related to exponents and are evaluated in the exponent step in the order of operations. Review the examples below to see how some complex expressions are simplified.

Tip for Simplifying Expressions:

Complete only one step at a time and rewrite the rest of the expression exactly as it is.

Example 1: Simplify the expression.

$$6\left(\left(\frac{1}{5}r\right)^2+5r-\frac{7}{3}\right)+4\left(r^2-\frac{5}{4}\right)$$ Within parentheses, evaluate exponents. Use the power of a product rule.

$$=6\left(\frac{1}{25}r^2+5r-\frac{7}{3}\right)+4\left(r^2-\frac{5}{4}\right)$$ Distribute.

$$=\frac{6}{25}r^2+30r-14+4r^2-5$$ Combine like terms.

$$=4\frac{6}{25}r^2+30r-19$$

Example 2: Simplify the expression.

$$\left(\sqrt{400}+13\right)\div\left(5\left|\sqrt[3]{-27}\right|+18\right)$$ Within parentheses, evaluate roots.

$$=\left(20+13\right)\div\left(5\left|-3\right|+18\right)$$ Evaluate the absolute value and simplify in the parentheses.

$$=33\div\left(5\bullet 3+18\right)$$ Multiply and add in parentheses.

$$=33\div\left(15+18\right)$$

$$=33\div 33$$

$$=1$$

Example 3: Simplify the expression.

$$\left(\frac{a^3b^{-8}}{c^5}\right)^2$$ Apply the power of a product and power of a quotient rules.

$$=\frac{a^6b^{-16}}{c^{10}}$$ Rewrite the expression with positive exponents.

$$=\frac{a^6}{c^{10}}\bullet\frac{1}{b^{16}}$$ Multiply.

$$=\frac{a^6}{c^{10}b^{16}}$$ Note: Exponents should all be positive in simplified expressions. This fraction is considered simplified.

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Example 4: Simplify the expression.

$$\frac{3\left(c^3\right)^4}{\left(2c^7\right)^5}$$ Apply the power rule and the power of a product rule.

$$= \frac{3c^{12}}{32c^{35}}$$ Simplify using the quotient rule.

$$= \frac{3}{32}c^{12-35}$$

$$= \frac{3}{32}c^{-23}$$ Rewrite the expression with positive exponents.

$$= \frac{3}{32} \bullet \frac{1}{c^{23}}$$ Multiply.

$$= \frac{3}{32c^{23}}$$

Example 5: Simplify the expression.

$$\frac{m^2p^3n^3m^4p}{m^4n^8p^4n^3}$$ Multiply. Use the product rule.

$$= \frac{m^6p^4n^3}{m^4n^{11}p^4}$$ Simplify using the quotient rule.

$$= m^{6-4} \bullet n^{3-11} \bullet p^{4-4}$$

$$= m^2 \bullet n^{-8} \bullet p^0$$ Rewrite the expression with positive exponents.

$$= m^2 \bullet \frac{1}{n^8} \bullet 1$$ Multiply.

$$= \frac{m^2}{n^8}$$

Expressions within a radical should be simplified before the square root is taken. Apply the order of operations under the radical in the numerator and denominator.

Example 6: Simplify the expression.

$$\sqrt{\frac{200-2\bullet 28}{9+4^2\bullet 2-5}}$$ Multiply in the numerator.
Evaluate the exponent in the denominator.

$$= \sqrt{\frac{200-56}{9+16\bullet 2-5}}$$ Subtract in the numerator.
Multiply in the denominator.

$$= \sqrt{\frac{144}{9+32-5}}$$ Add and subtract from left to right in the denominator.

$$= \sqrt{\frac{144}{36}}$$ Divide.

$$= \sqrt{4} = 2$$ Take the square root.

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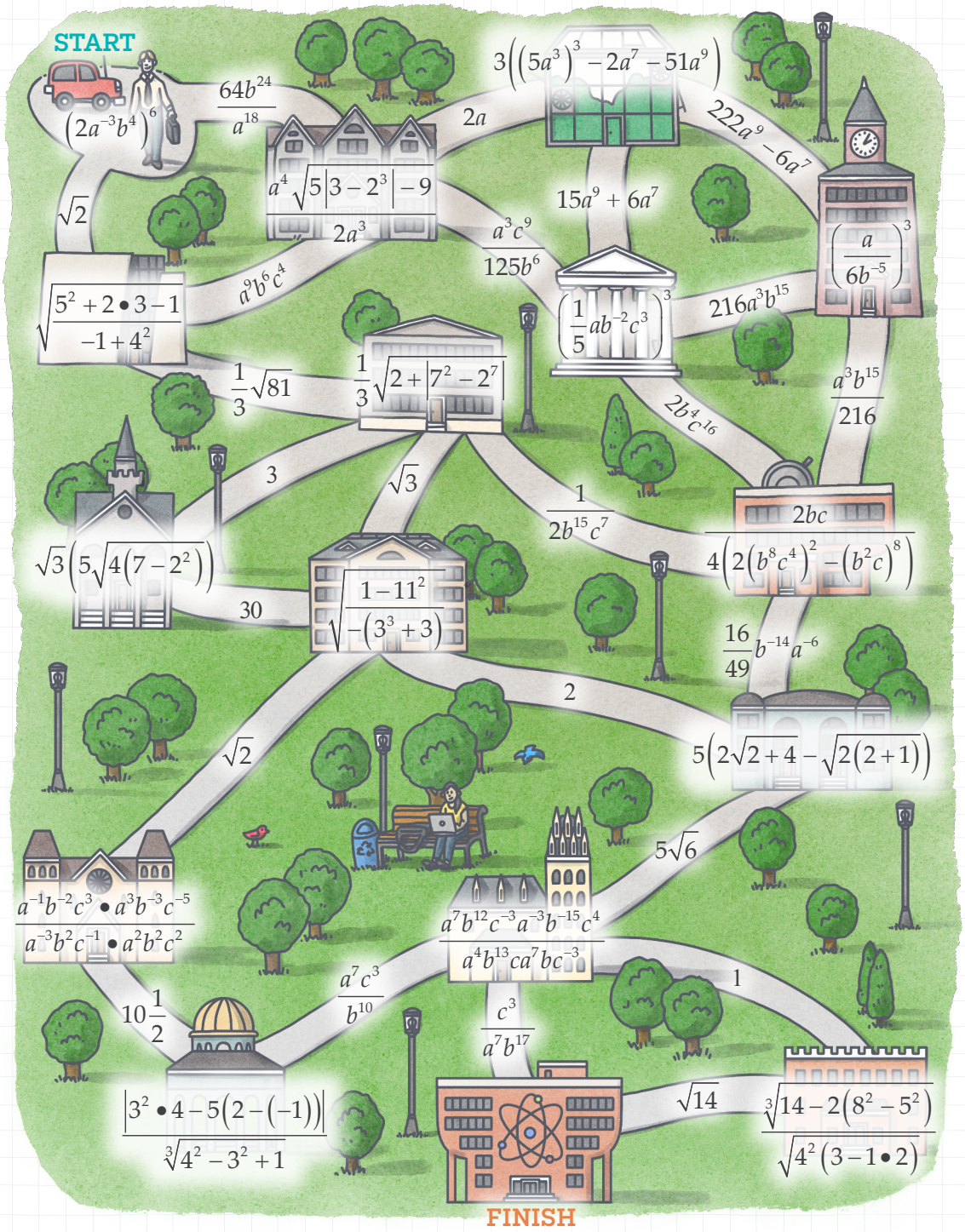
PRACTICE

Simplify the expressions to determine which path to follow in order to get the physics professor to his physics lab. Begin at START.



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Unit 1 Review

THE EVERGLADES

Complete this Unit Review to prepare for the Unit Assessment. There is no video, lesson, or practice. Because Unit Reviews include practice for an entire unit, they may take longer than regular lessons, and students may decide to take two days to finish.

Mr. and Mrs. Stetson and their three children, Alexandra, Peter, and Guinevere, are visiting the Everglades, a 1.5-million-acre wetland in Florida.

LESSONS 1, 5

1. a. The southern portion of the Everglades includes parts of Florida Bay, which has an average depth of about $1\frac{1}{2}$ meters. Florida Bay leads directly into the Gulf of Mexico, which has an average depth about 1076 times deeper than Florida Bay.

   Complete the problem below to find the average depth of the Gulf of Mexico.

   $-1\frac{1}{2} \cdot 1076$ _____ meters

   b. In mid-October, southern Florida gets about 11.5 hours of daylight, whereas in mid-September, southern Florida gets about 1.07 times as much daylight. Find how many daylight hours southern Florida gets in mid-September by completing the problem below. Round to the nearest tenth.

   $11.5 \cdot 1.07$ _____ hours

LESSONS 2, 3, 4

2. a. The family drives 21.4 miles to reach the park entrance and then goes on a 2.57-mile hike. Complete the problem below to find how many more miles they drove than hiked.

   $21.4 - 2.57$ _____ miles

   b. Much of the Everglades region is very close to sea level.

   If the Stetsons start their trip at $3\frac{1}{2}$ feet below sea level and end their trip at $2\frac{5}{8}$ feet below sea level, find their change in altitude.

   $-2\frac{5}{8} - \left(-3\frac{1}{2}\right)$ _____ feet

LESSONS 7, 8

3. Peter and Guinevere pass time in the car playing mental math games.

   a. Peter uses the commutative property of multiplication to rewrite $-6 \cdot 8$. Do the same and write the expression below.

   _____

   b. Guinevere uses the distributive property to mentally calculate $32 \cdot 302$. Do the same and write the answer below.

   _____

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LESSON 9

4. Alexandra plays her own mental math game with exponents and roots.

   a. Write a^4b^2 in factored form.

   _____

   b. Rewrite $3 \bullet 3 \bullet 3 \bullet 2 \bullet 2$ using exponents.

   _____

LESSON 10

5. Alexandra is 14 years old, Peter is 12, and Guinevere is 11.

   a. Find the prime factorization of each child's age. Circle the name of any child with a composite age.

   Alexandra: _____

   Peter: _____

   Guinevere: _____

   b. Determine the greatest common factor of Alexandra's and Peter's ages.

   GCF: _____

   c. Determine the least common multiple of Peter's and Guinevere's ages.

   LCM: _____

LESSONS 12, 13

The Stetson family decided to have a "kids versus parents" math contest at a rest stop. The kids simplified the expressions in Problem 6, while the parents evaluated the expressions in Problems 7 and 8.

6. Simplify each expression.

   a. $3a + 2 - 4(a + 2)$

   _____

   b. $\left(\frac{b^6}{d}\right)^5$

   _____

   c. $f^4 \bullet g^2 \bullet f^3$

   _____

   d. $\frac{b^{14}}{b^5}$

   _____

LESSONS 11, 14, 16

7. Evaluate each expression.

   a. $7 + 4\sqrt[3]{-125}$

   _____

   b. $\left(\frac{2^3}{3^2}\right)^2$

   _____

   c. $\frac{2(51 - 2(4 - 19))}{5^2 - 4^2}$

   _____

   d. $\frac{3^2 \bullet 5 - \sqrt{169}}{2\left|5 + 4^2 - 25\right|}$

   _____

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LESSON 12

8. Evaluate the expressions for the given variables.

a. $2m^3n + n - 7$ $\quad m = -2,\ n = 5$

_____

b. $\dfrac{\sqrt{2k}}{3j+1}$ $\quad k = 8,\ j = 1$

_____

LESSON 17

9. For lunch one day, Peter laid out a square picnic blanket that had an area of 30 ft^2.

a. Fill in the blanks with the closest perfect squares.

_____ $< 30 <$ _____

b. Determine the integers nearest to $\sqrt{30}$ and circle the closer integer.

_____ $< \sqrt{30} <$ _____

c. Use a calculator to evaluate $\sqrt{30}$ to the nearest tenth. This is the side length of the blanket in feet.

$\sqrt{30} \approx$ _____

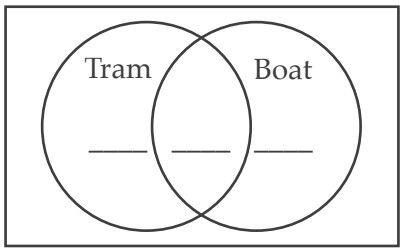
LESSON 18

10. The children polled some of the park visitors for recommendations on activities and found that 45 people recommended the Shark Valley tram tours and 67 people recommended a boat tour from the Flamingo Marina.

a. If the children polled a total of 80 people, how many people recommended both the tram tour and the boat tour?

_____

b. Write numbers in the blanks of the Venn diagram below to represent this situation.



LESSON 19

11. In recent decades, the exponential growth of Burmese pythons in the Everglades has had a negative effect on native wildlife. Evaluate the following expressions with negative exponents.

a. 5^{-3} $\qquad$ b. $(-2)^{-4}$

_____ $\qquad$ _____

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LESSONS 20, 21

12. Simplify the expressions.

a. $6\sqrt{2^3+2}-4\sqrt{2}\bullet\sqrt{5}$

_____

b. $\left(\frac{a^{-2}b^4a}{b^{-5}}\right)^7$

_____

LESSONS 22, 23, 24

13. It is estimated that there are at least 1.9×10^5 alligators in the Everglades and at least 1,500,000 alligators in Florida.

a. Write how many alligators there are in the Everglades in standard form.

_____

b. Write how many alligators there are in Florida in scientific notation.

_____

c. The Everglades are the only place in the wild where alligators and crocodiles live together, and there are about 1.6×10^3 crocodiles in the area. How many more alligators are there than crocodiles in the Everglades? Complete the problem below to find out.

$\left(1.9\times10^5\right)-\left(1.6\times10^3\right)=$ _____

d. An alligator hatchling weighs around 5.6×10^{-2} kg and grows to be about 8.04×10^3 times as heavy when it is an adult alligator. How much will the adult weigh? Complete the problem below and write the answer in scientific notation.

$\left(5.6\times10^{-2}\right)\bullet\left(8.04\times10^3\right)=$ _____ kg

LESSONS 25, 26

14. Two common birds found in the Everglades are the great blue heron and the little blue heron.

a. Write an equation to represent the sentence below. Use the variables given. Half of the wingspan of the great blue heron, g, is five inches less than the little blue heron's wingspan, l.

_____

b. A great blue heron stands at 48 inches and is twice as tall as a little blue heron. Solve the equation below to find the height of the little blue heron.

$$48=2x$$

_____ inches

LESSONS 25, 27

15. Upon leaving the Everglades, Guinevere said that she saw three fewer great blue herons than half of her dog's age.

a. Write an equation to model how old Guinevere's dog is if she saw four great blue herons. Use d for her dog's age.

_____

b. Solve the equation in Part A to determine Guinevere's dog's age.

_____ years old

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Unit 1 Assessment

○ This assessment covers concepts taught in Unit 1. Problems are designed to assess multiple skills. Read the instructions carefully and do not rush through the problems.

○ You may use the Reference Chart for the assessment. Calculators should only be used when noted. Lesson numbers are given by each problem so you can review lessons for any answers that are incorrect.

1. Write the number below using numerals. L1

five thousand, forty-three
and eighty-two hundredths

_____

2. Draw lines to connect equivalent values. L2

$1\frac{2}{5}$	$3.\overline{8}$
$3\frac{7}{8}$	3.875
$1\frac{5}{11}$	1.4
$3\frac{8}{9}$	$1.\overline{45}$

3. Find the distance between the two numbers on the number line. L3

–15 and 42 _____

4. Perform the indicated operation. L4–6

a. $5\frac{7}{8} - 2\frac{1}{4}$

_____

b. $7.485 + 2.956$

_____

c. $-\frac{8}{5} \cdot 1\frac{3}{4}$

_____

d. $-3.8 \cdot (-4.53)$

_____

e. $-4.2 \div 0.06$

_____

f. $\dfrac{3\frac{2}{5}}{7\frac{1}{2}}$

_____

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12. Simplify each expression. L14

a. $\left(c^2ba^3\right)^5$

_____

b. $\left(\frac{r^7}{ts^3}\right)^2$

_____

13. Evaluate the expression. L16

$$\frac{\sqrt{225}}{\sqrt[3]{64}+\sqrt{64}}$$

_____

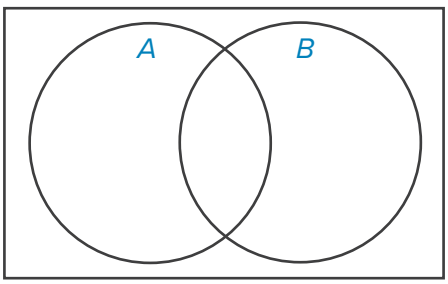
14. a. Determine which perfect squares are on either side of 123. L17

_____ and _____

b. Determine which integers are on either side of $\sqrt{123}$. Circle the integer that is closer to $\sqrt{123}$.

_____ and _____

15. Let set *A* be the set of three-letter number words from "one" to "ten." Let set *B* be the set of number words from "one" to "ten" that start with "t." Fill in the Venn diagram. L18



16. Rewrite each expression with a positive exponent. L13 & L19

a. b^{-5}

_____

b. $\frac{1}{c^{-3}}$

_____

c. $q^{-3} \bullet q$

_____

17. Simplify each expression. L20

a. $\sqrt{25} \bullet \sqrt{4}$

_____

b. $3\sqrt{5}+7\sqrt{5}$

_____

18. Evaluate the expression. L21

$$\frac{3^2\sqrt{|-25-11|}}{\sqrt[3]{27}}$$

_____

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