Algebra 1

Solving Linear Equations Unit Plan

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Introduction

In this Algebra 1 unit, students will explore equality, solve linear equations (with a single variable and literal equations), and then solve more specific types of equations involving percents and proportions. The major idea of the unit is identifying and performing the steps necessary to solve for a variable in a linear equation. To do this, students will have to answer the following essential questions:

- How can I preserve equality when solving equations?
- What is does a proportion represent, and how can I solve one?
- What does a percent represent and how can I solve problems involving percents?

These essential questions are the basis of the enduring understandings of the unit. Throughout the scope of this unit, students will explore solving equations using manipulatives, use diagrams to solve proportions involving missing lengths, and connect percent problems with real-world applications.

Standards:

This unit covers the following Common Core State Standards for Mathematics:

A.CED.A1: Create equations in one variable and use them to solve problems.
A.CED.A4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
A.REI.A1: Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
A.REI.B3: Solve linear equations in one variable, including equations with coefficients represented by letters.
N.Q.A1: Use units as a way to understand problems and to guide the solution of multi-step problems.
N.Q.A2: Define appropriate quantities for the purpose of descriptive modeling.

This unit also covers the following Common Core Standards for Mathematical Practices: MP1 (make sense of problems and persevere in solving them), MP2 (reason abstractly and quantitatively), and MP4 (model with mathematics).

<u>Goals</u>:

Learning Goal 1: The learner will understand the concept of equality and use this understanding when manipulating equations.

Learning Goal 1 is necessary because it requires students to do more than simply memorize steps in order to solve a linear equation. Students can master this learning goal in many different ways. In the introductory lesson (after the pre-assessment is taken) students learn this idea of equality using manipulatives. Thus, visual and kinesthetic learners can be engaged this way. Other strategies, such as using a scale can be used to develop the idea of equality for learners who do not prefer using manipulatives. In order to develop a deep, conceptual understanding of what it means to solve an equation, students need to understand this idea of keeping two quantities equal. In order to meet the CCSS A.REI.A1 and MP2, students need to master this learning goal.

Learning Goal 2: The learner will discover the idea of proportional relationships in order to begin solving proportions.

Learning Goal 2 is necessary because it helps students understand why they can set up a proportion and solve it. For many students, the additive relationship in mathematics is strongly developed, while proportional relationships are less familiar. While students should have learned about proportional relationships in earlier grades, they tend to struggle with this concept. Thus, before solving proportions, students need to know what it means for quantities to stay in proportion with other quantities. This is why the video clips of the sugar packets and Alice in Wonderland are used—to help students visually see this relationship. Again, in order to meet the CCSS related to solving linear equations, students need to master this learning goal.

Learning Goal 3: The learner will connect percent problems (percent change, increase, and decrease) to real-world applications.

Most students will have already worked with percents before this unit. They will have calculated percents and most likely have solved story problems involving percents. However, in order to appreciate solving equations and proportions involving percents, it helps to surround the problems within a meaningful context. In this unit, students will be exploring percent change as it relates to their futures (in a possible career choice) and to the global environment and economy (oil and other energy resources and its connection to gas prices). By connecting percent problems to real-world applications, it requires students to become more critical thinkers—they are able to see how the mathematics relates to the world around them and how it can possibly affect their own lives. By mastering Learning Goal 3, students are better prepared to meet the CCSS A.CED.A1, A.REI.B3, and MP1.

<u>Learning Targets</u>:

Learning Target 2.1: I can create and solve (linear) equations and use them to solve problems.

    <u>2.1a:</u> The learner can solve one-step equations in one variable (4 out of 5 times when given five equations by the end of the lesson).

    <u>2.1b:</u> The learner can solve two-step equations in one variable (3 out of 3 times when given three different problems by the end of the lesson).

    <u>2.1c:</u> The learner can create equations in one variable (with 80% accuracy when given a story problem by the end of the lesson).

    <u>2.1d:</u> The learner can solve multi-step equations in one variable (3 out of 4 times when given four equations by the end of the lesson).

    <u>2.1e:</u> The learner can solve equations with variables on both sides (3 out of 4 times when given four problems by the end of the lesson).

    <u>2.1f:</u> The learner can identify equations that are identities or have no solution (with 100% accuracy when given an equation of each by the end of the lesson).

    <u>2.1g:</u> The learner can rewrite and use equations in two or more variables (3 out of 4 times for both π and h for volume and surface area of the two containers by the end of the lesson).

Learning Target 2.2: The learner can write and solve proportions to solve problems.

    <u>2.2a:</u> The learner can find ratios and rates (with **80**% accuracy when given quantities to compare by the end of the lesson).

    <u>2.2b:</u> The learner can convert units and rates (with **80**% accuracy when given information in order to find a conversion factor by the end of the lesson).

    <u>2.2c:</u> The learner can solve proportions using the Multiplication Property or the Cross Products Property (4 out of 5 times when given proportions to solve by the end of the lesson).

    <u>2.2d:</u> The learner can use similar figures to find six out of seven unknown lengths by the end of the lesson.

Learning Target 2.3: The learner can write and solve proportions involving percents.

    <u>2.3a:</u> The learner can solve a percent problem using a proportion with 100% accuracy (when given a percent problem and a pay cut problem by the end of the lesson).

    <u>2.3b:</u> The learner can solve a percent problem using the percent equation with 100% accuracy (when given a percent problem and a pay cut problem by the end of the lesson).

    <u>2.3c:</u> The learner can find percent change (2 out of 2 times when given oil price data by the end of the lesson).

Calendar

Day 0: Pre-assessment

Day 1: Lesson 1—Investigating Equality

Day 2: Lesson 2—Solving One-step Equations

Day 3: Lesson 2—Solving One-step Equations

Day 4: Lesson 3—Solving Two-step Equations

Day 5: Lesson 4—Solving Multi-step Equations and Equations with Variables on both Sides

Day 6: Lesson 5—Literal Equations

Day 7: Lesson 6—Ratios and Proportional Reasoning

Day 8: Lesson 7—Solving Proportions

Day 9: Lesson 8—Similar Figures and Proportions

Day 10: Lesson 9—Percents

Day 11: Lesson 10—Percent Change

Day 12: Lesson 11—Culiminating Review Lesson

Day 13: Unit 2 Common Assessment

<p style="text-align: center;">Unit 2
Lesson 1—Investigating Equality Lesson Plan
(One Day)</p>

I. **CCSS:**
(Prepares for) **HSA.REI.A** Understand solving equations as a process of reasoning and explain the reasoning.

II. **Learning Objective:**
> (Prepares for) Learning Targets 2.1: The learner can create and solve (linear) equations and use them to solve problems.
> - The learner can manipulate both sides of an "equation" involving pictures in order to keep both sides equal and solve for an unknown with at least **80**% accuracy by the end of the lesson.

III. **Anticipatory Set:** Have students pick up or hand out the piggy bank and equal sign cutouts and poker tokens (which represent $**1** coins). On the projector display the anticipatory set problem (see Warm-up for lesson 1 in Unit Plan). The Warm Up problem gets students thinking about what the pictorial representation of an equation might look like.

IV. **Objective/Purpose:** "Today, we will be thinking about equality. We will be using pictures to determine how many coins our piggy banks hold in order to preserve the equality of our equations."

V. **Input**

    a. **Task Analysis:**
        i. Students should begin working on the anticipatory set at the start of class. (2 min)
        ii. Have a couple groups share their answers to the Warm Up. (1-2 min)
        iii. State the objective and purpose for the lesson. (1 min)
        iv. Introduce the *Investigating Equality* activity by reading the introductory paragraphs. Explain to students that the cutouts and tokens are for them to use to physically manipulate the equation. (1-2 min)
        v. Have students in their groups try solve the first problem in groups. (5 min)
        vi. Ask two or three students to share their groups' work on the board. Have each student explain their thinking. (5 min)
        vii. Ask students to proceed with the activity—allow them to work with their group members. (30 min)

viii. If students finish early, have each student in the group write their own problem and give it to a group member to solve.

ix. Display exit ticket (see Exit Ticket in Unit Plan). Students should *individually* complete in on half sheet of paper and turn it in before they leave. (5 min)

b. **Thinking Levels**
   i. Comprehension/understanding: Explain the steps in solving how many coins are in the piggy bank.
   ii. Evaluate: Justify the steps taken to solve the problem to group members.
   iii. Synthesis/Creating: Create your own piggy bank problem for group members to solve.

c. **Learning Styles and/or Accommodations**
   i. Learning Styles
      1. Visual and kinesthetic learning: Students have a pictorial representation of an equation. Students manipulate cutouts and tokens to solve problems.
      2. Intrapersonal and interpersonal: students work individually on exit ticket and in a group on the main activity of the lesson.
   ii. Extensions/Accommodations
      1. For the visually impaired, use the magnification camera and monitor in order to magnify what is displayed on the projector and drawn on the whiteboard. Always repeat directions and solution steps several times.
      2. Read directions/problems out loud to students. That way, if there are English Language Learners or students with low literacy levels, they will have the opportunity to hear the questions. Have other students working in these students' groups read each question out loud and assist these students if they need help reading anything else.
      3. Ask students who have solved a problem one way to experiment to solve it in another way.

d. **Methods and Materials**
   i. Ways of presenting: Workshop style/group work, whole group discussion, individual work on exit ticket.
   ii. Materials Needed: Whiteboard and markers, projector, piggy bank and equal sign cutouts, poker tokens/algebra tiles, computer files for Warm Up and Exit Ticket, *Investigating Equality* worksheet, magnification camera and monitor.

IV. **Modeling**
   a. After students have tried using the manipulatives themselves and have offered a solution to the first problem, rework the problem for the students by modeling the correct strategy.
   b. Students will be able to see as well as hear solutions. Students will also be able to draw their own diagrams and use manipulatives to solve problems.
   c. As students work in groups, help them (if needed) manipulate the equations by asking guided questions and/or suggest the next step in order to help the group move forward.

II. **Checking for Understanding**
   a. As students work in groups, listen to groups' conversations, check their work, and help groups who may get stuck on a problem.
   b. Questions to ask:
      i. How might we move the coins in our equation to find how many are in one piggy bank?
      ii. Does this step preserve equality?
      iii. How do you know your answer is correct?
   c. Exit Pass

III. **Guided Practice**
   a. After students have tried using the manipulatives themselves and have offered a solution to the first problem, rework the problem for the students by modeling the correct strategy. Thus, the first problem in the activity will be worked on collectively as a whole class.

IV. **Independent Practice**
   a. Students will be working alone on exit ticket.
   b. In the next lessons that teach the same concepts, students will have more opportunity to work independently.

V. **Closure:**
   a. Before displaying Exit Ticket, summarize what the students have done during the lesson.
      i. "We have explored equality today. In order to keep both sides of out equations equal, we had to be careful what steps we took. Tomorrow, we will be expressing the pictures as equations and begin solving equations for unknown variables."
   b. Display the Exit Ticket (see Unit Plan) and have students complete it individually. Students need to turn in ticket before they leave.

VI.   **Assessment:**
a. Students should be comfortable subtracting/adding coins and grouping coins in order to find the number of coins a piggy bank holds.
b. When observing students working on activity, ask probing questions to students who may have conducted an incorrect step in solving the "equation." For students who are confident in their incorrect answers, ask them to check their answer.
c. The Exit Ticket will be a good indicator of how comfortable the students are with this learning objective. It will also allow the student to share any confusion or misunderstanding he or she may have.

VII.   **Reflection:** Reflect on the lesson and make necessary changes. Use the Exit Tickets to determine what needs to be recovered during the next lesson.
a. Are the students ready to move onto solving equations for a variable instead of a piggy bank?
b. How were the engagement levels of the students throughout the lesson?
c. Which students struggled using the manipulatives to solve problems?

<u>Warm Up</u>

Discuss with your group members what you think the picture shown below means. As a group, use your piggy bank cutouts and tokens to represent the picture.

Unit 2—Solving Equations
Investigating Equality

What's In the Piggy Bank?

Jaden collects piggy banks identical to the one shown on the left. He fills each piggy bank to the top with $1 coins so that each piggy bank he owns **holds the same number of coins**.

One particular Saturday morning, Jaden takes *two* piggy banks and *four* $1 coins to the bakery to buy a cake. The baker takes Jaden's money, which equaled $24, and hands him over his chocolate cake.

- Can you figure out how many $1 coins were in each piggy bank? Use the visual representation below to help you.
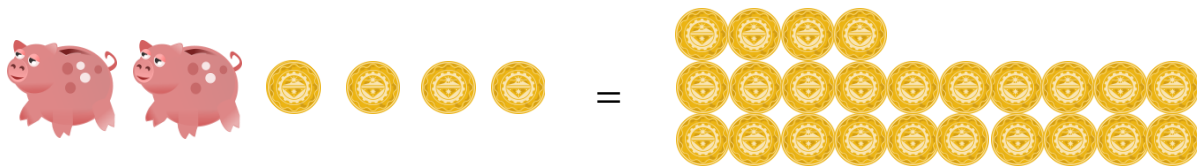
You will be solving more problems like the one above. For questions 1-4 below, assume each piggy bank holds the same number of $1 coins, and the total number of coins on each side of the equation is the same. For each question,

- Find the number of gold coins in each piggy bank. Write down the steps that you took to find that number. Also, explain how you could check your answer.

1.

2. =

3. =

4. =
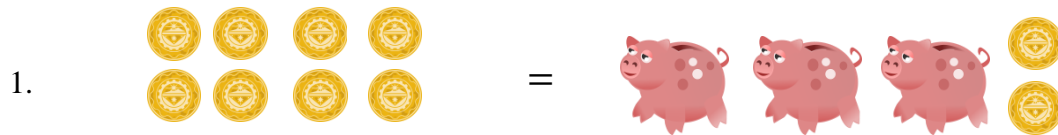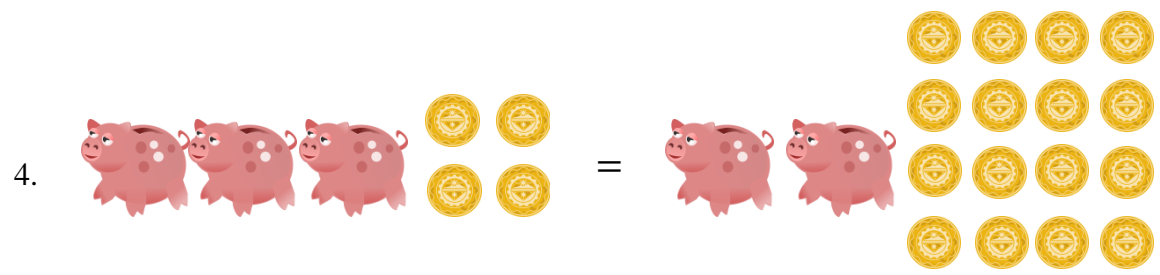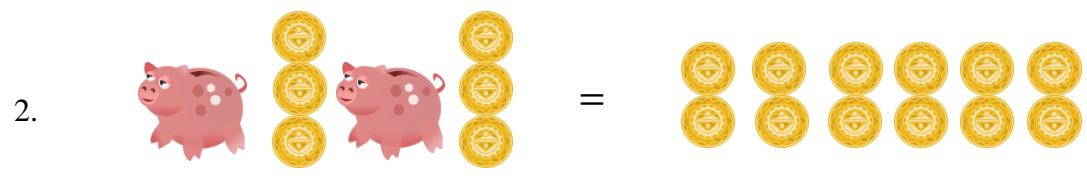
Exit Ticket

By yourself, use the picture below to find how many coins each piggy bank holds (assuming each piggy bank holds the same number of coins). Also, on a scale of $1 - 5$, with 1 being not confident and 5 being very confident, how do you feel about today's lesson—what is still confusing?
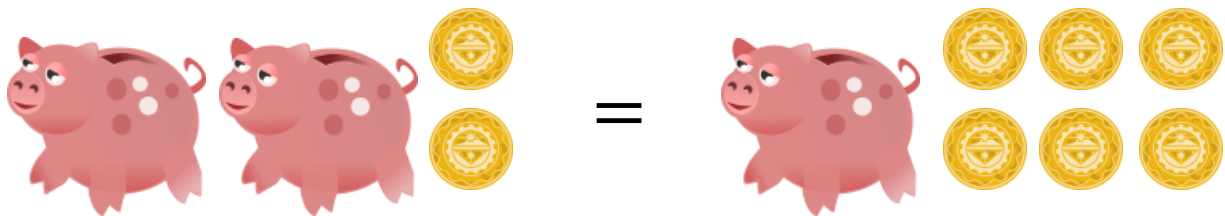
Lesson 2—Solving One-step Equations
(One-two days)

I. **CCSS:**
   HSA.CED.A.1 Create equations…in one variable….
   HSA.REI.B.3 Solve linear equations…in one variable….

II. **Learning Objectives:**
   Learning Targets 2.1: The learner can create and solve (linear) equations and use them to solve problems.
   a. The learner can solve one-step equations in one variable **4** out of **5** times when given five equations by the end of the lesson.

III. **Anticipatory Set:** On the projector display the anticipatory set problem (see Warm-up for lesson 1 in Unit Plan). The Warm Up will review the concept of open sentences, and get students thinking about finding the value of the variable that makes the open sentence true.

IV. **Objective/Purpose:** "Today, we will connect the idea of equality (represented with pictures) to solving equations that contain variables. We will represent the piggy bank situation with an open sentence, then solve the equation to find the value of the variable. Finally, we will solve one-step equations that contain one variable."

V. **Input**

   a. **Task Analysis:**
      i. Students should begin working on the anticipatory set at the start of class. (3 min)
      ii. State the objective and purpose for the lesson. (1 min)
      iii. Work through the first half of the *Solving Linear Equations* activity as a class. (10 min)
      iv. Students should work on the next three problems in the activity with their group members. (10-15 min)
      v. Ask two or three students to share their groups' work on the board. Have each student explain their thinking. Discuss each answer as a class and correct any misconceptions. (8 min)
      vi. Guide the class through the *One-Step Equations* worksheet. Define "equivalent equations" and the four properties of equality that are used to solve one-step equations. (10 min)

vii. At the end of the worksheet, have students complete the five problems individually. If students do not finish, have them complete them for homework. (10 min)

viii. Summarize the lesson before students leave. (1 min)

b. **Thinking Levels**

    i. Comprehension/understanding: Explain the steps in solving how many coins are in the piggy bank.

    ii. Evaluate: Justify the steps taken to solve the problem to group members.

    iii. Applying: Solve one-step equations in one variable and check your solution.

c. **Learning Styles and/or Accommodations**

    i. Learning Styles

        1. Visual and kinesthetic learning: Students have a pictorial representation of an equation. Students manipulate cutouts and tokens to solve problems.

        2. Intrapersonal and interpersonal: Students work in groups on the first activity and individually on practice/homework problems.

    ii. Extensions/Accommodations

        1. For the visually impaired, use the magnification camera and monitor in order to magnify what is displayed on the projector and drawn on the whiteboard. Always repeat directions and solution steps several times.

        2. Ask students who have solved a problem one way to experiment to solve it in another way.

        3. For students who finish early and/or grasp the concepts quickly, ask them to predict what a two-step equation might look like.

d. **Methods and Materials**

    i. Ways of presenting: Workshop style/group work, whole group discussion, lecture/guided practice, and individual work on homework.

    ii. Materials Needed: Whiteboard and markers, projector, piggy bank and equal sign cutouts, poker tokens/algebra tiles, computer files for Warm Up, *Solving Linear Equations* and *One-step Equations* worksheets, magnification camera and monitor.

IV. **Modeling**

a. Explain how to write an equation to represent the piggy bank problem. Model how to manipulate the equation to solve for the variable.

b. Explain and provide examples of the properties of equality, and model how to solve a one-step equation using these properties.

II. **Checking for Understanding**
   a. During the lecture/guided practice portion of the lesson, call randomly on students to provide ideas and answers.
   b. As students work in groups, listen to groups' conversations, check their work, and help groups who may get stuck on a problem.
   c. Questions to ask:
      i. How can we represent this equation as a picture with piggy banks and coins?
      ii. Does this step preserve equality?
      iii. What operation "undoes" this operation? How can we isolate the variable?
      iv. How do you know your answer is correct?
   d. Check homework the next day.

III. **Guided Practice**
   a. While working through the *One-step Equations* portion, solve the equation $\frac{2}{3}x = 36$ together as a class. Before students begin solving equations on their own, summarize the steps for solving one-step equations.

IV. **Independent Practice**
   a. Students work alone on problems 1-5 on the last page of *One-step Equations.*

V. **Closure:**
   a. Summarize what the students have done during the lesson.
      i. "We have learned the steps to solving one-step equations. We can use the properties of equality to undo operations in order to isolate the variable. Tomorrow, we will be using these same ideas to solve two-step equations."
   b. Remind students to finish the last five problems on *One-step Equations* if they didn't in class.

VI. **Assessment:**
   a. Students should be able to provide examples of the properties of equality. Students should be able to perform inverse operations in order to solve for the variable.
   b. Observe students as they solve one-step equations individually. Address any misconceptions and remind them to check their solutions.
   c. Assess student learning by checking the homework problems. Find what mistakes students are repeatedly making and address them during the Two-step Equations lesson.

VII. **Reflection:** Reflect on the lesson and make necessary changes. Use the practice/homework problems to determine if reteaching needs to take place.
   a. Are the students ready to move on to solving two-step equations in one variable?
   b. Did students properly display understanding of inverse operations while working through the five problems?
   c. How were the engagement levels of the students throughout the lesson?

Warm Up

On a half piece of paper, write down the definition of an open sentence in your own words. Then, write an example of an open sentence with one variable. Try and find the value for the variable that will make your open sentence a true equation.

Unit 2—Solving Equations
Solving Linear Equations

In the Piggy Bank activity, you found how many $1 coins were in each piggy bank. Let's look back at one example from that activity:
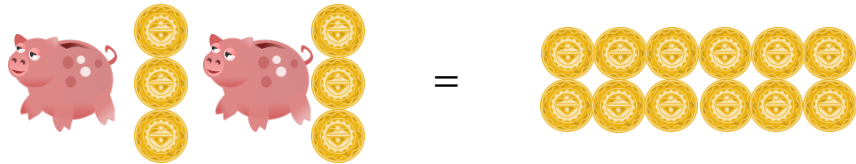
Before finding how many coins were in each piggy bank, the number was unknown. Therefore, you can represent the unknown number with the variable x.

Since there are two piggy banks that can be represented with the variable x and 6 coins that are worth $1, we can write the following equation to represent the situation above:

$$2x + 6 = 12$$

Austin took the following steps to find the number of coins in the piggy banks:

1. First, Austin took away six coins from both sides of the equal signs in order to get the piggy banks alone on one side.
2. Next, Austin divided the remaining coins into two equal groups. This showed him that one piggy bank holds 3 coins.

What would these steps look like as equations? Try starting with the equation $2x + 6 = 12$ and write two new equations that represent the two steps Austin took above.

$$2x + 6 = 12$$

Equation 1:

Equation 2:

In questions 1-3, draw a picture of piggy banks and coins that represents the equation. Under each picture, write the steps you would take to find the number of coins in each piggy bank. Then use equations to find the number of coins in each piggy bank.

1. $10 = 2 + 4x$

Picture	Steps	Equations

2. $3x + 5 = 4x + 1$

Picture	Steps	Equations

3. $2(x + 2) = 10$

Picture	Steps	Equations

Unit 2—Solving Equations
One-step Equations

Define

Word	Definition	Example
Equivalent Equations		

Lesson: One-step Equations

What is the general method for solving equations in order to preserve equality?

When you find the unknown value of a variable in an equation, you are *solving* or *finding the solution* of an equation. In order to find the solution of an equation, we have to get the variable by itself on one side of the equation. This is called **isolating** the variable.

We can find the solution of one-step equations by using the **properties of equality** and **inverse operations.**

1. Solve the following equation for x:
$$x + 2 = 8$$

2. Solve the following equation for x:
$$2x = 8$$

In order to solve the equations above for x, you had to perform one step. These types of equations that require you to use one step are called **one-step equations.**

The table below provides the Properties of Equality that you use when you solve one-step equations:

Property	Algebra Definition	Example
Addition Property of Equality: Adding the same number to each side of an equation produces an equivalent equation.	For any real numbers $a, b,$ and c, if $a = b$, then $a + c = b + c.$	
Subtraction Property of Equality: Subtracting the same number from each side of an equation produces an equivalent equation.	For any real numbers $a, b,$ and c, if $a = b$, then $a - c = b - c.$	
Multiplication Property of Equality: Multiplying each side of an equation by the same nonzero number produces an equivalent equation.	For any real numbers $a, b,$ and c, if $a = b$, then $a \cdot c = b \cdot c.$	
Division Property of Equality: Dividing each side of an equation by the same nonzero number produces an equivalent equation.	For any real numbers $a, b,$ and c, such that $c \neq 0$, if $a = b$, then $\frac{a}{c} = \frac{b}{c}.$	

*In order to isolate the variable in a one-step equation, we use inverse operations. *

Inverse operations undo each other. For example, subtraction is the inverse operation of addition and division is the inverse operation of multiplication.

Example: In order to solve $x - 4 = 1$ for x, we perform the inverse operation of subtraction, which is addition, by adding 4 to both sides of the equation in order to isolate x.

Solve $\frac{2}{3}x = 36$ for x.

How do we isolate x when the coefficient of x is a fraction?

Practice: Solve the equations below for each variable. Then, check your answer by plugging in your answer for x.

1. $23 + x = 12$

2. $\frac{y}{8} = 3$

3. $24 = 4m$

4. $g - 5.5 = 16$

5. $\frac{12}{5} = \left(\frac{11}{3}\right)d$

<div align="center">

Unit 2

Lesson 3—Solving Two-Step Equations

(One day)

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I. **CCSS:**
   HSA.CED.A.1 Create equations…in one variable….
   HSA.REI.B.3 Solve linear equations…in one variable….

II. **Learning Objectives:**
   Learning Target 2.1: The learner can create and solve (linear) equations and use them to solve problems.
   b. The learner can solve two-step equations in one variable 3 out of 3 times when given three different problems by the end of the lesson.
   c. The learner can create equations in one variable with 80% accuracy when given a story problem by the end of the lesson.

III. **Anticipatory Set:** On the projector display the Warm-up problem (first part of the *Two-Step Equations* worksheet). The Warm Up will refer back to the piggy bank problem, and students will write an solve the equation that solves the problem.

IV. **Objective/Purpose:** "For today's lesson, we will move on from solving one-step equations to solving two-step equations. We will continue to use inverse operations to isolate the variable."

V. **Input**

   a. **Task Analysis:**
      i. Students should begin working on the anticipatory set at the start of class. (5 min)
      ii. State the objective and purpose for the lesson. (1 min)
      iii. Work through the Lesson portion of the *Two-step Equations* activity as a class. Guide students through problems 1-3 together, call on students to provide ideas on how to solve the equations.(20 min)
      iv. Write the homework problems on the board for students to work on for the rest of the class period.(15 min)
      v. Have students complete the Exit Ticket (5 min)
      vi. Summarize the lesson before students leave. (2 min)

   b. **Thinking Levels**

        i. Comprehension/understanding: Explain the steps in solving how many coins are in the piggy bank. Explain the difference between a one-step and two-step equation.

        ii. Evaluate: Justify the steps taken to solve the problem to group members.

        iii. Applying: Solve two-step equations in one variable and check your solution.

c. **Learning Styles and/or Accommodations**

        i. Learning Styles

            1. Visual learning: Students have a pictorial representation of an equation.

            2. Intrapersonal: Students work individually on homework problems.

        ii. Extensions/Accommodations

            1. For the visually impaired, use the magnification camera and monitor in order to magnify what is displayed on the projector and drawn on the whiteboard. Always repeat directions and solution steps several times.

            2. For an extension, ask students to write a real-life context in which a two-step equation would have to be set up.

d. **Methods and Materials**

        i. Ways of presenting: Lecture/guided practice, and individual work on homework.

        ii. Materials Needed: Whiteboard and markers, projector, computer files for Exit Ticket, Two-*step Equations* worksheet, magnification camera and monitor.

IV. **Modeling**

a. Model solving a two-step equation that includes a fraction on the board. Model how to think through a story problem in order to set up and solve a two-step equation.

II. **Checking for Understanding**

a. During the lecture/guided practice portion of the lesson, call randomly on students to provide ideas and answers.

b. As students work in groups, listen to groups' conversations, check their work, and help groups who may get stuck on a problem.

c. Questions to ask:

        i. How can we represent this equation as a picture with piggy banks and coins?

        ii. Does this step preserve equality?

        iii. What operation "undoes" this operation? How can we isolate the variable?

iv. How do you know your answer is correct?
 d. Check homework the next day.

III. **Guided Practice**
 a. While working through *Two-step Equations*, ask students to try solving #1 on their own, then go back over the solution. Solve #2 and #3 together as a class. Before students begin solving equations on their own, summarize the steps for solving two-step equations.

IV. **Independent Practice**
 a. Students work alone on the homework assignment (**pg. 91 #6-16 evens, 24-30 evens**).

V. **Closure:**
 a. Summarize what the students have done during the lesson.
  i. "We have learned the steps to solving two step equations. We can use the properties of equality to undo operations in order to isolate the variable. When solving two-step equations, we undo the operations in the opposite order of the order of operations. Tomorrow, we will be using these same ideas to solve multi-step equations and equations with variables on both sides."
 b. Remind students to finish the last five problems on *One-step Equations* if they didn't in class.

VI. **Assessment:**
 a. Students should be able to perform inverse operations in order to solve for the variable.
 b. Observe students as they solve two-step equations individually. Address any misconceptions and remind them to check their solutions.
 c. Assess student learning by checking the homework problems. Find what mistakes students are repeatedly making and address them during the Multi-step Equations lesson or reteach if necessary.

VII. **Reflection:** Reflect on the lesson and make necessary changes. Use the homework problems to determine if reteaching needs to take place.
 a. Were students able to connect the piggy bank situation to a two-step equation with one variable?
 b. Are the students ready to move on to solving multi-step equations in one variable and equations where the variable is on both sides?

c. Did students properly display understanding of inverse operations while working through their homework?
d. How were the engagement levels of the students throughout the lesson?

Unit 2—Solving Equations
Two-step Equations

Warm-up: Assume each piggy bank holds the same number of $1 coins. Write an equation that represents the picture. Find how many coins each piggy bank holds. Write each step that you took, and write an equation that represents each step.

Lesson: Two-step Equations

Notice in the equation above that there are two operations being performed on the left side of the equation (addition and multiplication).

Two-step equations involve two operations. Thus, is takes two steps in order to solve them.

Let's go back to the Warm-Up problem above. What was the first step you performed in order to solve the problem?

What was the second step?

Notice that when you solved the problem, you performed subtraction first, then division second.

When we isolate the variable, we undo the operations in the reverse order of the order of operations.

1. What is the solution of $2x + 3 = 15$?

2. What is the solution of $\frac{x-7}{3} = -12$?

We can solve this in two ways:

  1ˢᵗ way: Rewrite as the difference of two fractions.

  2ⁿᵈ way: First undo division by multiplying.

3. You and your classmates are selling candy bars to raise money. You purchased a total of 500 candy bars for $50. After your class sold all of the candy bars you calculated your profit to be $825. What was the cost of each candy bar?

Exit Ticket

On a half piece of paper, explain the difference between a one-step and two-step equation. Write an example of each.

Unit 2
Lesson 4—Solving Multi-step Equations and Equations with variables on both sides
(One day)

I. **CCSS:**
HSA.CED.A.1 Create equations…in one variable and use them to solve problems.
HSA.REI.A.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
HSA.REI.B.3 Solve linear equations…in one variable….

II. **Learning Objectives:**
Learning Target 2.1: I can create and solve (linear) equations and use them to solve
problems.
d. The learner can solve multi-step equations in one variable 3 out of 4 times when given four equations by the end of the lesson.
e. The learner can solve equations with variables on both sides 3 out of 4 times when given four problems by the end of the lesson.
f. The learner can identify equations that are identities or have no solution with 100% accuracy when given an equation of each by the end of the lesson.

g. **Anticipatory Set:** Students should begin class by completing the Warm Up portion of the *Multi-Step Equations* lesson worksheet. The Warm Up will refer back to the piggy bank problem, and students will write an solve the equations that solves the problems.

h. **Objective/Purpose:** "For today's lesson, we will move on from solving two-step equations to solving multi-step equations and equations with variables on both sides. We will continue to use inverse operations to isolate the variable."

i. **Input**

a. **Task Analysis:**
i. Students should begin working on the anticipatory set at the start of class. (5-8 min)
ii. State the objective and purpose for the lesson. (1 min)
iii. Work through the Lesson portion of the *Multi-step Equations* lesson worksheet as a class. Guide students through solving the problems for both types of equations. Call on students to provide ideas on how to solve the equations.(25 min)

    iv. Pass out the *Steps for Solving Linear Equations* handout. Summarize the steps that students can use to solve any linear equation. (5 min)

    v. Students work on homework problems individually to practice solving multi-step equations and equations with variables on both sides. (10-15 min)

    vi. Summarize the lesson before students leave. (2 min)

b. **Thinking Levels**
   i. Comprehension/understanding: Explain the steps in solving how many coins are in the piggy bank. Explain the difference between a one-step and two-step equation. Summarize the steps for solving a linear equation.
   ii. Evaluate: Justify the steps taken to solve the problem during guided practice/lecture portion.
   iii. Applying: Solve multi-step equations in one variable and equations with variables on both sides, and check your solution.

c. **Learning Styles and/or Accommodations**
   i. Learning Styles
      1. Visual learning/Auditory learning: Students have a pictorial representation of an equation in the Warm Up, and students see/hear instructor work through example problems.
      2. Intrapersonal: Students work individually on homework problems.
   ii. Extensions/Accommodations
      1. For the visually impaired, use the magnification camera and monitor in order to magnify what is displayed on the projector and drawn on the whiteboard. Always repeat directions and solution steps several times.
      2. For an extension, ask students to write a real-life context in which a multi-step equation would have to be set up.

d. **Methods and Materials**
   i. Ways of presenting: Lecture/guided practice, and individual work on homework.
   ii. Materials Needed: Whiteboard and markers, projector, *Multi-step Equations* lesson worksheet, *Steps for Solving Linear Equations,* magnification camera and monitor.

IV.   **Modeling**
    a. Model solving both multi-step equations and equations that have variables on both sides on the board. Explain what an identity is and how to determine if an equation is an identity equation has no solution.

II.   **Checking for Understanding**
    a. Ask students to provide answers for Warm Up—address any misconceptions.
    b. During the lecture/guided practice portion of the lesson, call randomly on students to provide ideas and answers.
    c. Observe students as they work individually on homework assignment—ask questions below to help students progress.
    d. Questions to ask:
        i.   How can we isolate the variable?
        ii. Does this step preserve equality?
        iii. What operation "undoes" this operation
        iv. How do you know your answer is correct?
    e. Check homework the next day.

III.   **Guided Practice**
    a. Do the practice problems in the lesson worksheet together. "Think out loud" for students by talking through each step to solve the problems.

IV.   **Independent Practice**
    a. Students work alone on the homework assignment (**pg.97 #1-5, 9; pg.105 #1-5,9,27,28**).

V.   **Closure:**
    a. Summarize what the students have done during the lesson.
        i.   "We have learned the steps to solving multi-step equations and equations with variables on both sides. We can use the properties of equality to undo operations in order to isolate the variable. Tomorrow, we will be looking at equations that contain more than one variable."
    b. Remind students to finish the homework problems if they didn't finish them during class.

VI.   **Assessment:**
    a. Students should be able to perform inverse operations in order to solve for the variable.

b. Observe students as they solve multi-step equations and equations with variables on both sides individually. Address any misconceptions and remind them to check their solutions.

c. Assess student learning by checking the homework problems. Find what mistakes students are repeatedly making and reteach if necessary.

VII. **Reflection:** Reflect on the lesson and make necessary changes. Use the homework problems to determine if reteaching needs to take place.

a. Were students able to connect the piggy bank situation to a multi-step equation with one variable and to an equation with the variable on both sides?

b. Are the students ready to move on to working with literal equations formulas?

c. Did students properly display understanding of inverse operations while working through their homework?

d. How were the engagement levels of the students throughout the lesson?

Multi-step Equations
Equations with Variables on both sides

Warm Up: Write the equations that represent each picture below. Using the picture, try and solve the equation to find how many coins are in each piggy bank.

1.

2.
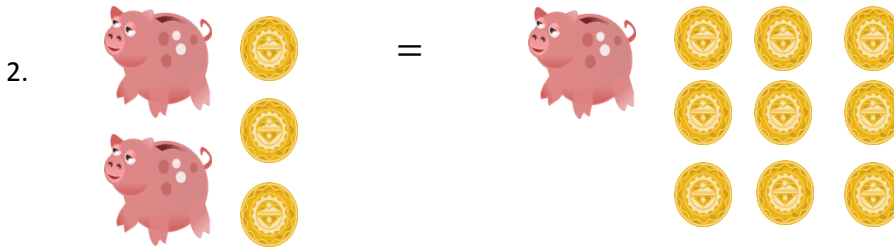
Lesson: In the Warm Up, you solved a multi-step equation and an equation with the variable on both sides. We will work more with solving these types of equations.

Multi-Step Equations: These equations can be simplified to a two-step or one-step equation. Below is an example of a multi-step equation:

$$2x - 3 + x = 5$$

This equation can be simplified to a two-step equation by adding like terms on the left side of the equation.

Let's try solving multi-step equations. Make sure to justify each step.

1. $5 = 5m - 23 + 2m$

2. $-8(2x - 1) = 36$

3. $\frac{3x}{4} - \frac{x}{3} = 10$

4. $3.5 - 0.02x = 1.24$

Equations with variables on both sides: In these types of equations, the variable is on both sides. The goal is to still isolate the variable on one side of the equation. Below is an example.

$$3t + 1 = 6 - 2t$$

Let's solve some of these kinds of equations. Make sure to justify each step.

1. $5x + 2 = 2x + 14$

2. $2(5x - 1) = 3(x + 11)$

3. $10x + 12 = 2(5x + 6)$

    An equation is an <u>identity</u> if

4. $9m - 4 = -3m + 5 + 12m$

    An equation has <u>no solution</u> if

Steps for Solving Linear Equations

Step 1: Remove parentheses on each side of the equation using the Distributive Property, if possible.

Step 2: Combine like terms on each side of the equation.

Step 3: Use the properties of equality to get the "variable terms" on one side of the equation and the constants on the other.

Step 4: Isolate the variable by using the properties of equality (divide both sides by the coefficient or multiply both sides by the reciprocal).

Step 5: Check your solution by plugging in your value of the variable back into the original equation.

Unit 2

Lesson 5—Literal Equations Lesson Plan

(One Day)

I. **CCSS:**
A.CED.A.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

II. **Learning Objective:**
Learning Target 2.1: The learner can create and solve (linear) equations and use them to solve problems.
- The learner can rewrite and use equations in both variables (3 out of 4 times for both π and h for volume and surface area of the two containers) by the end of the lesson.

III. **Anticipatory Set:** Hand out the Pre-assessment/Post-assessment worksheet (see unit plan). Students should complete the Pre-assessment portion to the best of their ability. Remind them that this is simply to see what they already know about literal equations.

IV. **Objective/Purpose:** "Today, we will be working with equations that have more than one variable—these are called literal equations. We will be measuring the dimensions of cylinders, calculating their volumes and surfaces areas, then checking our work by rewriting literal equations."

V. **Input**

a. **Task Analysis:**
   i. Students should begin working on the anticipatory set at the start of class. (10 min)
   ii. State the objective and purpose for the lesson. (1 min)
   iii. As a class, solve the equation $y + 2 = 4x - 6$ for x on the board. (3 min)
   iv. Explain the Cylinder Activity. (3 min)
      1. Students should get into groups of three. Each group needs to select one cylinder to begin.
      2. Students need to measure the height and diameter of their cylinder. Then use the equation to calculate the volume and surface area.
      3. Students will complete these same steps for a second cylinder (groups may have to trade cylinders).
      4. Students check their work by solving the surface area and volume equations for π and h (students do not need to solve for r)

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    v. Students will complete Cylinder Activity. Ask a couple groups to show their work for a particular cylinder. (25 min)

    vi. Summarize activity. Address any misconceptions students made during activity. (5 min)

    vii. Students should complete Post-assessment (see unit plan). If students do not finish during class, they should complete it for homework. (5 min)

b. **Thinking Levels**
    i. Application/Applying: Apply steps for solving one variable equations to rewrite equations with more than one variable. Solve/rewrite literal equations to find the value of a particular variable.
    ii. Evaluate: Justify the steps taken to solve the problem to group members.

c. **Learning Styles and/or Accommodations**
    i. Learning Styles
        1. Visual and kinesthetic learning: Students measure dimensions of cylinders and calculate their volume and surface areas to make the connection to literal equations.
        2. Intrapersonal and interpersonal: students work individually on pre and post assessment and in a group on the main activity of the lesson.
    ii. Extensions/Accommodations
        1. For the visually impaired, use the magnification camera and monitor in order to magnify what is displayed on the projector and drawn on the whiteboard. Always repeat directions and solution steps several times.
        2. Read directions/problems out loud to students. Have other students working in these students' groups read each question out loud and assist these students if they need help reading anything else.
        3. Ask students who have completed the activity to write a paragraph summarizing the steps for solving for a particular variable in a literal equation.

d. **Methods and Materials**
    i. Ways of presenting: Guided practice, group activity, individual work on pre and post assessment.
    ii. Materials Needed: Whiteboard and markers, projector, pre and post assessment worksheet, Cylinder Activity, 10 different-sized cylinders, 10 tape rulers.

IV. **Modeling**

a. After students have completed pre-assessment, "think outloud" about approaching solving a literal equation so students have a model on how to approach these problems on their own.

II. **Checking for Understanding**
   a. As students work in groups, listen to groups' conversations, check their work, and help groups who may get stuck on a problem.
   b. Questions to ask:
      i. What step can you perform to isolate π? What step can you peform to isolate h?
      ii. Does this answer make sense?
      iii. How do you know your answer is correct?
   c. Pre and Post assessment

III. **Guided Practice**
   a. After students have completed Pre-assessment, solve $y + 2 = 4x - 6$ for x on the board. Call randomly on students to offer suggestions on how to isolate x.

IV. **Independent Practice**
   a. Students will be working alone on post-assessment. They will be applying what they learned from the group activity to the post-assessment problems.

V. **Closure:**
   a. Summarize what the students have done during the lesson.
      i. "Today, we have seen real-life examples of literal equations. We can take the same steps to rewrite these equations as the steps to solve equations with one variable."

VI. **Assessment:**
   a. Students should be able to plug in values for r and h to obtain surface area and volume.
   b. Students should apply the properties of equality to rewrite each literal equation for the particular variable.
   c. When observing students working on activity, ask probing questions to students who may have conducted an incorrect step in solving the "equation." For students who are confident in their incorrect answers, ask them to check their answer.
   d. The post-assessment results will help determine if reteaching needs to take place.
   e. If students need more practice solving linear equations (and are not ready for the Lesson 2-1 through 2-5 Quiz, take an extra day to reteach/model solving particular equations, and have students complete the *Solving Equations Practice*—see *Review, More Practice* folder of Unit Plan).

VII. **Reflection:** Reflect on the lesson and make necessary changes. Use the post-assessments to determine what needs to be recovered during the next lesson.
   a. Are the students ready to review lessons 1-5 for the Quiz?
   b. How were the engagement levels of the students throughout the lesson? Did a hands-on activity engage those students who are not normally engaged during direct instruction (lecture)?

*This lesson was adapted from "Don't Take it so Literal," by Russell Renfro, contributed by Volusia.

Link: http://www.cpalms.org/Public/PreviewResourceLesson/Preview/46566

Name: _____   Period: _____   Date:_____

Show me what you know about literal equations!

Solve the given equations, show all steps.

1. $2.5x = 7.5$

2. $x + 7 = 13$

3. $2x + 3 = 9$

Solve the formula for the given variable?

4. $x =?$ $x + 2y = 5$

5. $r =?$ $d = rt$

6. $b =?$ $A = \frac{1}{2}bh$

7. $l =?$ $P = 2l + 2w$

8. $a =?$ $a^2 + b^2 = c^2$

9. $h =?$ $V = \pi r^2 h$

Name: _____   Period: _____   Date:_____

Show me what you've learned about literal equations!

Solve the given equations, show all steps.

2. $3.5x = 11.5$

2. $x - 7 = 13$

3. $3x - 3 = 9$

Solve the formula for the given variable?

4. $y =?$ $2x + y = 5$

5. $r =?$ $I = Prt$

6. $h =?$ $A = \frac{1}{2}bh$

7. $w =?$ $P = 2l + 2w$

8. $b =?$ $a^2 + b^2 = c^2$

9. $r =?$ $V = \pi r^2 h$

Volume of a cylinder	Surface area

$$V = \pi r^2 h$$ $$SA = 2\pi r^2 + 2\pi rh$$

Container 1   ## Container 2

h =_____   h =_____

r =_____   r =_____

π =_____ π =_____

V =_____   V =_____

SA =_____   SA =_____

$$V = \pi r^2 h$$ $$SA = 2\pi r^2 + 2\pi rh$$

Solve for (π) **Solve for** (π)

Solve for (h)   **Solve for (h)**

Solve for (r)   **Solve for (r)**

Unit 2
Lesson 6—Ratios and Proportional Reasoning
Lesson Plan
(One Day)

I. **CCSS:**
HSA.REI.B.3 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas
HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

II. **Learning Objective:**
   Learning Target 2.2: The learner can write and solve proportions to solve problems.
   a. The learner can find ratios and rates with **80**% accuracy when given quantities to compare by the end of the lesson.
   b. The learner can convert units and rates with **80**% accuracy when given information in order to find a conversion factor by the end of the lesson.

III. **Anticipatory Set:** Display Warm Up on the board. Ask students to work with a partner on the Warm Up. The Warm Up problem requires students to start thinking proportionally and recall what the term ratio means. Ask students to share their answers with the whole class.

IV. **Objective/Purpose:** "In today's lesson, we will be working with ratios. Some of you are probably familiar with ratios from middle school. We will be reviewing the definitions of ratios and rates. We will see a special kind of ratio called a conversion factor, which we will use in conversion problems."

V. **Input**

   a. **Task Analysis:**
      i. Students complete Warm Up with a partner—there will be a whole class discussion later regarding the answers after ratios have been defined. (5 min)
      ii. State the objective and purpose for the lesson. (1 min)
      iii. Explicitly define ratio for the class. Write on the board the three ways to write a ratio ($\frac{a}{b}$, $a:b$, and a to b). (2 min)
      iv. Ask students to "Think, Pair, Share" in order to determine the ratio of boys to girls in the classroom. (2 min)
      v. Address the answers to the Warm Up questions. Ask specific partner groups what they got for their answers, and if they still agree on those answers now that ratios have been explicitly defined (4 min).

     vi. Complete the *Ratios, Rates, and Conversions* student companion (pg. 58-60 from Pearson Success Net) as a class. (25 min)

    vii. Students complete pg. 61 of the student companion individually as formative assessment. Have each student turn in pg. 61 as an exit ticket. (10 min)

    viii. Summarize lesson—restate the main ideas of the lesson (1 min).

b. **Thinking Levels**
    i. Remembering/knowledge: Define ratio, rate, and conversion factor.
    ii. Applying/Application: Choose a conversion factor to convert units and rates.

c. **Learning Styles and/or Accommodations**
    i. Learning Styles
        1. Visual learning: Students can visualize a ratio by comparing the number of boys in the classroom to the number of girls.
        2. Logical: Students must determine what conversion factor will allow them to covert units and rates.
        3. Intrapersonal and interpersonal: Students work with a partner on Warm Up and in the Think, Pair, Share portion of the lesson. Students work individually on the Lesson Check (pg. 61 of student companion).
    ii. Extensions/Accommodations
        1. For the visually impaired, use the magnification camera and monitor in order to magnify what is displayed on the projector and drawn on the whiteboard. Always repeat directions and solution steps several times.
        2. Read directions/problems out loud to students. Have other students working in these students' groups read each question out loud and assist these students if they need help reading anything else.
        3. For students who are having a difficult time converting, remind them how units that are in both the numerator and denominator "cancel" each other out.
        4. For an extension (for those that finish the Lesson Checks early), ask students to write their own conversion problem and state the conversion factor that would be necessary to use in order to solve it.

d. **Methods and Materials**
    i. Ways of presenting: Lecture/modeling, individual practice.

ii.   Materials Needed: Whiteboard and markers, projector, Warm Up computer file, *Ratios, Rate, and Conversions* student companion from Pearson Success Net, magnification camera.

VI.   **Modeling**
   a.   Model problems 1 and 2 from student companion for the students. (Model how to change rates into unit rates and convert units.)

VII.   **Checking for Understanding**
   a.   Call randomly on students to help provide answers/ideas as the whole class works through the problems in the student companion.
   b.   Use the Lesson check portions of the student companion as an exit ticket. As students work in groups, listen to groups' conversations, check their work, and help groups who may get stuck on a problem.
   c.   Questions to ask students as they work through Problems 3 and 4 from the student companion as a whole class :
         i.   What conversion factor can we use in order to make sure our units cancel?
         ii.   Does this answer make sense?

VIII.   **Guided Practice**
   a.   Complete problems 3 and 4 of student companion as a class. Call on students to help fill in each step.

IX.   **Independent Practice**
   a.   Students complete the Lesson Checks individually and turn in as an exit ticket.

X.   **Closure:**
   a.   Summarize what the students have done during the lesson.
         i.   "Today, we have used ratios and rates to compare quantities. We then use ratios to convert between units and rates. Tomorrow we will continue to use ratios, but we will be setting up and solving equations that involve ratios."

XI.   **Assessment:**
   a.   Students should be able to write a ratio that compares two quantities.
   b.   Students should be able to change a rate into a unit rate.
   c.   Students should be able to find a conversion factor and then multiply a quantity by that conversion factor in order to solve a conversion problem.
   d.   Use the exit ticket (pg. 61) to determine if reteaching needs to take place.

XII. **Reflection:** Reflect on the lesson and make necessary changes. Use the exit tickets to determine what needs to be recovered during the next lesson.
   a. Are the students ready to move onto solving proportions?
   b. How were the engagement levels of the students throughout the lesson? Was a more "lecture based" lesson appropriate for reviewing ratios and conversion problems?

*The student companion was developed by Pearson and accompanies Section 6: Ratios, Rates, and Conversions from Chapter 2 of the *Algebra 1: Common Core* textbook.

Warm Up

Miss Kolbe gave her class a survey asking them if they preferred hot or cold lunch. Of the 30 students in her class, 10 preferred cold lunch and 20 preferred hot lunch. Decide whether each statement below accurately describes the results of the survey.

1. The number of students who prefer hot lunch is 10 more than the number of students who prefer cold lunch.

2. 50% of Miss Kolbe's students prefer cold lunch.

3. The number of students who prefer hot lunch is 2 times the number of students who prefer cold lunch.

4. In Miss Kolbe's class, $\frac{1}{3}$ of the students prefer cold lunch.

5. The ratio of students who prefer hot lunch to students who prefer cold lunch is $20:10$.

6. The ratio of students who prefer cold lunch to the total number of students in Miss Kolbe's class is $10:30$.

Unit 2
Lesson 7—Solving Proportions
Lesson Plan
(One Day)

I. **CCSS:**
HSA.REI.B.3 Solve linear equations in one variable….
HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems.

II. **Learning Objective:**
Learning Target 2.2: The learner can write and solve proportions to solve problems.
c. The learner can solve proportions using the Multiplication Property or the Cross Products Property 4 out of 5 times when given proportions to solve (in the modeling portion and exit ticket) by the end of the lesson.

III. **Anticipatory Set:** Display Warm Up on the board. To review ratios, students will need to write a ratio compare two different quantities in the classroom. They will then need to find an equivalent ratio to their ratio.

IV. **Objective/Purpose:** "In today's lesson, we will be writing equations involving variables (they are called proportions), and then we will solve the equations using two methods."

V. **Input**

  a. **Task Analysis:**
    i. Students complete Warm Up. Ask a couple students to share their ratios and equivalent ratios. (5 min)
    ii. State the objective and purpose for the lesson. (1 min)
    iii. Take a student's Warm Up answer and write her original ratio equal to the equivalent ratio. Explain that this is a proportion. Define a proportion for the class as an equation that states two ratios are equal. (3 min)
    iv. Play the "Sugar Packets" video.
    http://www.youtube.com/watch?v=7vS3GJ5x2tM
    Explain that the class is going to answer the question: How many packets of sugar are in a 20 oz soda? (1 min)
      1. Tell students they will be finding this answer for a 20 oz of Coke.
      2. Ask students to "Think, Pair, Share" about what information they need to solve this problem. Have them write their ideas down, then ask for students to share their ideas. (5 min)

v.   Display the nutrition labels for a pack of sugar and a 20oz bottle of coke. (See *Nutrition Labels* file.) Write on the board how much sugar is in one packet of sugar how much sugar is in one 20 oz bottle of coke. Tell students that you are going to round the amount of sugar in the coke to 64 grams to make the problem a little easier. (3 min)

    1. Ask students, "What ratio would represent the amount of sugar in grams in one packet of sugar?" Write the answer on the board.

    2. Ask students, "What ratio would represent the amount of sugar in grams in x number of packets in a 20oz bottle of Coke?" Write the answer on the board.

    3. Explain to students that the two ratios written on the board are equivalent (even though the number of grams of sugar increases, the amount of sugar compared to the number of packets stays the same). Therefore, show that these two ratios can be set equal to each other. (3 min)

vi.   Have students try to solve for x in order to determine the number of packets in one 20 oz bottle of coke. (4 min)

vii.   Using the same equation, show how to solve a proportion using the Cross Products Property. Have students write the definition of the Cross Products Property in their notes. (5 min)

viii.   Model how to use the Multiplication Property of Equality and Cross Products Property on the following two equations: $\frac{x}{8} = \frac{4}{5}$, $\frac{4}{3} = \frac{8}{x}$ and $\frac{b-8}{5} = \frac{b+3}{4}$. (5 min)

ix.   Students should begin working on homework problems in their groups (**pg. 127 #14-16 evens, 22-24 evens, 30-32 evens, 35**). (10 min)

x.   Summarize lesson—restate the main ideas of the lesson. (1 min)

xi.   Have students complete exit ticket before they leave class. (5 min)

b. **Thinking Levels**
    i. Applying/Application: Solve a proportion to find the value of the unknown variable.

c. **Learning Styles and/or Accommodations**
    i. Learning Styles
        1. Logical: Students are given a real-world situation in which a proportion can be solved. Before learning how to solve a proportion, students problem solve to try and find the number of packets in a coke bottle.
        2. Intrapersonal and interpersonal: Students work with a partner on Warm Up and in the Think, Pair, Share portion of the lesson.

Students have the option to work with their group members on homework. Students work individually on exit ticket.

    ii. Extensions/Accommodations

        1. For the visually impaired, use the magnification camera and monitor in order to magnify what is displayed on the projector and drawn on the whiteboard. Always repeat directions and solution steps several times.

        2. For students who are having a hard time understanding why the two ratios can be set equal to each other, refer back to the warm up when they found an equivalent ratio. Explain that while the numbers in the equivalent ratio are different, the ratio is the same (you can divide the numerators by the denominators and obtain the same number).

        3. Students can make a Cross Products Property foldable to help them remember how to solve proportions.

        4. For an extension to complete at home, ask students if they can find a 20 oz soda that contains more sugar than Coke. Ask them to show their work on a piece of paper.

d. **Methods and Materials**

    i. Ways of presenting: Lecture/modeling, group work.

    ii. Materials Needed: Whiteboard and markers, projector, Warm Up computer file, "Sugar Packets" video link, nutrition labels computer file, exit ticket computer file, magnification camera.

VI. **Modeling**

a. Model how to use the Multiplication Property of Equality and the Cross Products property to solve proportions.

VII. **Checking for Understanding**

a. Call randomly on students to help provide answers/ideas during the "Think, Pair, Share."

b. Observe students as they work on homework problems—address any misconceptions

c. Questions to ask students as they work on homework:

    i. How can you solve for the variable? What property can you use?

d. Check the exit tickets after students leave to determine whether they can use the Cross Products Property to solve a proportion.

VIII. **Guided Practice**
    a. Students will write down the steps to solve a proportion during the modeling part of the lesson. They will then attempt to follow these steps on their own when they work on homework problems. Guide specific students on problems if they need assistance.

IX. **Independent Practice**
    a. Students work on exit ticket alone.
    b. Students finish whatever homework problems they didn't get done in class at home.

X. **Closure:**
    a. Summarize what the students have done during the lesson.
        i. "Today, we have set up and solved equations called proportions. Tomorrow we will continue to solve proportions to solve problems."

XI. **Assessment:**
    a. Students should be able to write an equation that equates two ratios.
    b. Students should be able to use the Cross Products Property to solve a proportion (they may choose to use the Multiplication Property for particular proportions).
    c. Use the exit ticket to determine if reteaching needs to take place.

XII. **Reflection:** Reflect on the lesson and make necessary changes. Use the exit tickets to determine what needs to be recovered during the next lesson.
    a. Are the students ready to move onto using similar figures to solve proportions?
    b. Did the sugar packet problem engage the students?

*The sugar packets problem was adapted from Sarah Hagan's blog *Math=Love*. She used the same video to engage her students with solving proportions.

Warm up

Look around the classroom and find two groups of items (calculators, pencils, windows, lights, desks, etc.). Count the number of items in each group and compare these quantities by writing a ratio.

Is this ratio in simplest form? If yes, write a ratio that is equivalent to your ratio. If not, simplify your ratio into simplest form.

Nutrition Facts

Serving Size 1 Packet (3.5g)

Amount Per Serving

Calories 15

	% Daily Value*
Total Fat 0g	**0%**
Sodium 0mg	**0%**
Total Carbohydrate 4g	**1%**
Sugars 4g	
Protein 0g	

*Percent Daily Values are based on a 2,000 calorie diet.

INGREDIENTS: SUGAR

Coca-Cola

20 fl oz bottle GO

Nutrition Facts

Serving Size 1 bottle

Servings Per Container 1

Amount Per Serving

Calories 240

	% Daily Value*
Total Fat 0g	0%
Sodium 75mg	3%
Total Carbohydrate 65g	22%
Sugars 65g	
Protein 0g	

Not a significant source of fat calories, saturated fat, trans fat, cholesterol, fiber, vitamin A, vitamin C, calcium and iron.

*Percent Daily Values (DV) are based on a 2,000 calorie diet.

similar products

Exit Ticket

Use either the Multiplication Property of Equality or the Cross Products Property to solve each proportion:

1. $\dfrac{3}{4} = \dfrac{m}{5}$

2. $\dfrac{2c}{11} = \dfrac{c-3}{4}$

<div align="center">

Unit 2
Lesson 8—Similar Figures and Proportions
Lesson Plan
(One Day)

</div>

I. **CCSS:**
    HSA.CED.A.1 Create equation…in one variable and use them to solve problems.
    HAS.REI.B.3 Solve linear equations in one variable.

II. **Learning Objective:**
    Learning Target 2.2: The learner can write and solve proportions to solve problems.
    d. The learner can use similar figures to find six out of seven unknown lengths by the end of the lesson.

III. **Anticipatory Set:** Display Warm Up on the board. Students will think about what it means for two shapes to be similar. Have them share their thoughts with a partner. Call on a student to share his or her answer. Explain why the two triangles are similar. Write out how to show they are similar (label each vertex with a letter and write $\Delta ABC \sim \Delta FGH$).

IV. **Objective/Purpose:** "Today, we will continue solving proportions. However, we will be solving particular types of problems—problems that involve similar figures."

V. **Input**

    a. **Task Analysis:**
        i.   Anticipatory Set (8 min)
        ii. State the objective and purpose for the lesson. (1 min)
        iii. Show the Alice in Wonderland clip (2 min):
             http://www.youtube.com/watch?v=YxFU5T5IMnY
        iv. Ask students to discuss in their groups any important observations they made. Direct them to specifically think about Alice's change in size. Call groups to share their observations. (3-4 min)
        v.   Ask the class, "Did Alice grow proportionally?"
             1. If students are having a difficult time answering this questions, ask, "How did the parts of Alice's body grow? Did her arms grow faster than her head? Did her left leg grow faster than her right?"
             2. Explain to students that Alice grew proportionally. While her size before she grew is different than after she grew, Alice kept the same shape. (3-5 min)
        vi. Display the "Alice" pdf. Explain that the two "Alices" are similar figures because they have the same shape even though they are not the same size.

Pose the following scenario and question: "Suppose Alice was 5 feet tall and her head was 1 ft tall before she ate the cookie. After she was done growing, Alice was 50 ft tall. How tall was her head?"

1. Most students will immediately see that her head is 10 ft tall by multiplying 1 by 10. However, ask students to try to solve the problem by writing a proportion. (5 min)

vii. Solve the proportion for the class so they can see how to set up a proportion given two similar figures. (2 min)

viii. Introduce the Basketball Hoop problem, give each student the *Basketball Problem* worksheet, and have students begin working on the problem in partners. (20 min)

1. State that a professional basketball hoop is 10 feet tall. Explain that in the problem, they are given the dimensions of a professional basketball hoop, and their job is to find the corresponding dimensions of a youth size basketball hoop. Tell students that you will be assuming a youth size basketball hoop is 8 ft tall.

2. Have students review converting units by converting 10 ft and 8 ft to meters on the board.

3. Define **scale drawing**, the **scale** of a scale drawing, and a **scale model.** Point out that the worksheet they received is a scale drawing and that the scale is denoted in the bottom corner.

4. **Students will show work on a separate piece of paper.** They should have a proportion solved for each missing length of the youth size basketball hoop.

5. Students will work on problem in partners.

6. Students should turn in worksheet when they are finished.

ix. When finished, students can begin working on the homework problems. These problems will be due the next day. **(pg.134 #6-18 evens)**

x. Summarize lesson (1 min)

b. **Thinking Levels**
   i. Applying/Application: Solve a proportion to find the value of an unknown length.
   ii. Evaluating/Synthesis: Support your argument for determining if the two triangles are similar.

c. **Learning Styles and/or Accommodations**
   i. Learning Styles
      1. Visual: Students watch a clip displaying an example of growing proportionally from one figure to a similar figure. Students are

given a scale drawing of a basketball hoops in order to solve for the unknown lengths of the smaller hoop.

2. Logical: Students are given a real-world situation in which a proportion can be solved.
3. Interpersonal: Students work with a partner the Basketball Hoop Problem.

ii. Extensions/Accommodations
1. For the visually impaired, use the magnification camera and monitor in order to magnify what is displayed on the projector and drawn on the whiteboard. Always repeat directions and solution steps several times.
2. Re-explain to students who are struggling that because figures are similar, their ratios comparing the various lengths of the figure are equal.
3. Have students use the Cross Products Property foldable to help them find missing lengths.

d. **Methods and Materials**
   i. Ways of presenting: Lecture/modeling, guided practice, group work
   ii. Materials Needed: Whiteboard and markers, projector, Warm Up computer file, Alice in Wonderland video link, Alice pdf file, *Basketball Hoop Problem* worksheet, magnification camera.

VI. **Modeling**
   a. Model on the board how to find the length of Alice's head by solving the proportion.

VII. **Checking for Understanding**
   a. Call randomly on students to provide answers to Warm Up, question posed on the Alice clip, etc.
   b. Observe students as they work on the Basketball Hoop Problem, Questions to ask students as they work on homework:
      i. What ratio of using known lengths can you use in your proportion?
      ii. How can you solve for the variable? What property can you use?
   c. Students will hand in their Basketball Problem work; check work to see if there are still any misconceptions that need to be addressed the next lesson.

VIII. **Guided Practice**
   a. Students will follow along as the Alice proportion is solved on the board. While students work in partners on the Basketball Hoop Problem, some groups will need

guided practice with solving another proportion. Guide those groups while allowing other groups to continue on without teacher intervention.

IX. **Independent Practice**
   a. Students complete homework problems for more practice at home individually.

X. **Closure:**
   a. Summarize what the students have done during the lesson.
      i. "For today's lesson, we have set up and solved more proportions that deal with similar figures. Tomorrow we will continue to solve proportions to solve problems involving percents."

XI. **Assessment:**
   a. Students should be able to identify similar figures.
   b. Students should be able to use known lengths of similar figures to write a proportion in order to find an unknown length.
   c. Students should be able to use the Cross Products Property to solve a proportion (they may choose to use the Multiplication Property for particular proportions).
   d. Check students' work on the Basketball Problem to determine if reteaching needs to take place.

XII. **Reflection:** Reflect on the lesson and make necessary changes. Use observations of students working in partners and results on the Basketball Hoop problems to determine if learning objectives need to be readdressed the next day.
   a. Are the students ready to move onto percents?
   b. Were students engaged by the Basketball Hoop Problem? Did the visuals of the Alice clip and hoop diagrams help students see the proportionality of similar figures?

Warm Up

1. Are these triangles the same? Why or why not?
2. Are these triangles similar shapes? Why or why not?

? ft

1 ft

50 ft

5 ft

1.80 m

0.59 m

0.45 m

0.45 m

1.05 m

0.15 m

3.05 m

2.90 m

2.44 m

63
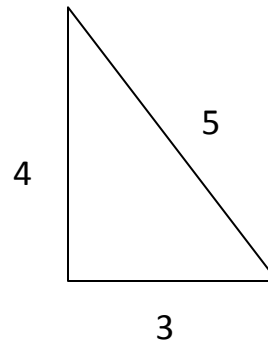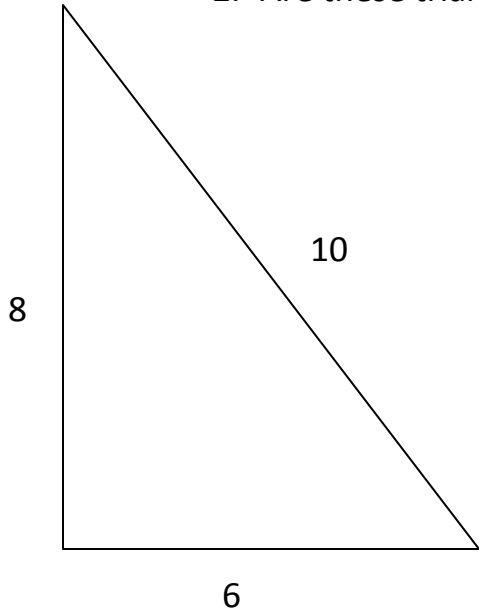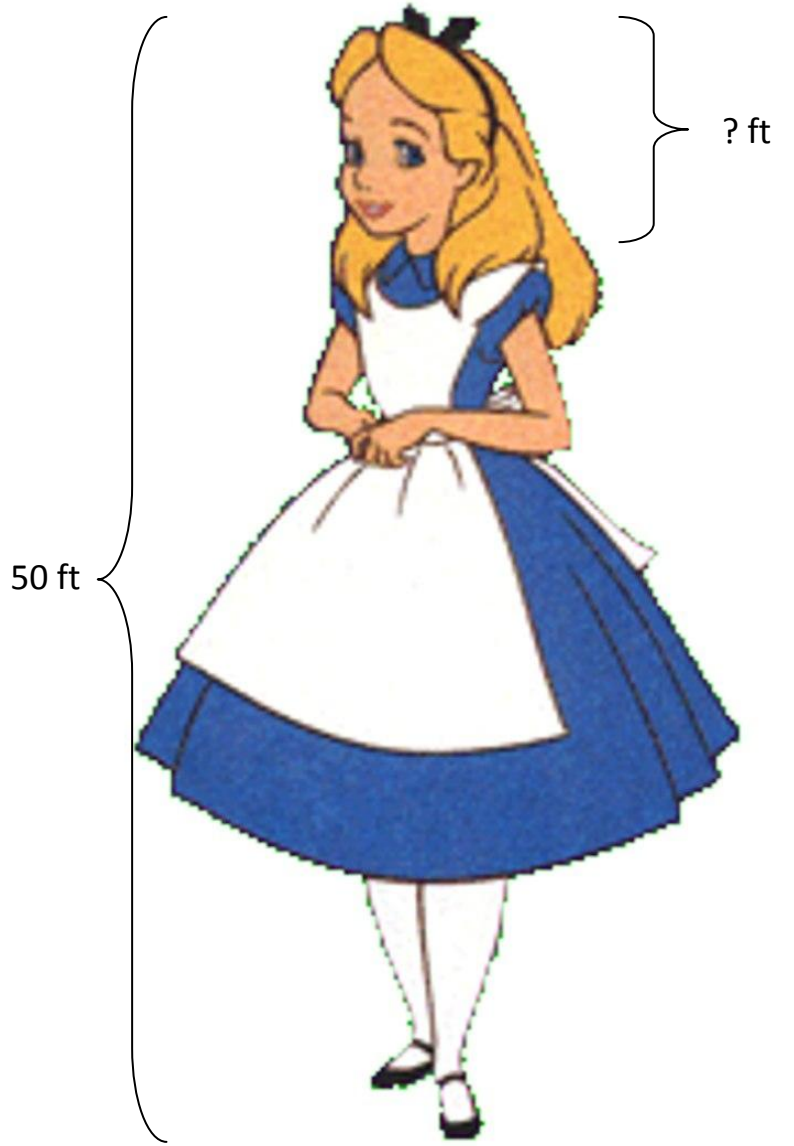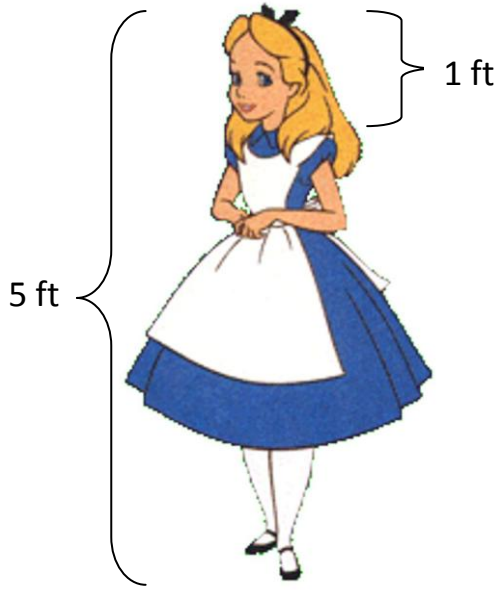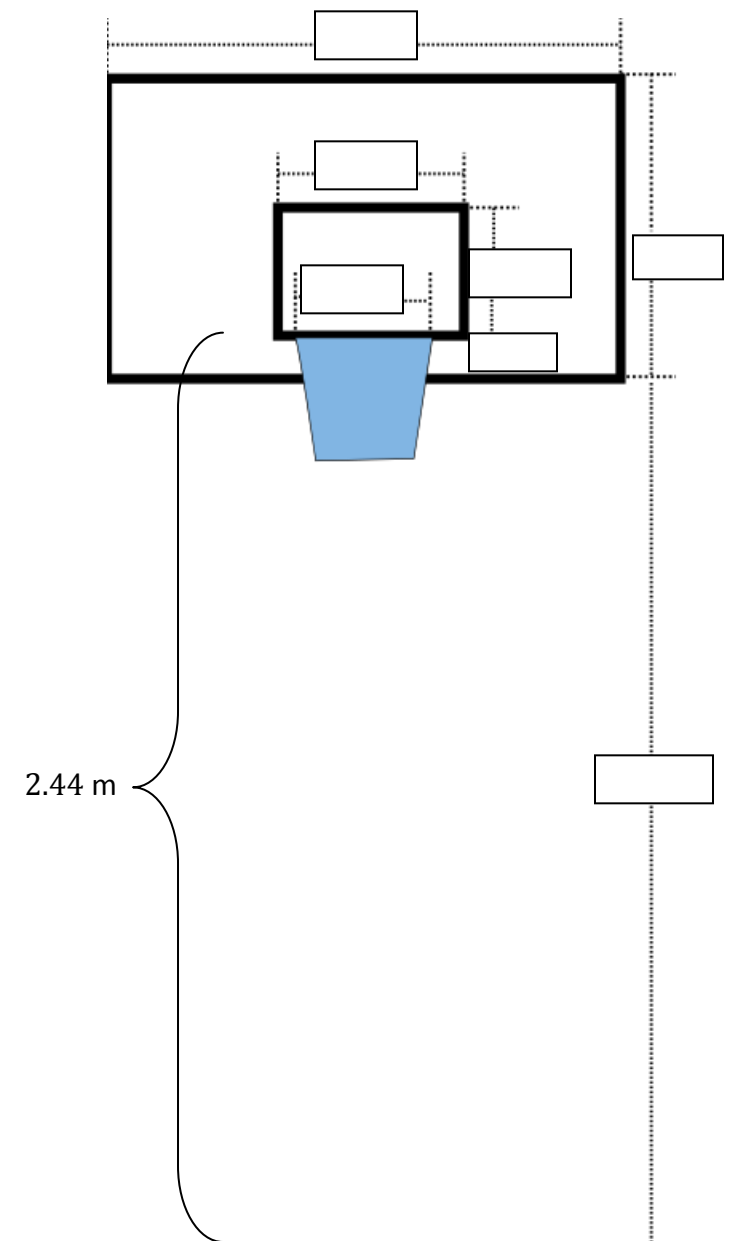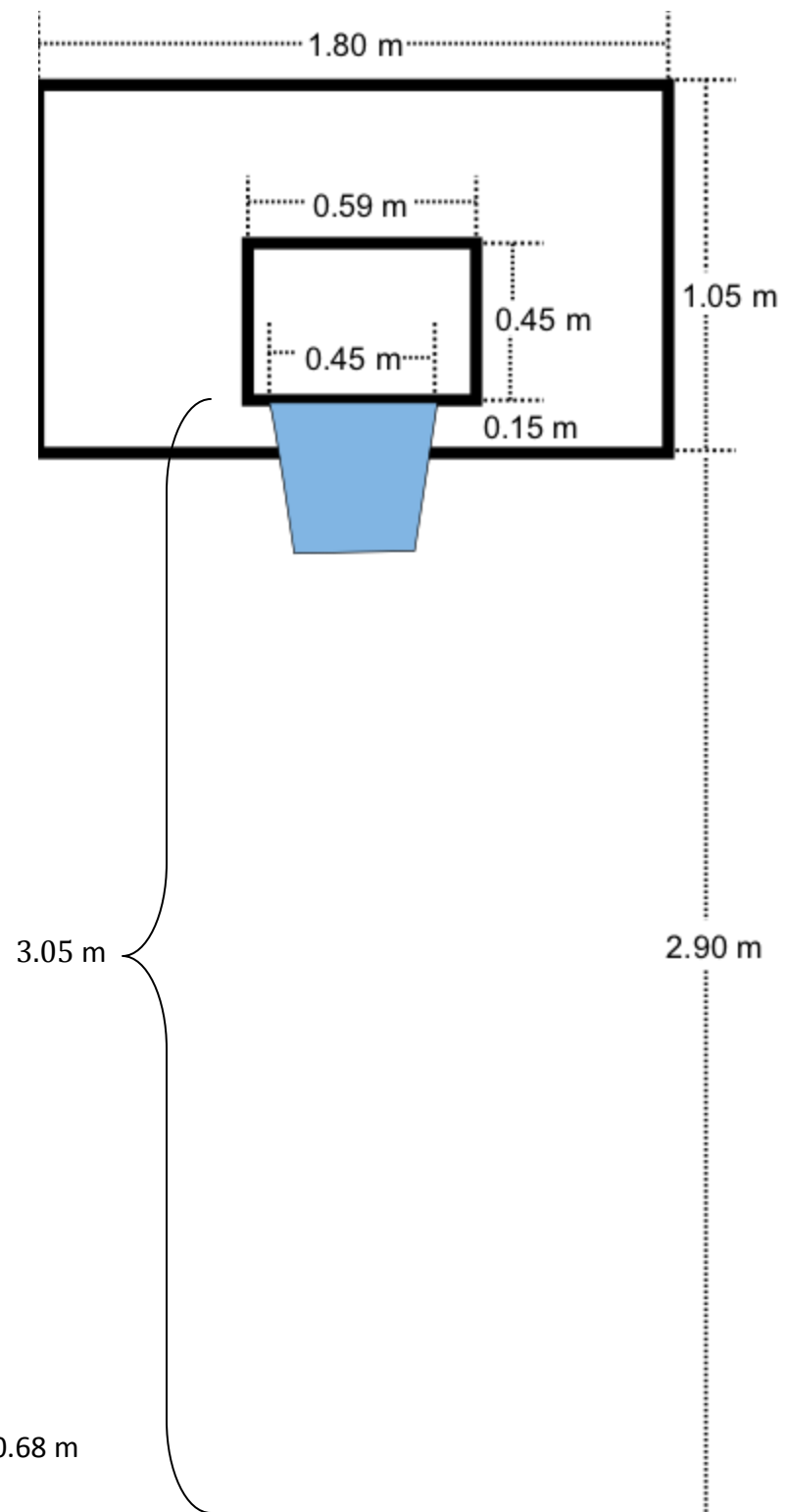
Scale

1 in. : 0.68 m

Unit 2
Lesson 9—Percents
Lesson Plan
(One Day)

I.   **CCSS:**
     HSA.CED.A.1 Create equations in one variable and use them to solve problems.
     HAS.REI.B.3 Solve linear equations in one variable.

II. **Learning Objective:**
     Learning Target 2.3: The learner can write and solve proportions involving
     percents.
     a. The learner can solve a percent problem using a proportion with 100% accuracy
         (when given a percent problem and a pay cut problem) by the end of the lesson.
     b. The learner can solve a percent problem using the percent equation with 100%
         accuracy (when given a percent problem and a pay cut problem) by the end of the
         lesson.

III. **Anticipatory Set:** Display Warm Up on the board. The Warm Up has students review
     what a percent of a number means. Students should try the problems individually for
     the first minute. If they need assistance after that, allow them to work with a partner.
     Ask students to share their responses/work on the board.

IV. **Objective/Purpose:** "Today, we will be working with percents. Many problems
     involving percents can be solved using proportions or the percent equation, which we
     will practice later on."

V.   **Input**

     a. **Task Analysis:**
         i.   Students complete Warm Up. Have students share answers/work. (5-8
              min)
         ii. State the objective and purpose for the lesson. (1 min)
         iii. Ask students to think about what 25% means. Students should discuss
              with a partner what they think. Have a partner pair share their thoughts. (2
              min)
         iv. Explain to students that a "percent" means parts per hundred. Therefore,
              25% means 25 for every 100, or 25 per 100. Write and explain the
              percent proportion ($\frac{a}{b} = \frac{p}{100}$) and percent equation ($a = p\% * b$) on the
              board. Solve problem 3 from the Warm Up using both methods. Also,
              remind students how to convert a percent to a decimal. Students should
              write it down in their notes. (10-15 min)

    v.   Introduce the *Pay Cut, Pay Raise* problem. Hand out the *Pay Cut, Pay Raise* worksheet. Have students fill out their "future job" title, employer's name, and annual salary. Explain the scenario, and give students the prompt. Students can discuss their thoughts with a partner. On the worksheet, students need to show their mathematical work to support their position. (10 min)

   vi.   After students have established a mathematical argument for their stance, they will write a letter to their future employer, defending their position. Show the writing prompt directions on the board. Students have the rest of the class period to write their letter. Students should finish writing their letter at home if they do not finish in class. (10-15 min)

  vii.   Summarize the lesson. (1 min)

b. **Thinking Levels**
      i.   Remembering/knowledge: Define percent.
     ii.   Applying/Application: Determine if a 20% raise undoes a 20% pay cut by solving a percent problem using a proportion or the percent equation.
   iii.   Evaluating/Synthesis: Support/defend whether giving a 20% raise after a 20% pay cut is fair.
   iv.   Creating/Evaluation: Write a letter to "future employer" explaining the mathematics behind the *Pay Cut, Pay Raise* problem to defend position.

c. **Learning Styles and/or Accommodations**
      i.   Learning Styles
         1.   Logical: Students must use what they know about percents to solve a real-world problem about a pay cut and pay raise situation.
         2.   Intrapersonal and interpersonal: Students have the option to share ideas with a partner on Warm Up and the *Pay Cut, Pay Raise* problem. Students work alone by writing their own letter and explaining the math behind the problem.
         3.   Existential: Students get to reflect on their futures—what professions/salaries they desire to pursue. They are able to make the problem personal for themselves.
     ii.   Extensions/Accommodations
         1.   For the visually impaired, use the magnification camera and monitor in order to magnify what is displayed on the projector and drawn on the whiteboard. Always repeat directions and solution steps several times.

2. Read directions/problems out loud to students. Have other students working in these students' groups read each question out loud and assist these students if they need help reading anything else.
3. To help students use the percent equation, explain that when they see "a is p percent of b" that "is" represents the equal sign and "of" represents multiplication.
4. For an extension, ask students to find the percent raise that would undo the original 20% pay cut.

    d. **Methods and Materials**
        i. Ways of presenting: Lecture/modeling, group discussion, problem-based learning.
        ii. Materials Needed: Whiteboard and markers, projector, Warm Up computer file, *Pay Cut, Pay Raise* worksheet, lined paper, magnification camera.

VI. **Modeling**
    a. Model how to solve the Warm Up problems using a proportion and the percent equation.

VII. **Checking for Understanding**
    a. Look at students work during the Anticipatory Set. Use this time to determine what students remember about percents, and what they have forgotten.
    b. As students work on the math portion of the *Pay Cut, Pay Raise* problem, check their work and thinking. Correct misconceptions by asking questions:
        i. What does a 20% pay cut of your made up salary mean?
        ii. What does a 20% raise mean?
        iii. In each case, what number are you taking 20% of?
        iv. Does this answer make sense?

VIII. **Guided Practice**
    a. This lesson, students will try to reason about percents on their own after seeing the modeling portion. Guided practice may need to take place for individual students who are struggling with the concept of a 20% pay cut or a 20% pay raise. Work through a related percent problem with students who are struggling.

IX. **Independent Practice**
    a. Students will explain their mathematical thinking in a letter independently. In the next lesson, students will have more opportunity for independent practice.

X.   **Closure:**
       a. Summarize what the students have done during the lesson.
           i. "Today, we have reviewed percents. In particular, we have solved percent problems using either proportions or the percent equation. Both methods work—from now on, you get the freedom to choose which you prefer. Tomorrow, we will continue working with percents—but we will be working more specifically with percent change and error."

XI.   **Assessment:**
       a. Students should be able to interpret a percent.
       b. Students should be able to solve a percent problem using a proportion.
       c. Students should be able to solve a percent problem using the percent equation.
       d. For the writing prompt, explain to students that the length of the letter is not what is important. Students simply need to write enough to make a convincing argument with evidence to back it up. Students should use proper grammar and spelling.
       e. Look at student work on the worksheet to determine if more practice using proportions or the percent equation to find a percent of a number is needed before moving on.

XII.   **Reflection:** Reflect on the lesson and make necessary changes.
       a. Are the students ready to move onto finding percent change and error?
       b. How were the engagement levels of the students throughout the lesson? Did this *Pay Cut, Pay Raise* problem interest them?
       c. Did allowing students to choose their job title, employer's name, and salary make the problem more meaningful to the students?
       d. Did the problem allow students to gain a better understanding of how to solve percent problems?

Warm Up

Please write the following answers down on your Warm Up worksheet.😊

1. What is 50% of 20?

2. What is 100% of 20?

3. What is 75% Of 20?

Pay Cut, Pay Raise Problem

Directions:

1. Put your name at the top of a piece of lined paper.
2. Imagine a profession that you think you might be a part of in your future. Write the following down on the top of your paper:
   a. Job title
   b. Employer's name
   c. Annual Salary

One day, your employer comes to you and says that, due to changes in the economy, you will receive a 20% pay cut. However, he then tells you that if the economy gets better, that he or she will give you a 20% raise.

Is this fair?

(Would a 20% pay raise make up for a 20% pay cut?)

Try working out the math on your piece of paper.

3. **Once you have come to a decision, write a letter to your future employer, explaining if this is a fair deal. Be sure to support your stance by providing the mathematics behind the problem.**
4.

Unit 2
Lesson 10—Percent Change
Lesson Plan
(One Day)

I. **CCSS:**
HSA.CED.A.1 Create equations in one variable and use them to solve problems.
HAS.REI.B.3 Solve linear equations in one variable.

II. **Learning Objective:**
Learning Target 2.3: The learner can write and solve proportions involving percents.
  c. The learner can find percent change 2 out of 2 times when given oil price data by the end of the lesson.

d. **Anticipatory Set:** Display the Getting Ready problem (pg. 144 of Algebra textbook) for the Warm Up. The students have already calculated percent change in the *Pay Cut, Pay Raise* problem; however, the idea has not yet been formalized. The Warm UP will remind them how to find **15**% off a price—and the idea will be formalized into percent change. After students have completed the Warm Up, at least two students should share their responses (record it on the board if necessary).

e. **Objective/Purpose:** "Today, we will be working with percent change. We will be looking at a current economic issue, gas prices, to explore percent increase and decrease. After today's lesson, we will be reviewing all of the Learning Objectives of Unit 2 so we will be prepared to take our Unit 2 summative assessment."

f. **Input**

   a. **Task Analysis:**
      i. Students complete Warm Up. Have students share answers/work. (5-8 min)
      ii. State the objective and purpose for the lesson. (1 min)
      iii. Have students reflect back on the *Pay Cut, Pay Raise* problem. Ask them if they think receiving a pay cut corresponds to a percent increase or decrease and why. Ask them if they thinking receiving a pay raise corresponds to a percent increase or decrease and why. (Students should complete "Think, Pair, Share" in order to answer these questions. (2 min)
      iv. Students will be adding percent change notes to their percent notes from the previous lesson. Define the percent change equation on the board (be sure to explain how to determine if a problem is dealing with

amount of increase or decrease.) Students should copy notes into notebooks. (5 min)

v. Model an example percent change problem on the board (Problem 2 on pg. 145 of Algebra textbook). Remind students that increasing a price of $295 by 15% does not mean the new price is 295 + 15. (5 min)

vi. Pair students up. Each partner pair will need a copy of the online USA Today news article "Why OPEC is fine with falling oil prices."

vii. Introduce news article to students. Put the news article into context for the students. (2 min)

viii. Students read article in partner pairs. They should highlight anytime they think they see a sentence involving math, and circle any percents they see. (10 min)

ix. After students have read the article, they should complete the *Calculating Percent Change* worksheet that goes along with the news story. Each partner needs the OPEC data chart as well. Students will be computing percent decrease using real oil prices. (10 min)

x. Summarize the news article activity. Do problem 4 on the worksheet as a class to make sure students understand how to calculate percent change. Ask a few students to share their predictions for gas prices. Summarize the lesson. (5-8 min)

xi. Students may begin on homework if there is time left in class. For homework, students will write their own percent change problem and solve it, making sure to show all work.

b. **Thinking Levels**

i. Understanding/Comprehension: Identify mathematical concepts within a news article.

ii. Applying/Application: Solve a percent change equation in order to find the percent decrease in oil prices from 2013 to 2014.

iii. Evaluating/Synthesis: Predict what will happen to gas prices in the next few months and justify your prediction using facts from the news article.

c. **Learning Styles and/or Accommodations**

i. Learning Styles

1. Interpersonal: Students work with a partner to discuss article and answer the questions on the worksheet.

2. Naturalist: Students make a connection between an environmental issue (supply of oil and fracking) with oil prices and mathematics.

    ii. Extensions/Accommodations
        1. For students with lower literacy levels, pair them with a more advanced reader so the pair can work together to read and interpret the news article.
        2. In order to put the article into perspective for students who are not familiar with oil and its impact on the US economy, explain US dependence on other parts of the world for oil supply and how the economic principle of supply and demand plays a factor.
        3. Make up a song/jingle in order to help students recall the percent change equation.
        4. For an extension, ask students to search for a current news article that contains a percent change problem.

d. **Methods and Materials**
    i. Ways of presenting: Lecture/modeling, Think Pair Share, partner work, whole group discussion, individual practice on homework
    ii. Materials Needed: Whiteboard and markers, projector, Warm Up "Get Ready" textbook problem, *Calculating Percent Change* worksheet, printed news articles, printed data tables.

g. **Modeling**
a. Explain to students how to set up the percent change equation. "Think out loud" when solving Problem 2 from the textbook during the note-taking portion of the lesson. Be explicit when telling students what numbers get plugged in for certain parts of the percent change equation.

h. **Checking for Understanding**
a. Use Think, Pair, Share responses to determine if percent increase/decrease needs to be further explained.
b. Ask clarifying questions during note-taking portion and call randomly on students to answer these questions.
    i. How do we find the amount of increase/decrease?
    ii. If the new amount is larger than the original amount, does that mean it's a percent increase or decrease problem?
    iii. If the new amount is smaller than the original amount, does that mean it's a percent increase or decrease problem?

i. **Guided Practice**
   a. Some student pairs may need to be guided through problem 4 of the worksheet. The students have already seen how to solve a percent change equation—however some will be ready to solve their own while other groups may need a little more assistance. During partner work, guide those students who are struggling.

j. **Independent Practice**
   a. Students will complete the homework problem individually at the end of class and/or at home. They will be required to apply what they learned during class in order to write and solve their own problem involving percent change. They will need to write out all the steps necessary to solve their problem. Collect the homework the next day.

k. **Closure:**
   a. Summarize what the students have done during the lesson.
      i. "Today, we have seen a percent change problem in real-life by examining oil and gas prices during the month of October. We have used our knowledge about percents and put it to use in order to calculate the percent decrease of gas prices. Tomorrow, we will be putting together all that we have learned during this unit in order to review for our summative assessment."

l. **Assessment:**
   a. Students should be able to state whether a percent change problem will result in percent increase or decrease.
   b. Students should be able to recall the percent change equation, identify the amount of increase/decrease and the original amount, and solve the equation.
   c. Use the homework to assess student learning of the learning targets.
   d. Collect *Calculating Percent Change* worksheets if further assessment is needed to determine if reteaching is necessary.

m. **Reflection:** Reflect on the lesson and make necessary changes.
   a. Have the students mastered setting up a percent change equation and solving it?
   b. Were students able to comprehend the main ideas of the article? Was the reading level appropriate?

c. Did students find the article interesting? Were they able to make the connection between changes in gas prices to what is going on environmentally?

d. Did pairing students up seem to help further students' understanding (would individual work on the activity have been more successful)?

e. Are students ready to move on to the last lesson of the unit?

Resources:

Regan, T. (2014, November 2). Why OPEC is fine with Falling Oil Prices. In *USA Today*. Retrieved November 2, 2014

OPEC Basket Price (2014). In *Organization of the Petroleum Exporting Countries*. Retrieved November 2, 2014

Calculating Percent Change:
Why OPEC is Fine with Falling Oil Prices news article

Directions: Read the news article, *Why OPEC is Fine with Falling Oil Prices*. With a partner, highlight or underline the sentences that you feel relates to mathematics. Also, circle any percentages you may find in the article.

After you have read the article, complete the questions below with your partner.

1. In a short paragraph, summarize the news article—think about the Who, What, When, and Where.

2. Write down a few of the sentence you highlighted below and explain why they contain math.

3. In the second paragraph of the article, Trish Regan writes, "Despite increasing tensions in the Middle East, the nationwide average for a gallon of gas stands below $3 for the first time in four years — a roughly 20% drop from June levels." Does this 20% drop in gas prices represent a percent increase or decrease? (**Be sure to explain your thinking.)**

4. Look at the data on OPEC's prices for oil. The price of a barrel on October 1, 2013 was $105.42. How much was the price of a barrel exactly one year later? Using these prices, calculate the percent decrease of the price of oil from October 1, 2013 to October 1, 2014. Show all work.

5. Choose two more prices (one from 2013 and one from 2014) and use these to calculate the percent change. Show all work.

6. After reading the article, what do you think will happen to gas prices over the next few months? Do you think they will increase, decrease, or stay the same? Explain why you think so using information from the article.

OPEC barrel prices (October 2013 and October 2014 data)

Date	Value	Date	Value
		October 2014 Prices	
October 2013 Prices			
10/1/2013	105.42	10/1/2014	92.19
10/2/2013	106.08	10/2/2014	90.4
10/3/2013	106.79	10/3/2014	90.33
10/4/2013	106.94	10/6/2014	90.4
10/7/2013	106.45	10/7/2014	89.37
10/8/2013	107.36	10/8/2014	88.32
10/9/2013	106.94	10/9/2014	88.27
10/10/2013	107.69	10/10/2014	86.43
10/11/2013	108.15	10/13/2014	85.93
10/14/2013	108	10/14/2014	85.14
10/15/2013	107.64	10/15/2014	81.89
10/16/2013	107.19	10/16/2014	81.17
10/17/2013	107.02	10/17/2014	83.19
10/18/2013	106.54	10/20/2014	82.37
10/21/2013	106.76	10/21/2014	82.09
10/22/2013	106.77	10/22/2014	81.94
10/23/2013	106.34	10/23/2014	81.67
10/24/2013	105.57	10/24/2014	82.48
10/25/2013	104.97	10/27/2014	82.37
10/28/2013	105.75	10/28/2014	82.44
10/29/2013	106.36	10/29/2014	83.24
10/30/2013	106.31	10/30/2014	82.79
10/31/2013	106.75		

Data from:

2014 Organization of the Petroleum Exporting Countries, http://www.opec.org/opec_web/en/data_graphs/40.htm.

Unit 2
Lesson 11—Culminating Review Lesson
Lesson Plan
(One Day)

I. **CCSS:**
    HSA.CED.A.1 Create equations in one variable and use them to solve problems.
    HSA.CED.A.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
    HSA.REI.A.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
    HAS.REI.B.3 Solve linear equations in one variable.
    HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems.
    HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

II. **Learning Objective:** The learner will create a literary piece or other genre (story, brochure, comic strip, how-to/instruction manual, news article, song lyrics etc.) that encompasses the unit 2 learning targets.

    Learning Target 2.1: I can create and solve (linear) equations and use them to solve problems.

    a. I can solve one-step equations in one variable.
    b. I can solve two-step equations in one variable.
    c. I can create equations in one variable.
    d. I can solve multi-step equations in one variable.
    e. I can solve equations with variables on both sides.
    f. I can identify equations that are identities or have no solution.
    g. I can rewrite and use equations in two or more variables.

    Learning Target 2.2: I can write and solve proportions to solve problems.

    a. I can find ratios and rates.
    b. I can convert units and rates.
    c. I can solve proportions using the Multiplication Property or the Cross Products Property.
    d. I can use similar figures to find unknown lengths.

    Learning Target 2.3: I can write and solve problems involving percents.

    a. I can solve a percent problem using a proportion.

b. I can solve a percent problem using the percent equation.
c. I can find percent change.

III. **Anticipatory Set:** For the Warm Up, students will individually complete the Self Assessment 1. Students rate themselves on how they feel they meet that particular objective. (See Unit Plan—Lesson 11 Self Assessment 1.)

IV. **Objective/Purpose:** "Today, we will be reviewing the learning targets of Unit 2 in order to prepare for the summative assessment. Each one of you will be creating your own literary genre (which will be explained soon) in order to help review these concepts."

V. **Input**

a. **Task Analysis:**
   i. Students complete Warm Up. Have students share answers/work. (5 min)
   ii. State the objective and purpose for the lesson. (1 min)
   iii. Explain the directions for the Literary Genre Review Activity. Each student will be responsible for his or her own work. (See *Literary Genre Review Activity.*) (5 min)
   iv. Students complete the activity by creating their own literary genre. (20-25 min)
   v. After students have completed their literary genre, each student should display his or her work on his or her desk. Students will then walk around the room, examining their peers' work and looking in depth at two other students' work. (8-10 min)
   vi. Students complete Self Assessment 2 in order to re-rate themselves on those learning objective they felt they struggled with the most. (5 min)
   vii. Summarize lesson. Remind students to study those learning targets listed by reviewing notes and reworking past homework problems in order to prepare for the summative assessment (1 min).

b. **Thinking Levels**
   i. Remembering/Knowledge: Recall key definitions and equations.
   ii. Creating: Create your own literary genre that incorporates Unit 2 learning targets (there must be problems and solutions to those problems in the literary genre).

c. **Learning Styles and/or Accommodations**
    i. Learning Styles
        1. Intrapersonal: Students self-assess themselves. Students work alone to create their own literary genre.
        2. Musical: Students have the option to create their own song and song lyrics that reviews the learning targets.
        3. Verbal/Linguistic: Students have the opportunity to write a story, play, article, etc. in order to display their knowledge of the learning targets.
        4. Visual: Students have the option to create a comic strip, picture book, etc. in order to display their knowledge of the learning targets.
    ii. Extensions/Accommodations
        1. For students with learning disabilities, allow them two choose their four lowest-rated learning targets in order to help them complete the activity in the proper amount of time.
        2. If it appears students need more time to complete their genres satisfactorily, continue this lesson into the next day, allowing more time and thought to be put into the review activity.
        3. For students who finish early, have them assist other students who may be struggling with incorporating a particular LT into his or her own genre.
        4. For an extension to the lesson, students could trade genres and identify all seven (or more) LT's they notice. Students could then give feedback to their partner, sharing what they like about the genre and/or offer any suggestions on how to further present mastery of a particular LT within the piece.
d. **Methods and Materials**
    i. Ways of presenting: Individual work, "Round Robin" type activity where students move around to each other's desks to examine the different genres.
    ii. Materials Needed: Paper (printer and lines), construction paper, colored pencils/crayons/markers/glue, *Literary Genre Review Activity* instructions, lists of learning targets.

VI. **Modeling**
a. N/A

VII. **Checking for Understanding**

a. As students work on their genres, circle the room making sure students understand the directions. Assist students if they are struggling with determining how to include a particular LT.

VIII. **Guided Practice**
   a. N/A

IX. **Independent Practice**
   a. Students complete activity alone—every student will have his or her own genre. Each student completes both self-assessments indivually.

X. **Closure:**
   a. Summarize what the students have done during the lesson.
      i. "Today, we have reviewed the learning targets of Unit 2. You have created a literary genre that shows examples of at least seven of these targets. You will have a summative assessment tomorrow in order to show what you have learned this unit. Make sure you study tonight in order to better prepare yourselves. I know you will all do great!"

XI. **Assessment:**
   a. Students should be able to explain why their genres incorporate a particular learning target if asked.
   b. Students use the self assessments to gauge what targets they need to work on the most before the summative assessment.

XII. **Reflection:** Reflect on the lesson and make necessary changes.
   a. Were students able to use the self assessments effectively in order to know what LT's to focus on during the activity?
   b. Did students seem to enjoy the freedom of choosing their own genre to create?
   c. How were student engagement levels throughout the activity and during the Round Robin portion of the lesson?
   d. Are students ready to take the summative assessment? During student work time, were students making progress on the LT's they self-assessed lowest on?

Self Assessment 1

Directions: For each Learning Target, **please circle the face that represents how well you feel you have mastered that particular objective**. For example, if you feel that you sort of know how to solve a one-step equation (LT.2.1a), you would circle the face in the middle.

<u>Station 1</u>:

Learning Goal 2.1: I can create and solve (linear) equations and use them to solve problems.

LT.2.1a: I can solve one-step equations in one variable.

LT.2.1b: I can solve two-step equations in one variable.

LT.2.1c: I can create equations in one variable.

LT.2.1d: I can solve multi-step equations in one variable.

LT.2.1e: I can solve equations with variables on both sides.

LT.2.1f: I can identify equations that are identities or have no solution.

LT.2.1g: I can rewrite and use equations in two or more variables.

Learning Goal 2.2: I can write and solve proportions to solve problems.

LT.2.2a: I can find ratios and rates.

LT.2.2b: I can convert units and rates.

LT.2.2c: I can solve proportions using the Multiplication Property or the Cross Products Property**.**

LT.2.2d: I can use similar figures to find unknown lengths.

Learning Goal 2.3: I can write and solve problems involving percents.

LT.2.3a: I can solve a percent problem using a proportion.

LT.2.3b: I can solve a percent problem using the percent equation.

LT.2.2c: I can find percent change.

Literary Genre Review Activity

We are at an end to our Unit on Solving Equations! However, before we take our summative assessment and move on to the next unit, we need to review what we have learned during this unit. For this activity, you will be creating your own literary genre. The next page is a list of possible genres you could create.

Directions: You received a paper that lists all of Unit 2's Learning Goals and their corresponding Learning Targets. In your genre that you create, you must incorporate all three of Unit 2's Learning Goals (2.1, 2.2, and 2.3).

Look at your Self-assessment Part 1. From the Learning Targets, you must choose at least three you rated the lowest from 2.1, at least two you rated the lowest from 2.2, and at least one you rated the lowest from 2.3 and include them in your genre.

That means you will incorporate at least <u>seven</u> Learning Targets in your genre. <u>You may create more than one genre if you are struggling to fit all seven targets into the first genre.</u>

What it means to incorporate a Learning Target:

In order to incorporate a Learning Target into your genre, **<u>you must present an example of that learning target being used/displayed within the genre</u>**. This could be creating a problem and solution to that problem and tying it into your genre.

For example, let's say I was creating a news article about a hurricane that struck the United States east coast. If I wanted to display LT 2.2b in my article, I could write a problem within the article that converts the hurricane's wind speed of 74 mph into kilometers per hour.

How this Activity is Graded: This activity is worth seven points—one point for each Learning Target that is included in your genre. This assignment is not worth very much because its purpose is to formatively assess your learning in order to help prepare for the summative assessment.

Examples of possible genres:

- Personal Letter
- Classified or Personal Ads
- Poetry
- Song Lyrics
- Autobiographical Essay
- Dialogue of a Conversation among Two or More People
- Short Story
- Adventure Magazine Story
- Ghost Story
- Myth, Tall Tale, or Fairy Tale
- Talk Show Interview or Panel
- Comedy Routine or Parody
- Picture book
- Chart or Diagram with Explanation and Analysis
- Brochure or Newsletter
- Magazine or TV Advertisement or Infomercial
- Travel Brochure Description
- How-To or Directions Booklet
- Local News Report
- Comic Strip or Graphic Novel excerpt
- Newspaper or Magazine Article
- News Program Story or Announcement

Self Assessment 2

Directions: For each Learning Target, **please circle the face that represents how well you feel you have mastered that particular objective**. For example, if you feel that you sort of know how to solve a one-step equation (LT.2.1a), you would circle the face in the middle.

<u>Station 1</u>:

Learning Goal 2.1: I can create and solve (linear) equations and use them to solve problems.

LT.2.1a: I can solve one-step equations in one variable.

LT.2.1b: I can solve two-step equations in one variable.

LT.2.1c: I can create equations in one variable.

LT.2.1d: I can solve multi-step equations in one variable.

LT.2.1e: I can solve equations with variables on both sides.

LT.2.1f: I can identify equations that are identities or have no solution.

LT.2.1g: I can rewrite and use equations in two or more variables.

Learning Goal 2.2: I can write and solve proportions to solve problems.

LT.2.2a: I can find ratios and rates.

LT.2.2b: I can convert units and rates.

LT.2.2c: I can solve proportions using the Multiplication Property or the Cross Products Property**.**

LT.2.2d: I can use similar figures to find unknown lengths.

Learning Goal 2.3: I can write and solve problems involving percents.

LT.2.3a: I can solve a percent problem using a proportion.

LT.2.3b: I can solve a percent problem using the percent equation.

LT.2.2c: I can find percent change.

Assessments

Formative: Pre-assessment

Summative: Chapter 2 Common Assessment

(Pre-assessment should be given before lesson 1. Common Assessment should be given after lesson 11.)

Algebra Chapter 2 Pretest

Directions: This is a formative assessment. The purpose of this pre-test is to determine your mastery level of the learning targets before we begin Unit 2. It is okay if you do not know the answers to these problems--just do your best. Please show your work.

Multiple Choice
Identify the choice that best completes the statement or answers the question.

         LT 2.1a: I can solve one-step equations in one variable.

         What is the solution of the equation?

____ 1. $3 = b + 3$
        a. 0   c. 9
        b. 1   d. 6

         LT 2.1b: I can solve two-step equations in one variable.

         What is the solution of the equation?

____ 2. $16 = -d + 6$
        a. 10   b. −10   c. −9   d. −15

____ 3. **LT 2.1c: I can create equations in one variable.**

        Steven wants to buy a $565 bicycle. Steven has no money saved, but will be able to deposit $30 into a savings account when he receives his paycheck each Friday. However, before Steven can buy the bike, he must give his sister $65 that he owes her. For how many weeks will Steven need to deposit money into his savings account before he can pay back his sister and buy the bike?
        a. 25 weeks   b. 19 weeks   c. 22 weeks   d. 21 weeks

         LT 2.1d: I can solve multi-step equations in one variable.

         What is the solution of the equation?

____ 4. $2 = 6p - 8 - 5p$
        a. −10   b. −6   c. 2   d. 10

LT 2.1e: I can solve equations with variables on both sides.

What is the solution of the equation?

5. $6x - 3 = 5x - 5$
   - a. -4
   - b. -2
   - c. 0
   - d. -1

LT 2.1f: I can identify equations that are identities or have no solution.

What is the solution of each equation?

6. $2(h - 8) - h = h - 16$
   - a. 8
   - b. -8
   - c. infinitely many solutions
   - d. no solution

7. **LT 2.1g: I can rewrite and use equations in two or more variables.**

   What equation do you get when you solve $z - m = z + bx$ for x?
   - a. $x = -\dfrac{2z + m}{b}$
   - c. $x = -\dfrac{m}{b}$
   - b. $x = -\dfrac{b}{m}$
   - d. $x = \dfrac{2z - m}{b}$

8. **LT 2.2a: I can find ratios and rates.**

   At an automobile factory, 1849 parts are made in 4 hours. What is the average rate at which parts are made per hour?
   - a. 491 parts/h
   - b. 426 parts/h
   - c. 511 parts/h
   - d. 462 parts/h

9. **LT 2.2b: I can convert units and rates.**

   A car is driving at a speed of 45 mi/h. What is the speed of the car in feet per minute?
   - a. 3,960 ft/min
   - b. 1,935 ft/min
   - c. 237,600 ft/min
   - d. 2,700 ft/min

LT 2.2c: I can solve proportions using the Multiplication Property or the Cross Products Property.

What is the solution of the proportion?

_____ 10. $\dfrac{14}{12} = \dfrac{d}{48}$

     a.   56   c.   168
     b.   672   d.   576

LT 2.2d: I can use similar figures to find unknown lengths.

In the diagram, the figures are similar. What is x?

_____ 11.

Drawing not to scale

     a.   18 cm   b.   11.9 cm   c.   14.1 cm   d.   5.8 cm

_____ 12. **LT 2.3a: I can solve a percent problem using proportions.**
LT 2.3b: I can solve a percent problem using the percent equation.

What percent of 100 is 30?
     a.   30%   c.   3.33%
     b.   333%   d.   0.3%

_____ 13. **LT 2.3c: I can find percent change.**

The circulation of a newsletter decreased from 5200 to 3140. Find the percent of decrease in circulation to the nearest percent.
     a.   66%   b.   40%   c.   166%   d.   6%

Algebra 1 Chapter 2 Common Assessment

Directions: It's time to show what you know about solving equations! Please show all of your work for each problem. Good luck!

For problems 1-8 below, solve the equation. Check your solution.

1. $w - 2 = -3$

2. $\frac{6}{7}x - 8 = 7$

3. $\frac{b + 6}{5} = 10$

4. $5d - d - 2d + 8 - 3d = 0$

5. $3(y - 5) + 2 = 5$

6. $2.4x + 2.6 = 17$

7. $-4x - 9 = -5 - 6x$

8. $-6p + 7 = 3(2p - 3) - 4(-10 + 4p)$

9. What equation do you get when you solve $z - m = z + bx$ for x?

10. What is the radius of a circle with circumference 17 mm? Round to the nearest tenth. Use 3.14 for π.

11. You are driving to visit a friend in another state who lives 440 miles away. You are driving 55 miles per hour and have already driven 275 miles. Write and solve an equation to find how much longer in hours you must drive to reach your destination.
   Define your variable:

   Equation:

   Solution:

12. John and 2 friends are going out for pizza for lunch. They split one pizza and 3 large drinks. The pizza cost $12.00. After using a $5.00 gift certificate, they spend a total of $11.35. Write an equation to model this situation, and find the cost of one large drink.

   Define your variable:

   Equation:

   Solution & check:

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

_____ 13. Which equation is an identity?
   a. $11 - (2v + 3) = -2v - 8$ c. $7m - 2 = 8m + 4 - m$
   b. $5w + 8 - w = 6w - 2(w - 4)$ d. $8y + 9 = 8y - 3$

_____ 14. Which equation has no solution?
   a. $8 - (5v + 3) = 5v - 5$ c. $3w + 4 - w = 5w - 2(w - 2)$

   b. $3m - 6 = 5m + 7 - m$ d. $7y + 9 = 7y - 6$

2

_____ 15. Find the number of parts manufactured per hour if 1630 parts are made in 6 hours. Round to the nearest integer.

   a.   325 parts/h   b.   272 parts/h   c.   237 parts/h   d.   291 parts/h

_____ 16. A van travels 220 miles on 10 gallons of gas. Write and solve a proportion to find how many gallons the van needs to travel 550 miles.

   a. $\dfrac{220}{10} = \dfrac{550}{g}$; 31 gallons of gas   c. $\dfrac{10}{220} = \dfrac{550}{g}$; 115 gallons of gas

   b. $\dfrac{10}{220} = \dfrac{550}{g}$; 121 gallons of gas   d. $\dfrac{220}{10} = \dfrac{550}{g}$; 25 gallons of gas

_____ 17. A package delivery company has determined that they can meet their schedules if they have 4 drivers for every 30 square miles of area they cover. If they want to offer service to a county of 75 square miles, how many drivers must they have?

Show work by setting up a proportion here:

   a.   12 drivers   b.   10 drivers   c.   15 drivers   d.   9 drivers

_____ 18. School guidelines require that there must be at least 2 chaperones for every 25 students going on a school trip. How many chaperones must there be for 80 students?
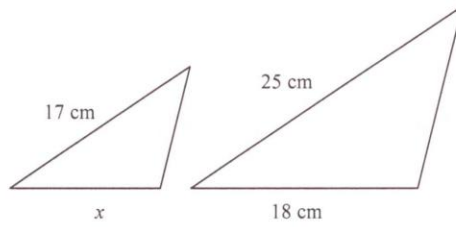
Show work by setting up a proportion here:

   a.   6 chaperones   c.   3 chaperones
   b.   40 chaperones   d.   7 chaperones

3

_____ 19.
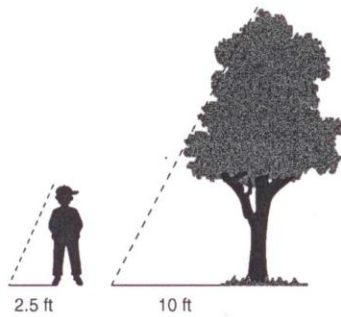

17 cm   25 cm

x   18 cm

Drawing not to scale

a.   12.2 cm   b.   19.1 cm   c.   26.5 cm   d.   26 cm

_____ 20.   A tree casts a shadow 10 ft long. A boy standing next to the tree casts a shadow 2.5 ft. long. The triangle
shown for the tree and its shadow is similar to the triangle shown for the boy and his shadow. If the boy is 5
ft. tall, how tall is the tree?

2.5 ft   10 ft

Drawing not to scale

Show work by setting up a proportion here:

a.   18 ft   b.   12.5 ft   c.   15 ft   d.   20 ft

_____ 21.   What percent of 100 is 30?
a.   30%   c.   3.33%
b.   333%   d.   0.3%

4

_____ 22. A dress that normally costs $69.50 is on sale for 45% off. What is the sale price of the dress?
   a. $38.23   c. $24.50
   b. $31.28   d. $1.54

_____ 23. The viewership of a television show has decreased from 5.1 million viewers to 3.5 million viewers per episode. Find the percent of decrease in viewership to the nearest percent.
   a. 7%   b. 146%   c. 46%   d. 31%

_____ 24. A map has a scale of 1 cm : 20 km. Two cities are 2.5 cm apart on the map. To the nearest tenth of a kilometer, what is the actual distance corresponding to the map distance?

   Show work by setting up a proportion here:

   a. 52.5 km   b. 50 km   c. 150 km   d. 70 km

Reflections/Evaluations

Student Evaluation:

       Part 1—Content Evaluation

       Part 2—Teacher Evaluation

Teacher Evaluation:

       Lesson Reflection Form

       Overall Reflection of the Unit

Student Evaluation of Unit 2

Part 1: Unit Content Evaluation

<u>Directions:</u> For Part 1 of the Student Evaluation, you will answer each question below to the best of your ability. The learning target that corresponds to that question will be listed before the question in parentheses. After you have solved the problem, circle the number that corresponds to how much you agree with the statement.

1. (Learning Target 2.1a: I can solve one-step equations in one variable).

   Solve for x.
   $$3 + x = 10$$

I have mastered LT 2.1a.				
Strongly Disagree				Strongly Agree
1	2	3	4	5

2. (Learning Target 2.1b: The learner can solve two-step equations in one variable).

   Solve for x.
   $$4x + 6 = 40$$

I have mastered LT 2.1b.				
Strongly Disagree				Strongly Agree
1	2	3	4	5

3. (Learning Target 2.1c: The learner can create equations in one variable).

   Olga bought a new smart phone. She paid $500 for the phone and then pays $50 every month in order to use the phone. Write an equation that represents the total cost, C, Olga paid for her phone for x months.

<div style="border:1px solid black; padding:10px;">

I have mastered LT 2.1c.

Strongly Disagree				Strongly Agree
1	2	3	4	5

</div>

4. (Learning Target 2.1d: The learner can solve multi-step equations in one variable).

   Solve for x.

   $$4(x + 2) - 6 = 24$$

<div style="border:1px solid black; padding:10px;">

I have mastered LT 2.1d.

Strongly Disagree				Strongly Agree
1	2	3	4	5

</div>

5. (Learning Target 2.1e: The learner can solve equations with variables on both sides.)

   Solve for x.
   $$3x + 11 = -5 + 36$$

I have mastered LT 2.1e.				
Strongly Disagree				Strongly Agree
1	2	3	4	5

6. (Learning Target 2.1f: The learner can identify equations that are identities or have no solution.)

   Solve the equation for x. Then tell whether the equation is an identity or has no solution.

   $$5(x - 10) = 3x - 10 + 2x - 40$$

I have mastered LT 2.1f.				
Strongly Disagree				Strongly Agree
1	2	3	4	5

7. (Learning Target 2.1g: The learner can rewrite and use equations in two or more variables.)

Solve for t.
$$I = Prt$$

<div style="border:1px solid black; text-align:center;">

I have mastered LT 2.1g.

Strongly Disagree   Strongly Agree

1   2   3   4   5

</div>

8. (Learning Target 2.2a: The learner can find ratios and rates.)

A car drives 60 miles in 1.5 hours. Write this as a rate, and then simply the rate into simplest terms (into a unit rate).

<div style="border:1px solid black; text-align:center;">

I have mastered LT 2.2a.

Strongly Disagree   Strongly Agree

1   2   3   4   5

</div>

9. (Learning Target 2.2b: The learner can convert units and rates.)

Convert 14000 mL into L.

<div style="border:1px solid black; text-align:center;">

I have mastered LT 2.2b.

Strongly Disagree   Strongly Agree

1   2   3   4   5

</div>

10. (Learning Target 2.2c: The learner can solve proportions using the Multiplication Property or the Cross Products Property.)
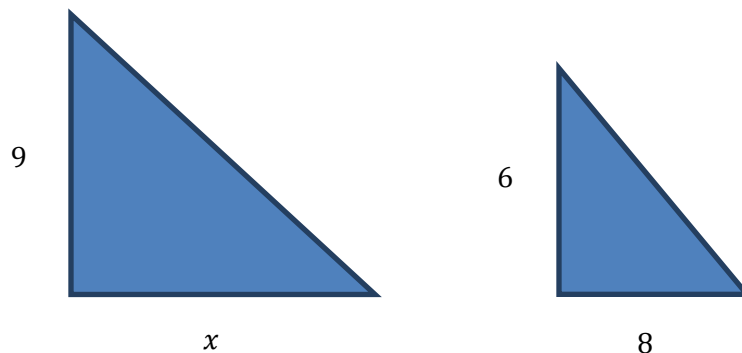
Solve the proportion for x.

$$\frac{11}{60} = \frac{55}{x}$$

I have mastered LT 2.2c.				
Strongly Disagree				Strongly Agree
1	2	3	4	5

11. (Learning Target 2.2d: The learner can use similar figures to find unknown lengths.)

Assume the two triangles are similar. Find x.

9

x

6

8

I have mastered LT 2.2d.				
Strongly Disagree				Strongly Agree
1	2	3	4	5

12. (Learning Target 2.3a: I can solve a percent problem using a proportion.)
    (Learning Target 2.3b: I can solve a percent problem using the percent equation.)

    14 is what percent of 68?

I have mastered LT 2.3a and b.				
Strongly Disagree				Strongly Agree
1	2	3	4	5

13. (Learning Target 2.3c: I can find percent change.)

    The original price of a pair of shoes was $35. They are now on sale for $22. What is the percent decrease in price?

I have mastered LT 2.3c.				
Strongly Disagree				Strongly Agree
1	2	3	4	5

Part 2: Teacher Evaluation

<u>Directions:</u> Please answer the following questions honestly. Do not put your name on this paper so the responses can stay anonymous.

1. What was did you enjoy most about this unit on solving equations?

2. What did you enjoy least about his unit on solving equations?

3. What were some of the things Miss Kolbe did well to help you learn and master the learning targets?

4. What could Miss Kolbe have done better to help you learn and master the learning targets?

5. Do you have any more questions/comments/advice for Miss Kolbe?

Reflection/Evaluate of Lesson _____

1. Reflections specific to the lesson (see reflection section for each lesson plan to see reflection questions to answer).

2. What was successful? How did I help students learn? Was the lesson's objective met?

3. What have I learned? Were the students engaged? How was my timing?

Overall Reflection of Unit

Overall, I feel this unit went very well. I feel the learning goals and learning targets were met by the majority of the students (a few students still struggle with one or two targets). Going into the unit, several students were familiar with ratios, proportions, and percents. However, I decided to spend more time on these targets because the students needed to review the major concepts of these targets before moving onto the next unit.

In regards to lesson 1, I felt that the manipulatives helped students gain a better understanding of equality, it kept students engaged, and it assisted those students who prefer hands-on learning. After teaching lesson 1, I knew students were ready to move onto solving equations after evaluating the exit tickets.

Lessons 2, 3, and 4 progressed very similarly to lesson 1. I had to take one extra day than I had planned to review solving multi-step equations and equations with variables on both sides. After teaching these lessons, I revised lesson 4 and added the "Steps for Solving Linear Equations" student guide because I thought it would help break down the steps for students in order to help them remember how to solve equations.

Lesson 5 was more challenging for students than I had expected. I assumed they would be able to transfer the steps they learned for solving equations with one variable to equations with two or more variables. The equations with more than one variable were a little daunting to my students. Thus, the results on the post-assessment piece showed me that they were not ready to move on to ratios. Because of this, I had to take an extra day to break down the steps for solving literal equations. However, the activity where they measured cylinders and solved for variables kept the students engaged the entire lesson.

Lesson 6 (on ratios and unit conversions) was more review than new material for the students. In seventh grade, they learn about ratios and canceling units. However, as we worked through the lesson, many students needed the review because they had forgotten how to convert units and rates. The students turned in the lesson checks (pg. 61) on the student companion, and their responses indicated that they were ready to move onto solving proportions.

The students were very engaged during lesson 7. I presented the sugar packets video, and immediately, the students were discussing the problems amongst their group members. I think the problem was engaging because it related to students' lives, and determining how much sugar was in a 20 oz. bottle of pop was an interesting problem for them to solve. At first, students did not set up proportions to solve this problem so I had to direct them to using that particular method. Once we solved the problem using a proportion, and I defined cross multiplication, students successfully solve their own proportion problems. I would use this lesson again, however, before I set students to solve the sugar packets problem, I would ask them to use more than one method—which would hopefully get them to use a proportion.

Showing the Alice in Wonderland video and presenting the Alice diagram during lesson 8 helped my students see how to compare lengths and set up proportions to solve for an unknown length. When I gave them the basketball hoop diagram to begin working on, I hadn't planned for so many students being confused on how to start. Many simply wanted to multiply by the scale factor (which was a correct method) but I had to emphasize that I wanted them to practice solving proportions. By observing students as they worked in their groups on the basketball hoops diagrams, I decided to spend another day on similar figures because I knew the majority needed more practice mastering that learning target. That extra day of working on the basketball hoop problem and more problems from the textbook really helped students progress in their

understanding of using similar figures to solve proportions. If I were to do this lesson again, I would do more guided practice examples before assigning the basketball hoop diagram.

I believe that my student engagement levels had never been higher than when I gave them the *Pay Cut, Pay Raise* problem during lesson 9. When I presented the problem, students got very excited discussing with their peers possible careers and salaries they were thinking of pursing in their futures. They had fun making up employers' names and salaries. Every student was able to find how much they would make after the pay cut. It took a little more direct instruction from me before they could find how much they would make after the pay raise. I had expected them to make a fuss when they learned they would have to write a letter to their future employer explaining the mathematics behind the problem. However, this was not the case at all. I think because they were so engaged with the problem, they didn't mind the writing portion. After the lesson, I knew students understood percents, and from the success on the *Pay Cut, Pay Raise* problem, they were ready to move on to percent change.

I was a little nervous for lesson 10 because I wasn't sure how well the students would comprehend the article. Yet, after I gave the background on the article, the students worked through the activity fairly well. Most student pairs were able to identity percents/math in the article. Because problems 3 and 4 on the worksheet guide students to find the percent decrease in oil prices, they were able to use the data table to find their own percent decrease on problem 5. The article sparked some students' interests because as they worked, a few partner pairs were discussing why they thought gas prices were lower this year compared to last year and what they thought might happen in the future to gas prices. After completing this worksheet, some students began the homework. By seeing students' work, I knew most had mastered finding the percent change.

Before moving onto the last, culminating lesson, I decided to take one more day for students to work on review problems that covered solving equations, unit conversions, proportions, and percents. This way, they would be better prepared to determine which learning targets they needed most work on for lesson 11.

Finally, lesson 11 took more time than I had anticipated. Some students wanted to spend more than 20-25 minutes on their literary genres. Thus, I gave them more time to work, and we cut out the Round Robin portion where students looked at each other's work. If I were to do this lesson again, I would spend two days on it—one for students to work on their genre, and one for students to see their peer's work and re-assess their mastery of the learning targets. However, I think this lesson was a good review for my students before they took the final summative assessment. My students had the opportunity to work on those targets they were weakest on in order to prepare for the test.

Ultimately, I feel that I implemented unit 2 successfully. There were a couple activities that turned out to be more challenging for my students than I had anticipated. Also, I had to extend the length of time on the unit in order to incorporate review days of particular lessons. However, by examining the pre-assessment and final common assessment results, I knew my students went from a very low level of understanding of the learning goals/targets to a mastery level of the targets/goals.

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