LESSON 6 - PERCENTS

INTRODUCTION

So far in this course we have worked with different types or forms of numbers including whole numbers, fractions, and decimals. With each number type or form we have learned to join them using mathematical operations or to convert them from one form to another. In this lesson, we will combine our knowledge of whole numbers, decimals, and fractions and apply this knowledge to learning about the concept of *percent (%)*.

The table below shows the specific objectives that are the achievement goal for this lesson. Read through them carefully now to gain initial exposure to the terms and concept names for the lesson. Refer back to the list at the end of the lesson to see if you can perform each objective.

Lesson Objective	Related Examples
Convert *percent* to decimal	2, YT3
Convert *percent* to fraction	2, YT3
Convert decimal to *percent*	2, YT3
Convert fraction to *percent*	2, YT3
Solve equations of the form $x = a \cdot b$	WE4
Solve equations of the form $a \cdot x = b$	WE5
Create and solve *percent* equations: Type I	6, YT7
Create and solve *percent* equations: Type II	8, YT9
Create and solve *percent* equations: Type III	10, YT11
Solve applications involving *percent*	1, 12-14, YT15
Determine *percent increase* or *decrease*	16, 17, YT18
Determine *percent discount*	19, YT21a
Compute *simple interest*	20, YT21b

KEY TERMS

The key terms listed below will help you keep track of important mathematical words and phrases that are part of this lesson. Look for these words and circle or highlight them along with their definition or explanation as you work through the MiniLesson.

- Percent
- Variable
- Percent Equations (Type I, II, III)
- Percent Increase or Decrease
- Percent Discount
- Simple Interest
- Principle
- Interest Rate

LESSON CHECKLIST

Use this page to track required components for your class and your progress on each one.

Component	Required? Y or N	Comments	Due	Score
Mini-Lesson				
Online Homework				
Online Quiz				
Online Test				
Practice Problems				
Lesson Assessment				

MINILESSON

DEFINITON OF PERCENT

Numbers written in percent form represent amounts out of 100. The word "*percent*" actually means "per 100" (Think of it as "per cent" and there are 100 cents in $1). The following example will help us start thinking about numbers in percent form.

Example 1: At a recent "Rats on Rafts" rock concert (there actually is a 2012 band with this name! ☺), 50% of the attendees were under 18, 25% were 18 – 24 and the rest were over 24. If 22,140 people attended the concert, how many were in each age group?

DECIMALS, FRACTIONS, PERCENTS

Decimals, fractions, and percents are closely connected. The following table shows how to convert from one type to the other.

Percent to Decimal	$50\% = .50$	Remove % sign. Divide by 100.
Percent to Fraction	$50\% = \frac{50}{100} = \frac{1}{2}$	Remove % sign. Place over 100. Reduce fraction.
Decimal to Percent	$0.50 = 50\%$	Multiply by 100. Include % sign.
Fraction to Percent	$\frac{1}{2} = .50 = 50\%$	Divide. Multiply by 100. Include % sign.

Example 2: Complete the missing parts of the table. Round to THREE decimal places as need. Simplify all fractions. Show all work.

Fraction	Decimal	Percent
		32%
	0.040	
$\frac{3}{4}$		
	0.625	
		150%
$1\frac{3}{7}$		

YOU TRY

3. Complete the missing parts of the table. Round decimal part to FOUR decimal places as needed. Simplify all fractions. Show all work.

Fraction	Decimal	Percent
a. $\frac{1}{9}$		
b.	0.0625	
c.		80%

Now that we have a feeling for what percent numbers look like and how they can be written as decimals or fractions, we will learn how to compute percent numbers given different pieces of information. Before we do that, however, we need to learn one new idea that will make working with percent numbers a fairly straightforward process.

SOLVING EQUATIONS OF THE FORM x = a · b

Worked Example 4 In mathematics, we let *variables* (letters) take the place of number values that we do not know. The mostly commonly used variable is the variable "x". In each of the following, to determine the value of the unknown number (x), we simply multiply the two numbers that we do know.

a. $x = 3 \cdot 4$
$x = 12$

b. $x = 2.5 \cdot 8$
$x = 20$

c. $x = 0.12 \cdot 50$
$x = 6$

SOLVING EQUATIONS OF THE FORM a · x = b

These problems are a little different in that there is a division step in each one. Follow the examples carefully and notice the check for accuracy. In the first, three, you could probably determine the unknown x without having to divide (for example, what number times 3 gives 6? Has to be 2). But the last three are more complicated and involve some decimal results.

Worked Example 5 Determine the value of the unknown number x. Show complete division steps and also show a check. Round to two decimals as needed. [*Note: There are also video links for this problem!]*

a.	$3x = 6$ $x = \frac{6}{3}$ $x = 2$	b.	$12x = 24$ $x = \frac{24}{12}$ $x = 2$	c.	$2x = 20$ $x = \frac{20}{2}$ $x = 10$
Check:	$3 \cdot 2 = 6$ $6 = 6$	Check:	$12 \cdot 2 = 24$ $24 = 24$	Check:	$2 \cdot 10 = 20$ $20 = 20$
d.	$\frac{1}{4}x = 9$ $x = 9 \div \frac{1}{4} = 9 \cdot 4$ $x = 36$	e.	$5x = 12$ $x = \frac{12}{5}$ $x = 2.40$	f.	$6x = 11$ $x = \frac{11}{6}$ $x = 1.83$
Check:	$\frac{1}{4} \cdot 36 = 9$ $\frac{36}{4} = 9$ $9 = 9$	Check:	$5 \cdot \frac{12}{5} = 12$ $\frac{60}{5} = 12$ $12 = 12$	Check:	$6 \cdot \frac{11}{6} = 11$ $\frac{66}{6} = 11$ $11 = 11$

CREATING AND SOLVING PERCENT EQUATIONS

When working with a problem involving percent, the most straightforward way to solve it is by setting up a *percent equation*. The information we just covered on the previous page will help solve percent equations once they are set up. The information below provides translation guidance for words or phrases that are part of percent statements.

- The percent (usually represent as a decimal)
- Multiplication (replace the word "of" with multiplication)
- The unknown (usually represented by the word "what" and replace with "x")
- Equals (replace the word "is" with "=")

Let's see how these translations are used when setting up the three main types of percent problems.

TYPE I: Unknown is A% of B

Example 6: Determine the missing number in each of the following. Round to two decimals as needed.

a. What is 12% of 20?

b. What is 30.45% of 450?

c. 12% of 600 is what number?

d. What number is 0.5% of 8?

YOU TRY

7. Determine the missing number in each of the following. Round to two decimals as needed.

a. What is 15% of 324?

b. 25.12% of 132 is what number?

TYPE II: A% of Unknown is B

Example 8: Determine the missing number in each of the following. Round to TWO decimals as needed. Show all work.

a. 60% of what number is 15?

b. 25 is 12.25% of what number?

c. 175% of what number is 325.16?

d. 20 is 0.14% of what number?

YOU TRY

9. Determine the missing number in each of the following. Round to TWO decimals as needed. Show all work.

a. 40% of what number is 20?

b. 105 is 15.15% of what number?

TYPE III: Unknown % of A is B

Example 10: Determine the missing number in each of the following. Round to TWO decimals as needed. Show all work.

a. What % of 140 is 3.8?

b. What percent of 620 is 136.4?

c. What % of 25 is 0.05?

d. 240 is what percent of 100?

YOU TRY

11. Determine the missing number in each of the following. Round to TWO decimals as needed. Show all work.

a. What % of 12 is 8?

b. 105 is what percent of 123?

APPLICATIONS OF PERCENTS – TYPES I, II, III

Try to recognize the percent problem as one of our three types and set up the percent equation to solve for the missing part. Use a modified version of our problem-solving process by circling the given information and underlining the goal in each problem.

Example 12: (TYPE I)
At a restaurant, the bill comes to $51.23. If you decide to leave a 14% tip, how much is the tip and what is the final bill? Round to the nearest cent.

Example 13: (TYPE II)
Joyce paid $33.00 for an item at the store that was marked as 45 percent off the original price. What was the original price? Round to the nearest cent.

Example 14: (TYPE III)
Trader Joe's sold 8233 bags of tortilla chips recently. If 5178 of these bags were fat free, find the percent that were fat free. Round your answer to the nearest whole percent.

YOU TRY

15. To win the election as president of the United States of America, a person must obtain 270 out of 538 possible votes from the electoral college. What percentage of the overall electoral votes is this? Round to 4 decimals initially. Be sure to set up your percent statement and equation as in the examples.

PERCENT INCREASE OR DECREASE

Example 16: Determine the percent increase or decrease for the change from 20 to 30. Round % to the nearest whole number.

Example 17: Determine the percent increase or decrease for the change from 30 to 20. Round % to the nearest hundredth.

YOU TRY

18. Determine the percent increase or decrease for each of the following. Round % to the nearest hundredth.

a. the change from 54 to 62

b. the change from 50 to 40

% DISCOUNT

Example 19: A $725 couch is on sale for 20% off. Find the amount of the discount and the sale price. Round to the nearest cent. [Circle GIVENS and underline GOAL]

SIMPLE INTEREST

SIMPLE INTEREST = PRINCIPLE x INTEREST RATE x TIME

In shortened form, I = PRT

Remember the following:

- Principle is the amount borrowed
- Interest Rate is the annual rate and should be written as a decimal
- Time is in years

Example 20: Calculate the simple interest and the final balance on $200 borrowed at 8% interest over 4 months.

YOU TRY

21a. An $85 pair of sunglasses is on sale for 30% off. Find the amount of the discount and the sale price. Round to the nearest cent. [Circle GIVENS and underline GOAL]

21b. Calculate the simple interest and the final balance on $14,000 borrowed at 3% interest over 10 years. Round to the nearest cent. [Circle GIVENS and underline GOAL]