Unit 8: Ratio, Proportion and Percent

Lessons 2 and 3: Ratios

Ratio: A comparison of 2 quantities

3 Ways to Write Ratios:

1. As a fraction: $\frac{1}{4}$
2. With a colon: 1 : 4
3. With the word "to": 1 to 4

All these ratios are read "1 to 4"

Writing a ratio in lowest terms:

1. Convert it to a fraction (never a whole or mixed number, leave it as in improper fraction.)
2. Simplify the fraction

$$10 \text{ to } 15 = \frac{10}{15} = \frac{2}{3} = 2 \text{ to } 3$$

*In word problems, be sure to write the ratios in the order they are being compared. If you prefer 1 slice of tomato to 2 pickles on your hamburger, the ratio of tomatoes to pickles is 1:2.

* When comparting parts and wholes, be very careful that you are using the correct numbers.
Ex. There were 15 girls and 16 boys in class. Compare girls to the total number of students.

The answer would be 15:31. 15 being the number of girls, 31 being the total number of students.

Class Examples:

Khan Video https://www.khanacademy.org/math/cc-sixth-grade-math/cc-6th-ratios-prop-topic/cc-6th-describing-ratios/v/ratios-intro

Lessons 4 Rates & Lesson 6: Unit Rates

Rates: Ratios that are used to compare quantities with different units.

For example, if it costs $35 to buy 10 gallons of gas, then *$35 to 10 gallons* is a rate. One of the quantities is measured in dollars, and the other is measured in gallons.

Unit Rate: A ratio that has a denominator of 1; it tells you the rate for ONE thing

How to Calculate a Unit Rate : Divide both the numerator and the denominator by the number that is in the denominator

Example: $\frac{120\ miles}{3\ hours} \div \frac{3}{3} = \frac{40\ miles}{1\ hour}$ OR 40 miles per ONE hour

Find a Unit Rate

To find a unit rate:
Step 1. Separate the units from the number part of the fraction.
Step 2. Simplify the number part of the fraction.

Example:

Cleo earned $320 for 40 hours of work. Write this as a unit rate:

Step 1. $\frac{320}{40} \cdot \frac{dollars}{hours}$

Step 2. $\frac{320 \div 40}{40 \div 40} \cdot \frac{dollars}{hours} = \frac{8}{1} \cdot \frac{dollars}{hour}$, or $8 per hour

Complex Fraction: a fraction which has one or more fractions in the denominator or numerator.

To write a complex fraction as a unit rate—

Step 1 Rewrite the complex fraction as a division problem.
Step 2 Find the quotient.

$$\frac{1\frac{1}{2}}{\frac{3}{4}} = 1\frac{1}{2} \div \frac{3}{4} = \frac{3}{2} \cdot \frac{4}{3} = \frac{12}{6} = \frac{2}{1}$$

Problem

A recipe for peanut brittle requires $1\frac{1}{4}$ tsp of salt for a 5 lb batch. What is the unit rate representing the amount of salt per pound?

$$\frac{1\frac{1}{4}}{5} = 1\frac{1}{4} \div 5 = \frac{5}{4} \div \frac{5}{1} = \frac{5}{4} \cdot \frac{1}{5} = \frac{5}{20} = \frac{1}{4}$$

Given two quantities with different units, you can make two different rates depending on the order of the terms.

Example:

60 kilometers and 30 minutes

$$\frac{60\ km}{30\ min} = \frac{2\ km}{min} \quad \text{or} \quad \frac{30\ min}{60\ km} = \frac{\frac{1}{2}min}{km}$$

When you are writing a multiplication equation to solve a problem, choose the rate that will allow you to more easily answer the question you are asked and, if possible, make the equation easier to solve.

50 miles in 5 hours = 10 miles per hour

Class Examples:

Khan Video: https://www.khanacademy.org/math/cc-sixth-grade-math/cc-6th-ratios-prop-topic/cc-6th-rates/v/finding-unit-rates

Lessons 8 and 9: Proportion

Finding Equivalent Ratios:

Multiply or divide the numerator and denominator of a ratio (fraction) by the same number. (It can be any number!)

Example: $\frac{30}{35} \div \frac{5}{5} = \frac{6}{7}$ Divide top and bottom by 5

$\frac{30}{35} \times \frac{2}{2} = \frac{60}{70}$ Multiply top and bottom by 2

Therefore: $\frac{30}{35} = \frac{6}{7}$ and $\frac{30}{35} = \frac{60}{70}$ These are both equivalent ratios

Proportion: An equation stating that 2 ratios are equal

Example: $\frac{a}{b} = \frac{c}{d}$ if and only if $ad = bc$ (cross multiply)

a and *d* are called the **extremes**

b and *c* are called the **means**

If you write the ratio with a colon, you see that the extremes are the outside numbers and the means are the inside numbers. a : b = c : d

To determine if 2 ratios are proportional, just cross multiply. If the products are equal, the ratio is a proportion.

Example: $\frac{4}{6}$ and $\frac{10}{15}$ 6 x 10 = 60

4 x 15 = 60

60 = 60 so the ratios are proportional

Use Ratios to solve proportions:

Example: $\frac{n}{15} = \frac{6}{20}$ 1. Multiply the 2 numbers on the diagonal: 15 x 6 = 90

2. Divide by the 3rd number: 90 ÷ 20 = 4.5

3. n = 4.5

4. Cross Multiply to check: 4.5 x 20 = 90

6 x 15 = 90

Class Examples:

Khan Video: https://www.khanacademy.org/math/cc-seventh-grade-math/cc-7th-ratio-proportion/cc-7th-constructing-proportions/v/writing-proportions

Lesson11: Percent, Fractions and Decimals

Convert a Fraction to a Decimal:

Divide the denominator into the numerator

Example: $\frac{9}{15}$ = .6 (nine divided by fifteen)

Convert a Decimal to a Fraction:

Write the decimal as a fraction, then simplify

Example: .45 = $\frac{45}{100} \div \frac{5}{5} = \frac{9}{20}$

Convert a Decimal to a Percent:

Move the decimal point 2 places to the right and add a % sign

(Multiply times 100)

Example: .35 = 35%

Convert a Percent to a Decimal:

Move the decimal 2 places to the left and remove the % sign

(Divide by 100)

Example: 65% = .65

Convert a Fraction to a Percent:

Convert the fraction to a decimal (divide the top by the bottom)

Convert the decimal to a percent (move the decimal 2 places to the right)

Example: $\frac{4}{5}$ = .80 = 80%

Convert a Percent to a Simplified Fraction:

Write the percent as a fraction with a denominator of 100

Simplify the fraction

Example: 85% = $\frac{85}{100} \div \frac{5}{5} = \frac{17}{20}$

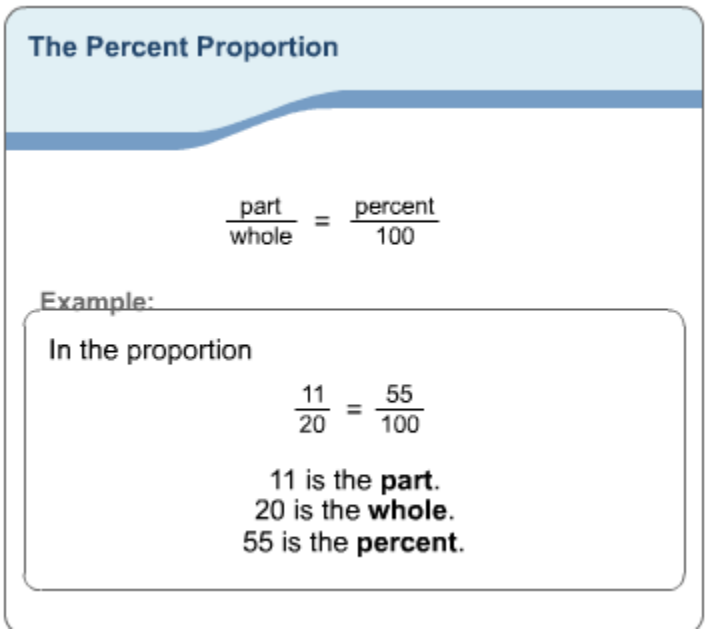
Class Examples:

Lesson 12: Working with Percent

Percent problems that involve parts of whole amounts can be solved using the percent proportion.

There are three types of percent problems that involve parts of whole amounts.

1. You know the part and the whole, and you want to find the percent.
2. You know the percent and the whole, and you want to find the part.
3. You know the percent and the part, and you want to find the whole.



Class Examples:

Khan Video: https://www.khanacademy.org/math/cc-sixth-grade-math/cc-6th-ratios-prop-topic/percent_word_problems/v/another-percent-word-problem

Lesson 13: Identifying Proportions

The Core Concept

The relationship between two quantities is proportional if the ratios of every data pair are equal.

Problem 1

The table shows the amount of coffee grounds needed to make various amounts of coffee. Is the relationship between the amount of coffee grounds and the cups of coffee proportional?

Amount of coffee grounds (tbsp)	Cups of coffee
3	6
5	10
8	16
12	24

$\frac{3}{6} = \frac{1}{2}$ $\frac{8}{16} = \frac{1}{2}$

$\frac{5}{10} = \frac{1}{2}$ $\frac{12}{24} = \frac{1}{2}$

Since the ratios are the same, the relationship between the amount of coffee grounds and the cups of coffee is proportional.

Problem 2

The table shows the amount of coffee grounds needed to make various amounts of coffee. How many cups of coffee will 15 tbsp of coffee grounds make?

Amount of coffee grounds (tbsp)	Cups of coffee
3	6
5	10
8	16
12	24
15	?

$$\frac{3}{6} = \frac{15}{x}$$

$$3x = 15 \cdot 6$$

$$3x = 90$$

$$3x \div 3 = 90 \div 3$$

$$x = 30$$

So 15 tbsp of coffee grounds will make 30 cups of coffee.