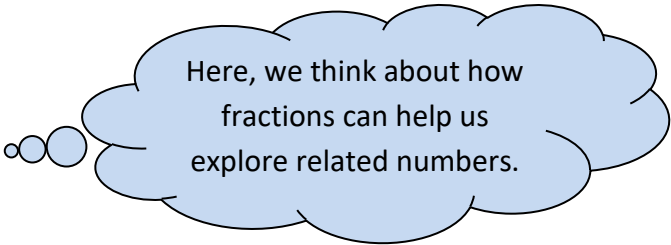


Technical Math for Allied Health
Class notes
Averages, Ratios, and Proportions (Module 3)

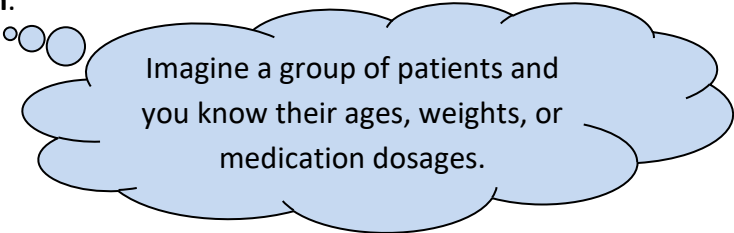


Here, we think about how fractions can help us explore related numbers.

Averages:

If we have a bunch of numbers and want to summarize them quickly, an **average** is often a great option. It is also called an **arithmetic mean**.

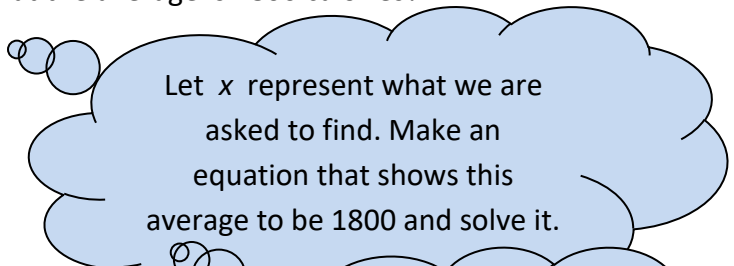
You find the average by adding the numbers and dividing by how many numbers you had.



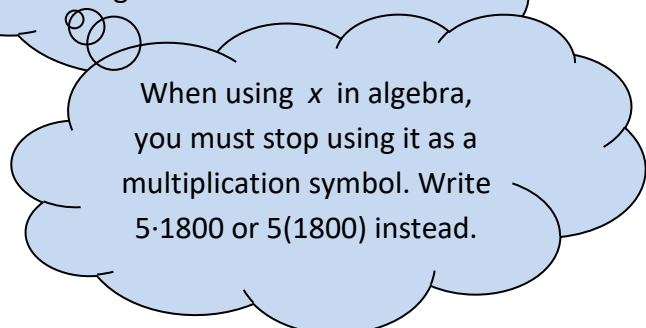
Imagine a group of patients and you know their ages, weights, or medication dosages.

expl 1: Six members of a health club have all run a few laps around the gym. Their times are 100, 115, 95, 78, 160, and 105 seconds. What is the average time? Include units.

expl 2: Margaret knows her patient should consume an average of 1800 calories each day. For the first four days, this patient consumed 1700, 1950, 1780, and 1800 calories each day. How much should the patient consume on Day 5 so that the average is 1800 calories?



Let x represent what we are asked to find. Make an equation that shows this average to be 1800 and solve it.



When using x in algebra, you must stop using it as a multiplication symbol. Write $5 \cdot 1800$ or $5(1800)$ instead.

Ratios:

A **ratio** is simply a comparison of two numbers. Sometimes we write it as a fraction but it can be written with a colon or the words “to” or “per” as below.

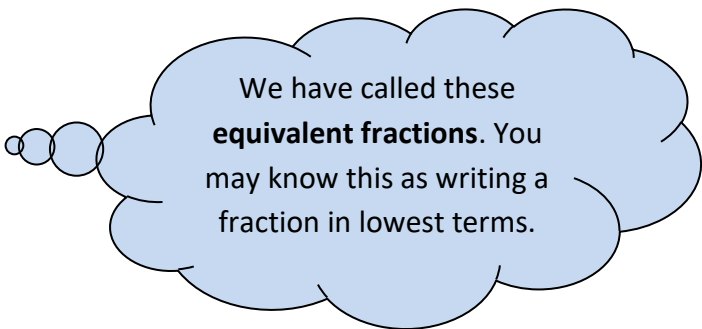
A common migraine drug contains 250 mg of acetaminophen, 250 mg of aspirin, and 65 mg of caffeine. To compare caffeine to acetaminophen, we can write the ratio as

65 to 250 or $65/250$ or 65 per 250 or 65:250

Of course, it’s really important that we know the *first* number refers to caffeine and the *second* number refers to acetaminophen. When working with ratios, and later proportions, *keep the order in mind*.

expl 3: Reduce the ratio to its simplified form.

$$\frac{65}{250}$$



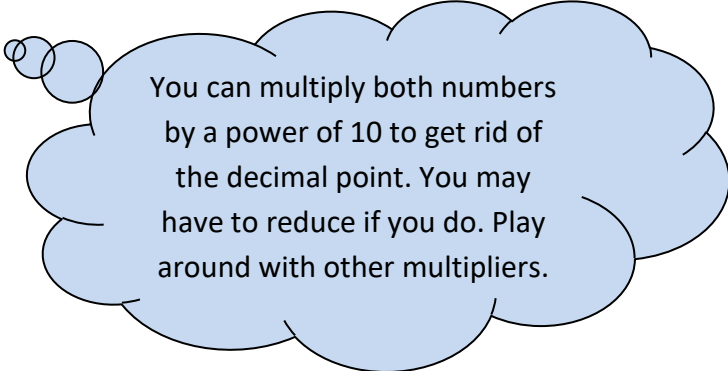
We have called these **equivalent fractions**. You may know this as writing a fraction in lowest terms.

It is usual to write this simplified form as a fraction where both the top and bottom are integers. Do you remember the integers?

expl 4: Rewrite the ratios below with integers.

a.) 2.5 to 6

b.) 1 to 0.45

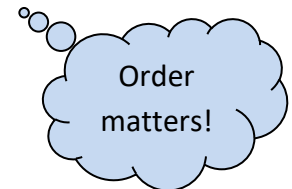


You can multiply both numbers by a power of 10 to get rid of the decimal point. You may have to reduce if you do. Play around with other multipliers.

expl 5: A common migraine drug contains 250 mg of acetaminophen, 250 mg of aspirin, and 65 mg of caffeine. Write the following as reduced ratios.

a.) caffeine to the total

b.) acetaminophen to aspirin

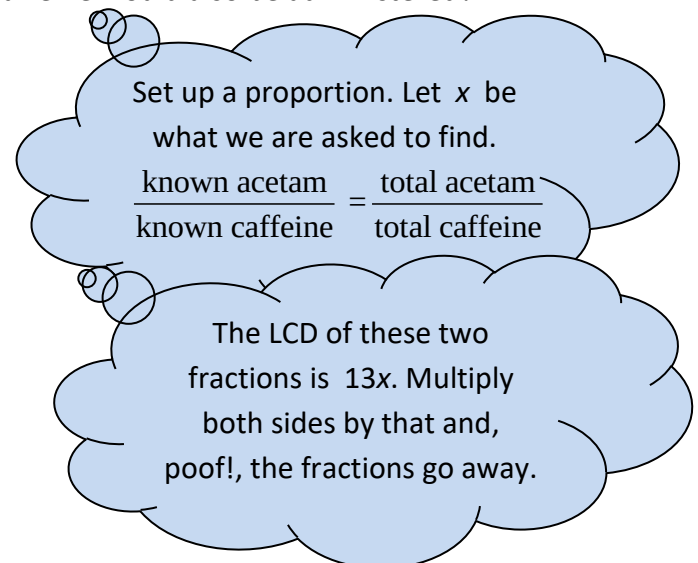


c.) acetaminophen to caffeine

Proportions:

A **proportion** is an equation where we set two ratios (fractions) equal to each another. We do this because we have four quantities that are related by equal ratios. We are usually given three values and asked for the fourth value.

expl 6: We know that the ratio of acetaminophen (sometimes abbreviated acetam) to caffeine in the pill described above is 50/13. It is recommended that a patient take enough of the drug to get 400 mg of acetaminophen. How much total caffeine would also be administered?

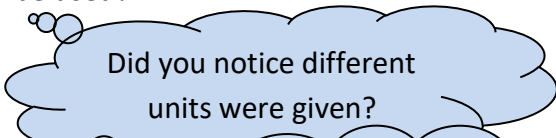


Cross-multiplying Shortcut:

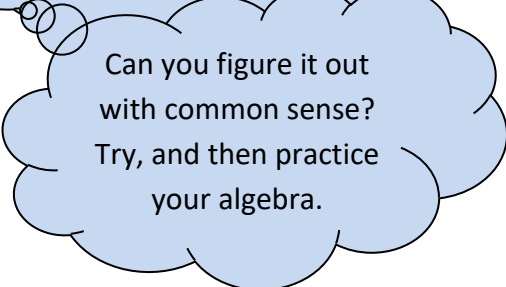
Notice the last problem quickly became $50x = 13 \cdot 400$ once we multiplied by the LCD. We were then able to solve it with division. That LCD step can be shortcut by what is commonly called cross-multiplying. When you have an equation with just one fraction on each side, you can “cross-multiply” to get a simpler equation with no fractions. But beware! It only works if the equation is in the form “one fraction = another fraction”. Many times, it saves a little brain power.

expl 7: To sooth sore throats, it is recommended that we combine $\frac{1}{2}$ teaspoon of salt in 8 ounces of warm water to create a gargle solution. Answer the following questions.

a.) If we want to use $1 \frac{1}{2}$ cups of water, how much salt should be used?

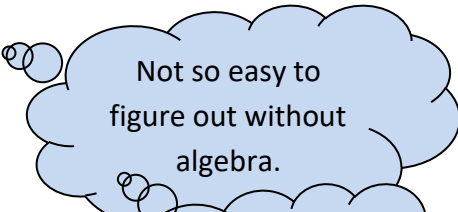


Did you notice different units were given?

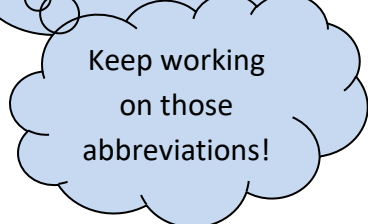


Can you figure it out with common sense? Try, and then practice your algebra.

b.) If we want to use 3 oz of water, how much salt should be used? Give your answer as an exact fraction.



Not so easy to figure out without algebra.



Keep working on those abbreviations!