

Unit Conversions with Spreadsheets

In this activity, we will take a look at some unit conversion problems with the aid of spreadsheets.

Part 0: Review of Unit Conversion Concept

Example: Walking with a consistent stride, it takes you 43 steps to walk from your front doorstep to your neighbor's doorstep. You also measure this distance with a tape-measure and find that it is 37.6 meters.

What type of quantity is being measured here? **A volume**

What are some other units for this type of quantity? (You should list both common units, such as meters, and more creatively defined units, such as "steps" or "dog leash lengths")

Some common units:

Possible answers: inches, yards, miles, kilometers, centimeters, etc.

Some creatively defined units:

Possible answers: spans of a hand, bicycle wheel rotations, jump-rope lengths, baseball bat lengths, parking spaces, dog-leash lengths

The key thing to understand is that **the same quantity can be measured numerically in different ways** (i.e., with different units). In our example, the numbers 43 and 37.6 are two different ways of describing the same underlying quantity (in this case, the distance to the neighbor's doorstep).

For this example, perform the following unit conversion:

$$70 \text{ steps} = 61.2 \text{ meters} \quad (\text{round to one decimal place})$$

Show work here:

$$70 \text{ steps} \times \frac{37.6 \text{ meters}}{43 \text{ step}} \approx 61.2 \text{ meters}$$

Write the unit conversion factor you used: $\frac{37.6 \text{ meters}}{43 \text{ step}}$ or $0.8744 \frac{\text{meters}}{\text{step}}$

Example: You find that your dog's food bowl can be filled with 3 scoops of dog food. When measured in cups, this is 7.5 cups. Answer the same questions as the previous problem.

Type of quantity being measured: **A distance (or length)**

Some common units for this type of quantity:

Possible answers: cups, tablespoons, cubic inches, cubic centimeters, gallons

Some creatively defined units:

Possible answers: dog food scoops, coffee cups, handfuls, soup cans

$$4 \text{ scoops} = 10 \text{ cups}$$

Show work here:

$$4 \text{ scoops} \times \frac{37.6 \text{ cups}}{43 \text{ scoop}} \approx 10 \text{ cups}$$

Write the unit conversion factor you used: $\frac{7.5 \text{ cups}}{3 \text{ scoop}}$ or $2.5 \frac{\text{cups}}{\text{scoop}}$

Part 1: Introduction with Excel

Open the Excel document titled "Excel Template" and follow along with your instructor.

Use the CONVERT function in Excel to convert inches to centimeters. Begin with 75 inches, but then select some other values for the number of inches (such as 12 inches, etc.).

Next, consider the following question:

Road Trip: "Suppose you are planning a long road trip. Your car's fuel efficiency is 25 miles per gallon, and you plan to drive a total distance of 2,300 kilometers. The average price of gasoline is \$3.25 per gallon. How much will you spend on gasoline for the trip?"

Use the Excel template to find the solution.

Part 2: Solving Unit Conversion Problems (in groups)

1. In your groups, choose one of the 6 problems (listed below) and discuss a strategy for solving the problem.
2. Open a blank Excel spreadsheet, and solve the problem using a table in the spreadsheet. Your table should have a similar format to the table in the template (i.e., columns for “Description,” “Quantity,” and “Units”). You might find it helpful to color-code the cells, but this is not required.
3. After solving the problem, make some changes within the spreadsheet to the initial quantities given, and notice how these changes affect the final quantities. (For example, if the original problem says to use a speed of 95 mph, then enter a different number, such as 85mph, etc.)
4. Select one person from your group to explain the problem and solution to the class. Be sure to explain how the unit conversion that is performed in your particular problem involves a numerical measurement (in two different ways) of the same underlying quantity.

Jell-O Prank

Suppose you want to prank your friend for April Fool’s Day. You want to fill his swimming pool with Jell-O. A box of Jell-O costs \$1.48 and makes 2 cups. How much would it cost to fill a circular swimming pool with Jell-O if the pool has a radius of 7 feet and a depth of 4 feet?

Hitting a Baseball vs Softball

Compare the reaction time required to hit a softball pitch from an elite college softball pitcher to a baseball pitch from an MLB pitcher. The distance from the pitcher's mound to home plate in softball is 43 feet, while in baseball it is 60.5 feet. An elite college softball pitcher throws at an average speed of 65 mph, and an MLB pitcher throws at an average speed of 95 mph. Calculate the reaction time required to hit a pitch for each sport and compare. What happens if we change the speeds a little bit?

Aircraft Carrier and an F-16

During a Navy airshow, an aircraft carrier ship travels at 30 knots, while an F-16 approaches the ship in the opposite direction traveling at 2 Mach (also called Mach 2). (Note: 1 Mach = 767 miles per hour, which is the speed of sound). How fast is the F-16 moving relative to the aircraft carrier?

Thunder and Lightning

The speed of light is so fast that we can assume that light travels between two places on earth nearly instantly. On the other hand, the speed of sound through the air is much slower (roughly 343 meters per second). Suppose you see a flash of lightning in the distance, after which the sound of thunder comes rolling in 12 Mississippi’s later (that’s about 12 seconds). About how many miles away was the lightning strike from you? After answering this question, come up with a “rule-of-thumb” for how far away a lightning strike is.

Distance to the Nearest Star

Proxima Centauri, the closest star to our solar system, is 4.24 light-years away. A “light-year” is the distance that light travels in one year (so it is a distance, not a time interval). Given that the speed of

light is 186,000 miles per second, calculate the distance to Proxima Centauri in kilometers. After solving this, find the distance in kilometers to the nearest large galaxy (the Andromeda Galaxy), which is 2.537 million light-years away.

Protecting your Flowers

Suppose you have a rectangular flower bed (4 feet by 9 feet) that you would like to cover with mulch to protect the flowers from insects and summer heat. While shopping at your local lawn and garden store, you find two options: a wood mulch and a rubber mulch. A bag of wood mulch covers 1.5 cubic feet and costs \$4.98, while a bag of rubber mulch covers 0.8 cubic feet and costs \$7.48. The wood mulch must cover the garden to a depth of 3 inches, while the rubber mulch must cover the garden to a depth of 2 inches. Compare the total costs of the two options. Although the wood mulch is cheaper than the rubber mulch, a sale associate informs you that the wood mulch must be replaced every year, while the rubber mulch lasts 12 years. Compare the costs of the two options over the course of 12 years.

Note: Remember that “whole” bags must be purchased. So, if the math says that 4.3 bags are required, then 5 bags must be purchased. In Excel, to round a decimal up to the nearest whole number (such as rounding 4.3 up to 5), you may type =ROUNDUP(4.3,0) and this will return the value 5.

Part 3: Design your own Unit Conversion Problem

Design your own unit conversions problem and solve it using a table in Excel. The problem should involve at least two different unit conversions.

Write the problem here:

Answers will vary

Write the solution here:

Answers will vary