

4. Jamie wants to carpet her bedroom and knows that the rectangular room has dimensions of $10' \times 11'$. If the carpet she needs is sold for \$7.50 per square yard, how much will she pay for the carpet? Consider that she needs to buy a whole number of square yards.

HOW IT WORKS

To convert units using dimensional analysis:

1. Find a relationship between the units using conversion facts. This may be a direct relationship with only one conversion fact or a path from one unit to the other with more than one conversion fact.
2. Write the calculation, using the conversion factors in such a way that unwanted units will divide off.
3. Divide off units and perform the necessary multiplication and division.
4. Check that your answer is reasonable.

EXAMPLE: Convert 100 yards to meters.

To convert 100 yards to meters, use the conversion facts 1 yard = 3 feet, 1 foot = 12 inches, 1 inch = 2.54 centimeters, and 100 centimeters = 1 meter. Multiply 100 yards by the conversion factors so that the units divide off and only meters remain.

$$100 \text{ yd} \cdot \frac{3 \text{ ft}}{1 \text{ yd}} \cdot \frac{12 \text{ in.}}{1 \text{ ft}} \cdot \frac{2.54 \text{ cm}}{1 \text{ in.}} \cdot \frac{1 \text{ m}}{100 \text{ cm}} = 91.44 \text{ m}$$

So 100 yards is the same as 91.44 meters.

Check that the answer makes sense. Meters are a larger unit of length than yards. So, in converting from 100 yards to meters, fewer meters are needed to cover the same length.

EXAMPLE: Convert 100 cubic yards to cubic meters.

To accomplish this conversion, write the following calculation. Notice that the same conversion factors are used as in the previous example, but each conversion factor is cubed.

$$100 \text{ yards}^3 \cdot \frac{3^3 \text{ ft}^3}{1^3 \text{ yd}^3} \cdot \frac{12^3 \text{ in.}^3}{1^3 \text{ ft}^3} \cdot \frac{2.54^3 \text{ cm}^3}{1^3 \text{ in.}^3} \cdot \frac{1^3 \text{ m}^3}{100^3 \text{ cm}^3} = 76.46 \text{ m}^3$$

If you need a conversion fact for the homework that is not listed here, look it up online.

Commonly used unit conversions:

1 ft = 12 in.	1 in. = 2.54 cm	1 L = 1,000 mL	1 min = 60 sec
1 mi = 5,280 ft	1 km = 1,000 m	1 lb = 16 oz	1 hr = 60 min
1 yd = 3 ft	1 m = 100 cm	1 kg = 1,000 g	1 yr = 52 weeks
1 km ≈ 0.62 mi	1 cm = 10 mm	1 g = 1,000 mg	1 week = 7 days
1 mi ≈ 1.61 km		1 ton = 2,000 lb	
		1 gal = 4 qt	
		1 kg ≈ 2.2 lb	

Conversion facts shown in bold provide a conversion between the English and metric systems.

When you convert squared or cubed units, square or cube only the numbers and units that are involved in the conversion factor, not the number that you are converting.

5. Convert 8 cubic meters to cubic inches.

$$8 \cancel{\text{m}^3} \cdot \frac{100^3 \cancel{\text{cm}^3}}{1^3 \cancel{\text{m}^3}} \cdot \frac{1^3 \text{in}^3}{2.54^3 \cancel{\text{cm}^3}} = 8 \cdot 100^3 \cdot \frac{1}{2.54^3} = 488,190 \text{ in}^3$$

6. a. How many yards are in 4 miles?

$$4 \text{ mi} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} \cdot \frac{1 \text{ yd}}{3 \text{ ft}} = 7040 \text{ yd}$$

b. How many square yards are in 4 square miles?

$$4 \text{ mi}^2 \cdot \frac{5280^2 \text{ ft}^2}{1^2 \text{ mi}^2} \cdot \frac{1^2 \text{ yd}^2}{3^2 \text{ ft}^2} = 12,390,400 \text{ yd}^2$$

Connect

Jake is taking a graduation trip to London for a week in the summer. His parents gave him \$750 in spending money. When he arrives, he sees the following currency exchange rate information:

	USD	EUR	GBP	JPY	CAD	AUD
1 USD =	1.000	0.9432	0.6635	122.63	1.3327	1.3870
1 EUR =	1.0602	1.000	0.7034	130	1.4127	1.4704
1 GBP =	1.5071	1.4217	1.000	184.79	2.0082	2.0901
1 JPY =	0.0082	0.0077	0.0054	1.000	0.0109	0.0113
1 CAD =	0.7504	0.7079	0.4980	91.9963	1.000	1.0406
1 AUD =	0.7210	0.6801	0.4784	88.4173	24.6305	1.000

Reading across the first row of the table, he can find what one U.S. dollar is worth in the United States (in dollars), in Europe (in euros), in Great Britain (in pounds), in Japan (in yen), in Canada (in Canadian dollars), and in Australia (in Australian dollars). The remaining rows indicate what one unit of the other currencies is worth in the listed countries.

7. a. Why is there a "1.000" in each row? What is its significance?

b. How much is 1 U.S. dollar worth in British pounds on this day?

c. Convert Jake's \$750 to pounds. Round to the nearest whole number.

d. Analyze the calculation made in part c to determine a quick rule for converting dollars to British pounds. Rules like this help travelers make quick conversions without using paper or possibly even calculators.

You can convert units by multiplying or dividing if it's clear to you which you need to do. Otherwise, use dimensional analysis.