

Algebra RH

Essential Question: How do we use dimensional analysis for unit conversion?

Do Now:

You are riding your bike on a 3 mile trail. A sign says you have completed 1,500 feet. How many feet do you have left to bike? (1 mile = 5,280 feet)

$$3(5,280) - 1500$$
$$15,840 - 1500$$

14,340 feet



Converting Units

To convert between units, you're usually given one measure and asked to convert to another measure. To change a given measurement from one unit to another, you can use a process called "Dimensional Analysis." This method involves multiplying the given measurement by a conversion factor, a ratio of two measurements that is equal to 1.

1) Convert 16 quarts to gallons. ($\frac{1 \text{ gal}}{4 \text{ qt}}$)

$$16 \text{ quarts} \cdot \frac{1 \text{ gallon}}{4 \text{ quarts}} = 4 \text{ gallons}$$

2) How many kilometers are in 20,000 meters? (1 km = 1000 m)

$$20,000 \text{ meters} \cdot \frac{1 \text{ km}}{1000 \text{ m}} = 20 \text{ km}$$

3) The body of a large male contains about 12 pints of blood. Convert this quantity to liters. (2.1 pints \approx 1 liter)

$$12 \text{ pints} \cdot \frac{1 \text{ liter}}{2.1 \text{ pints}} = \frac{12}{2.1} \text{ liters}$$

4) Express the number of days in w weeks.

$$w \text{ weeks} \cdot \frac{7 \text{ days}}{1 \text{ week}} = 7w \text{ days}$$

5.71 liters

5) Express the number of cents in q quarters.

$$q \text{ quarters} \cdot \frac{25 \text{ cents}}{1 \text{ quarter}} = 25q \text{ cents}$$

6) A gallon of gasoline weighs about 2.84 kg. How many pounds does a pint of gasoline weigh? (1 kg = 2.2 pounds, 8 pints = 1 gallon).

$$1 \text{ pint} \cdot \frac{1 \text{ gallon}}{8 \text{ pints}} \cdot \frac{2.84 \text{ kg}}{1 \text{ gallon}} \cdot \frac{2.2 \text{ pounds}}{1 \text{ kg}} = \frac{6.248 \text{ pounds}}{8} = .781 \text{ pounds}$$

Converting Rates

Sometimes you will need to convert not just one measurement, but a ratio of measurements. This requires two or more conversion factors.

7) A cyclist travels 105 kilometers in 4.2 hours. Convert the cyclist's speed to miles per minute. (1 mile = 1.61 kilometers)

Given Rate	Conversion Factor	Conversion Factor	Answer
$\frac{105 \text{ km}}{4.2 \text{ hours}}$	$\times \frac{1 \text{ hour}}{60 \text{ minutes}}$	$\times \frac{1 \text{ mile}}{1.61 \text{ km}}$	$= \frac{.26 \text{ miles}}{\text{min}}$

Set up conversion factors so that both km and hour units divide out

8) If a rocket is launched at 64 feet per second, how many miles per hour is this?
(1 mi = 5280 ft)

$$\frac{64 \text{ feet}}{1 \text{ second}} \cdot \frac{60 \text{ seconds}}{1 \text{ minute}} \cdot \frac{60 \text{ minutes}}{1 \text{ hour}} \cdot \frac{1 \text{ mile}}{5280 \text{ feet}} = 43.64 \text{ mph}$$

(miles)
hour

Practice Problems:

9) Express the number of 4ths of a mile in m miles.

$$m \text{ miles} = \frac{4 \text{ 4ths}}{1 \text{ mile}} \quad 4m \text{ fourths}$$

10) How many quarts are in 7000 milliliters? (1 L = 1000 mL, 1 L \approx 1.06 qt)

$$\frac{7000 \text{ mL}}{1000 \text{ mL}} \cdot \frac{1.06 \text{ qt}}{1 \text{ L}} \rightarrow 7.42 \text{ quarts}$$

11) Convert 6 gallons to pints. (1 gallon = 4 quarts, 1 quart = 2 pints)

$$6 \text{ gallons} \cdot \frac{4 \text{ quarts}}{1 \text{ gallon}} \cdot \frac{2 \text{ pints}}{1 \text{ quart}} \rightarrow 48 \text{ pints}$$

12) Convert 2 miles to inches. (1 mile = 1760 yd, 1 yd = 36 in)

$$2 \text{ miles} \cdot \frac{1760 \text{ yd}}{1 \text{ mile}} \cdot \frac{36 \text{ in}}{1 \text{ yd}} = 126,720 \text{ inches}$$

13) Express the number of hours in w weeks.

$$w \text{ weeks} \cdot \frac{7 \text{ days}}{1 \text{ week}} \cdot \frac{24 \text{ hours}}{1 \text{ day}} = 168w \text{ hours}$$

14) Which is faster, 80 miles an hour or 40 meters per second?

1 mile: 5280 feet
2.54 cm: 1 inch
100 cm: 1 meter

$$\frac{40 \text{ meters}}{1 \text{ second}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hour}} \cdot \frac{100 \text{ cm}}{1 \text{ meter}} \cdot \frac{1 \text{ in}}{2.54 \text{ cm}} \cdot \frac{1 \text{ ft}}{12 \text{ in}} \cdot \frac{1 \text{ mile}}{5280 \text{ ft}}$$

$$\frac{14,400,000 \text{ miles}}{160,934.4 \text{ hours}} \rightarrow 89.48 \text{ mph}$$

40 meters per second is faster