

Section A.1: You Can't Add Apples and Oranges**Definition of units**

The *units* of a quantity describe what is measured or counted.

We cannot add or subtract numbers with different units, but we can **multiply** and **divide** quantities with different units.

There are four different operations that we are allowed to use with different units.

(1) Division**Ex.1**

If you drove 100 miles in two hours, your average speed was the distance traveled (= 100 mi) divided by the time it took (= 2 hr):

We read this answer as 50 “miles per hour”.

Note that the word *per* means “divided by”.

(2) Raising to second power**Ex.2**

Find the area of a room 12 feet long and 10 feet wide.

We say that the area is “120 square feet”.

The word *square* means something raised to the second power.

(3) Raising to third power**|| Ex.3**

Find the volume of a box 6 inches wide, 4 inches deep and 10 inches long.

We say that the volume is “240 cubic inches”.

The word *cubic* means something raised to the third power.

(4) Multiplication**|| Ex.4**

Find the energy used by a 0.5-kilowatt light bulb for 6 hours.

We say that the energy is “3 kilowatt-hours”.

Identifying UnitsIdentifying units in a problem

In order to understand what a problem is about, the first thing to do is to look at the units involved in the problem.

Ex.5

Identify the units in the price for gasoline found by dividing its total cost in dollars by the number of gallons of gas.

Ex.6

Identify the units in the area of a circle πr^2 , where r is the radius of a circle measured in centimeters.

Ex.7

Identify the units in the volume found by multiplying an area measured in acres by a depth measured in feet.

Section A.2: Unit ConversionsUnit conversions

It is very important to understand how we can convert one unit to another one.

Ex.8

The statement $12 \text{ in.} = 1 \text{ ft}$ is an example of a conversion factor. We can write this conversion factor in three equivalent ways:

|| **Ex.9 Feet to Inches.**

|| Convert a distance of 5 feet into inches.

|| **Ex.10 Inches to Feet.**

|| Convert a length of 102 inches into feet.

We can use many conversion factors to get the solution to a problem.

|| **Ex.11 Chain of conversions.**

|| How many seconds are there in one decade?

Conversions with Units Raised to Powers

|| **Ex.12**

|| Convert 1 yd^2 to ft^2 .

Ex.13

Convert 1 yd^3 to ft^3 .

Ex.14

You want to carpet a room that measures 10 feet by 12 feet, making an area of 120 square feet. But carpet is usually sold by the square yard rather than by the square foot. How many square yards of carpet do you need?

Ex.15

You are preparing a vegetable garden that is 40 feet long and 16 feet wide, and you need enough soil to fill it to a depth of 1 foot. The landscape supply store sells soil by the cubic yard. How much soil should you order?

Currency Conversions**Currency**

Different countries use different money, or *currency*.

Ex.16

1 euro = \$1.272.

Ex.17

\$1 = 10.95 pesos.

Ex.18 Price conversion.

At a french department store, the price for a pair of jeans is 45 euros. What is the price in U.S. dollars?

Ex.19 Buying Currency.

You are on holiday in Mexico and need cash. How many pesos can you buy with 100 U.S. dollars? Assume that the transaction does not involve any fees.

Section A.3: Problem Solving with Units**Working with units**

- (1) Identify the units involved in the problem. Use the units to help you decide how to approach the problem and what units to expect in the answer.
- (2) Perform any operations (addition, multiplication,...) on both the numbers and the associated units. Remember:
 - You cannot add or subtract numbers with different units (you cannot add apples and oranges), but you can combine different units through multiplication, division or raising to powers.
 - To make your work with units easier, replace division with multiplication by the reciprocal.
- (3) When you complete your calculations, make sure that your answer has the units you expected. If it doesn't, then there is a mistake.

Ex.20

A car is traveling 25 miles every half-hour. How fast is it going?

Ex.21

You are buying 30 km^2 of farm land at a cost of \$12,000 per km^2 . What is the total cost?

Ex.23 Gas Mileage.

After a long day of driving, your destination is only 90 miles away. You know that your car gets 25 miles per gallon. How much gas do you need in your tank if you are to reach the destination without stopping? If you have a 12-gallon tank and the fuel gauge shows it is one-quarter full, will you make it?