

Announcements

- Snapshot 8 this week over Writing Project Reflection
- Midterms returned on ~~Wednesday, Oct 30th~~ in recitation *Thursday 10/31*
- Grades will be posted as TAs finish grading
- Writing Project due Monday, Nov 4th
 - Make sure you follow the rubric!!

Dimensional Analysis

+

— Order of Magnitude —

There were approximately 2.2 million marriages in the United States in 2015. Express this quantity in marriages per hour.

Common Unit Conversions

Time

1 year = 365 days

1 day = 24 hours

1 hour = 60 minutes

1 minute = 60 seconds

Currency

\$1 USD = \$1.31 CAD

\$1 USD = 680.00

Chilean Peso

Distance

10mm=1cm

100cm=1m

1000m=1km

2.54 cm = 1 inch

1 foot = 12 inches = 0.3048m

3 feet = 1 yard

1 mile = 5280 feet

1 mile = 1776 yards

1 mile = 1.61km

Volume

1 gal = 3.785 L

1L=1000 cm³

Unit Conversion - General Strategy

Multiply by the appropriate form of 1 - a **conversion factor**.

Example. Convert 30 inches into feet.

Example. Convert 2.8 feet into inches.

Example. Convert 20mi/h in to ft/s.

Unit Conversion - General Strategy

Multiply by the appropriate form of 1 - a **conversion factor**.

Example. Convert 30 inches into feet.

$$30\text{in} = 30\text{in} * 1 = 30\text{in} * 1\text{ft}/12\text{in} = 5/2 \text{ ft} = 2.5\text{ft}$$

In this case we used the conversion factor $1=1\text{ft}/12\text{in}$

Example. Convert 2.8 feet into inches.

$$2.8\text{ft} = 2.8\text{ft} * 1 = 2.8\text{ft} * 12\text{in}/1\text{ft} = 33.6\text{in}$$

In this case we used the conversion factor $1=12\text{in}/1\text{ft}$

Example. Convert 20mi/h in to ft/s.

$$20\text{mi}/\text{h} = 20\text{mi}/\text{h} * 1 * 1 = 20\text{mi}/\text{h} * 5280\text{ft}/1\text{mi} * 1\text{h}/3600\text{sec} = 29.33\text{ft}/\text{sec}$$

In this case we used the conversion factor $1=5280\text{ft}*\text{h}/(3600\text{mi}*\text{sec})$

Unit Conversion-PollEverywhere L8-Q1a

1 gal = ???? m³

A. 1 m³

B. 0.003785 m³

C. 3.785 m³

Unit Conversions

Your car gets an average of 35.5 mpg. Your sister lives in Europe and says that her car gets an average of 7.9L/100km. Whose car has the better fuel economy?

- What does a bigger number mean in terms of efficiency?
 - Which has better fuel economy? 30 mpg or 20 mpg?
 - Which has better fuel economy? 8L/100km or 3L/100km?

Unit Conversions

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?

Unit Conversions

A gas station in Canada sells gasoline for CAD 1.23 per liter. What is the price in US dollars per gallon?

Big Numbers in the News Recently...

- Venezuela's inflation will hit **1 million percent**.
 - a candy bar that cost \$1 today would cost \$10,000 at the end of a year.
- Record **\$1.6B** jackpot (Oct 2018)
- As of Feb 11, 2019 the US National Debt was **\$22 trillion**

Million = 1,000,000 = 10^6

Billion = 1,000,000,000 = 10^9

Trillion = 1,000,000,000,000 = 10^{12}

.....quadrillion, quintillion, sextillion, septillion, octillion, nonillion, and decillion

Fix this
meme

Powerball 1.3 Billion
÷ U.S. Pop 300 Million

Everyone receives 4.33 mil
@Livesosa

Poverty Solved!!

- Philippe Andolini

Scientific Notation

Scientific notation is a format in which a number is expressed as a number between 1 and 10 multiplied by a power of 10.

Example. Rewrite in scientific notation:

- A. The total spending in the new federal budget is \$4,200,000,000,000.
- B. The diameter of the hydrogen nucleus is about 0.000 000 000 000 001 meter.

Example. $1\text{mm} = 10^{??}\text{m} = 10^{??}\text{km}$

Orders of Magnitude

An **order of magnitude** estimate specifies only a broad range of values, usually within one or two powers of ten, such as “in the ten thousands” or “in the millions”.

10^{-2}

10^1

10^{-1}

10^2

10^0

10^3

Orders of Magnitude

The average adult human has a height of about:

10^{-2} meters

10^1 meters

10^0 meters

10^3 meters

Orders of Magnitude - PollEverywhere L8-Q1

You are multiplying 1277 times 14,385. You expect the answer to be a number between 1 and 10 times

A. 10^3

B. 10^5

C. 10^7

Orders of Magnitude - PollEverywhere L8-Q2

Earth is approximately 1×10^7 meters in diameter. Which of the following could be Earth's diameter?

- A. 1,271,543 meters
- B. 12,715,430 meters
- C. 127,154,300 meters
- D. 1,271,543,000 meters

Orders of Magnitude - PollEverywhere L8-Q3

The height of a typical kitchen table is approximately...

- A. 10^{-2} m
- B. 10^0 m
- C. 10^1 m
- D. 10^2 m

Orders of Magnitude - PollEverywhere L8-Q4

The mass of a high school football player is approximately...

- A. 10^0 kg
- B. 10^1 kg
- C. 10^2 kg
- D. 10^3 kg

Think About It--to the nearest order of magnitude

What is the diameter of a proton? (L8-Q5)

- A. 10^{-14} m B. 10^{-5} m C. 10^0 m

What is the diameter of the Earth? (L8-Q6)

- A. 10^3 m B. 10^7 m C. 10^{15} m

What is the diameter of the Milky Way Galaxy? (L8-Q7)

- A. 10^{10} m B. 10^{15} m C. 10^{21} m

Orders of Magnitude -- Video

[Powers of Ten](#)