Announcements

- Snapshot 8 this week over Writing Project Reflection
- Midterms returned on Thursday, March 14 during recitation
- Grades will be posted as TAs finish grading

Dimensional Analysis

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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 (2B)

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 cm^3

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.
30in = 30in * 1 = 30in * 1ft/12in = 5/2 ft = 2.5ft
In this case we used the conversion factor 1=1ft/12in

Example. Convert 2.8 feet into inches.
2.8ft = 2.8ft * 1 = 2.8ft *12in/1ft = 33.6in
In this case we used the conversion factor 1=12in/1ft

Example. Convert 20mi/h in to ft/s.
20mi/h = 20mi/h * 1* 1 = 20mi/h * 5280ft/1mi * 1h/3600sec = 29.33ft/sec
In this case we used the conversion factor 1=5280ft*h/(3600mi*sec)

Unit Conversion

1 gal = ???? m^3

Unit Conversions (2B)

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 (2B)

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 (2B)

A gas station in Canada sells gasoline for CAD 1.34 per liter. What is the price in 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!!

- Philipe Andolini

© @esteyban

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. 1mm = $10^{??}$ m = $10^{??}$ 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} $\qquad\qquad\qquad\qquad\qquad\qquad$ 10^{1}

10^{-1} $\qquad\qquad\qquad\qquad\qquad\qquad$ 10^{2}

10^{0} $\qquad\qquad\qquad\qquad\qquad\qquad$ 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 1x10^7 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. 100 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](#)