$1\text{cm} = 10^{-1}$ meter (m)

$1 \text{ km} = 10^3 \text{ m}$

$100 \text{ km} = 10^5 \text{ m}$

$1000 \text{ km} = 10^6 \text{ m}$

light year $= 10^{16} \text{ m}$

$1 \text{ mm} = 10^{-3} \text{ m}$

1 micrometer =
$1 \text{ } \mu\text{m} = 10^{-6} \text{ m}$

1 nanometer =
$1 \text{ nm} = 10^{-9} \text{ m}$

Smiling Face

10 Centimeters

https://www.youtube.com/watch?v=Usj6viU0AaI

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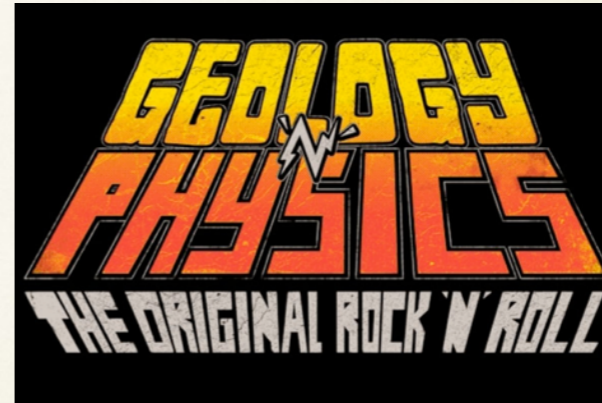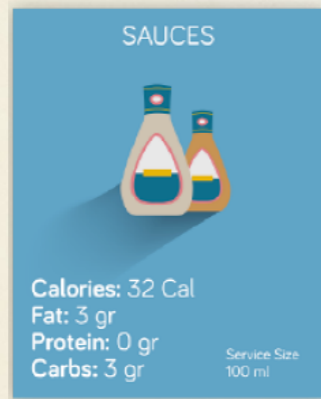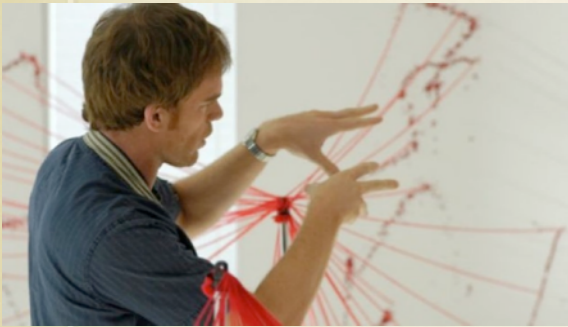**Smiling Face**

10 Centimeters

Today's Plan

- A few class logistics

- Scientific Notation

- Units and Converting Units

- Estimation

- Significant Figures

- Brief trigonometry review(?)

- NOT polar coordinates or atoms/quarks (Sec. 1.2)

Extra Practice Problems (Answers in back of book): 1.7, 1.9, 1.11, 1.15, 1.19, 1.21, 1.23, 1.31, Conceptual 1, 5, & 11

Overview of notecard answers

- Improve critical thinking/analysis

- Like physics and/or "required class"

- Learn physics ☺

- Some of you are completely new, some have had physics before.

Homework and Reading Assignments

Due day before next class, midnight
(today's: due tomorrow, 11:59pm)
Note: extra credit for correct answers,
11am before class.

WebAssign.

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My Assignments

Current Assignments (1)

Name	Due
1/11 Homework and Reading: Ch. 1	Jan 12 2017 11:59 PM EST

1/11 Homework and Reading: Ch. 1 (Homework)

Current Score : – / 2   **Due :** Thursday, January 12 2017 03:09 PM EST

Print Assignment

Question	1	2	3	4	Total
Points	–/0	–/0	–/1	–/1	–/2 (0.0%)

Description

Read Chapter 1. Homework to be completed via WebAssign. In[...] problems; these will not contribute to your score.

Instructions

QUESTIONS 3 AND 4 WILL CONTRIBUTE TO YOUR GRADE.

1.   – /0 points   SerCP10 1.WU.001.

Convert the following numbers to scientific notation.

(a)   568,083

[____] × 10 [__]

(b)   0.000385

[____] × 10 [__]

Need Help?   [Read It]

4.   – /1 points   SerCP10 1.P.022.WI.

Suppose your hair grows at the rate of 1/68 inch per day. Find the rate at which it grows in nanometers per second. Because the distance between atoms in a molecule is on the order of 0.1 nm, your answer suggests how rapidly atoms are assembled in this protein synthesis.

[____] nm/s

Need Help?   [Read It]   [Watch It]

[Submit Assignment]   [Save Assignment Progress]

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Need Help? Read It Watch It

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Need Help?   Read It   Watch It

Submit Assignment   Save Assignment Progress

iClickers

- **Starting next Wednesday**

- 20% correctness, 80% participation

- iClicker Registration :

  - When you register on eCampus, it will show you which number is needed off of the back of the iClicker.

Yippee!

Questions? Need help?
Contact iclicker at support@iclicker.com or by phone at 866-209-5698.

Main ideas today

- Scientific Notation

- Units and Converting Units

- Estimation

- Significant Figures

- Brief trigonometry review?

- NOT polar coordinates or atoms/quarks (Sec. 1.2)

Extra Practice Problems (Answers in back of book): 1.7, 1.9, 1.11, 1.15, 1.19, 1.21, 1.23, 1.31, Conceptual 1, 5, & 11

Scientific notation

6,022 inches

is the same as saying

6.022 x 1000 inches

is the same as

6.022 x 10^3 inches

Scientific notation

6,022 inches

is the same as saying

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is the same as

coefficient

6.022×10^3 inches

Only one digit
between 1-9 on
left of decimal!

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base

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6,022 inches

is the same as saying

6.022 x 1000 inches

is the same as

coefficient   exponent ("order of magnitude")

$$6.022 \times 10^3 \text{ inches}$$

base

Only one digit between 1-9 on left of decimal!

Direction and number of spots the decimal point is shifted

Scientific notation
LONG NUMBER SHORT-HAND

~37,200,000,000,000 cells in body
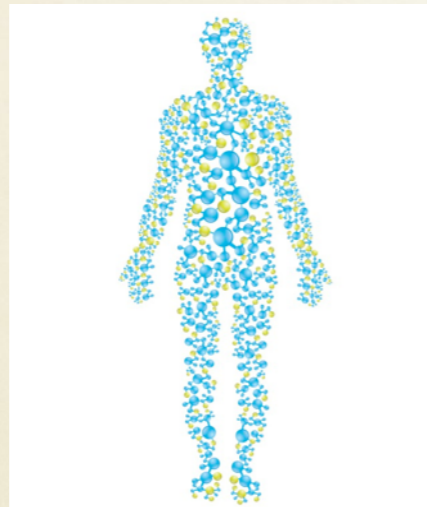
~200,000,000,000 galaxies (in known universe)

3.72 x 10^{13} cells

2 x 10^{11} galaxies

- Warnings:

- To write in WebAssign or Google, you would write "**3.72e+23**" (or with all the zeros)

- For example, "0.000023" and "2.3e-5" are same in WebAssign

- EE in calculator, not e^x

Take a relaxing drive to Canada

Take a relaxing drive to Canada

Units

In the fateful year 1960…

"UNITE!"
(Metric/SI system)

meter = 3.28 ft
kilogram = 2.2 lb
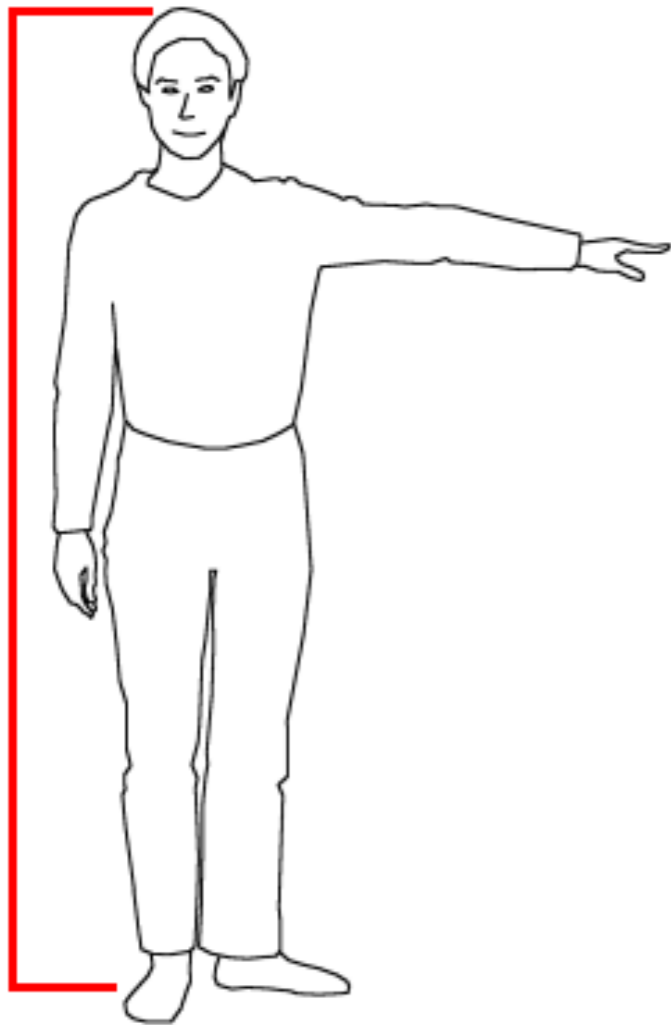second
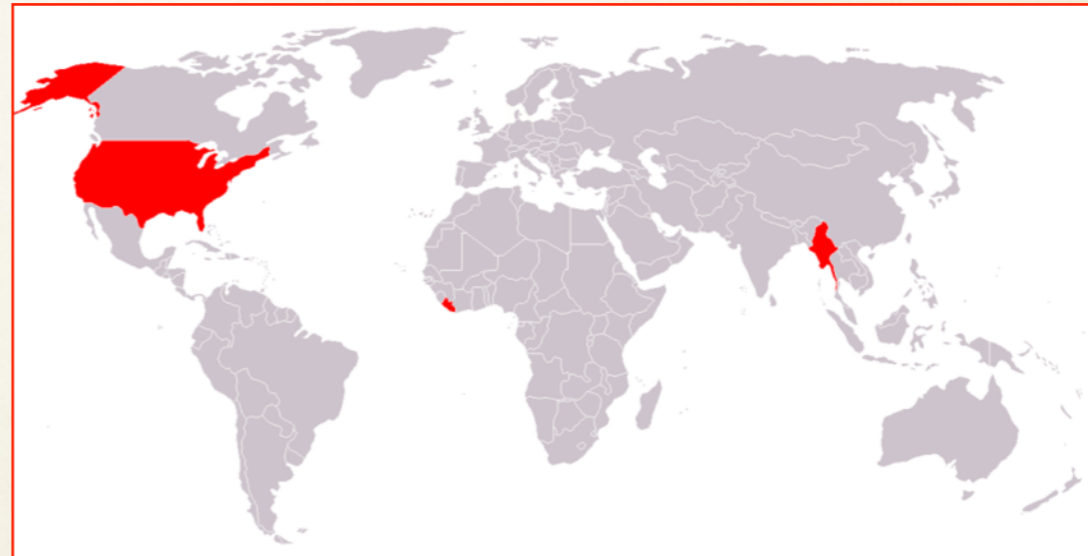
"Nah"
(Imperial system)

foot = 0.30 m
pound = 0.45 kg
second

Approximate Values in SI Units

Height of person

~ 2 m (6.5 feet)

Average weight of person

~ 80 kg (176 lbs.)

Would 100 kg be an incorrect **estimate**?

Average life of person

~ 2 x 10^9 s (2 billion seconds) = 63.4 years

Units

Some common short-hands for scientific notation

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Scientific Notation: 2×10^{-9} m Big or Small?

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Scientific Notation: 2×10^{-9} m Big or Small?

Prefixes:
kilo(k) = 10^3 or 1000
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Conversion examples:
1 kilometer (1km) = 1000 meters (1000 m)
1000 mm = 1m
1000 grams = 1 kg

ALWAYS use units!

101.2

Units and Dimensional Analysis

I won't test you on this explicitly, but it makes everything easier.

A + B = C

To add terms together, they must have the same units.

7 m + 10 m = 17 m

A x B = C

Units on each side of the equation must be the same.

Speed x time = distance travelled

$$60 \frac{km}{h} \times 2\ h = 120\ km$$

Conversion of units

- You might need to convert from familiar to standard units or vice versa

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A student is going to study abroad during the summer and is looking for an apartment in Europe. She finds an ad for an apartment of 90 square meters. How many square feet is that? Is this a big apartment?   (1 m = 3.28 ft)

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90 m^2

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$$90 \text{ m}^2 \ \ X \ \frac{3.28 \text{ ft}}{1 \text{ m}} X \ \frac{3.28 \text{ ft}}{1 \text{ m}} = 968 \text{ ft}^2$$

Fast or slow?

$1 \text{ mile} = 1.6 \times 10^3 \text{ meters}$

HOW MANY MILES PER HOUR?

"Order of magnitude" Estimation

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- **Sometimes** an exact answer is not necessary. Within a factor of 10 might be fine.

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  - How many gumballs fit in a jar (contests).

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- Used when you only need to "**estimate**"

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  - How many gumballs fit in a jar (contests).

  - **Use whenever uncertainty in numbers is large.**

Significant Figures

- Measurements are not typically perfect

- Even if not estimating, there is some error

- Significant figures are used to indicate how confident you are in the number given

22 inches means accurate to 1 inch (means it could be 21 to 23 inches)

2 significant figures

22.0 inches means accurate to 0.1 inches (or 21.9 to 22.1 inches)
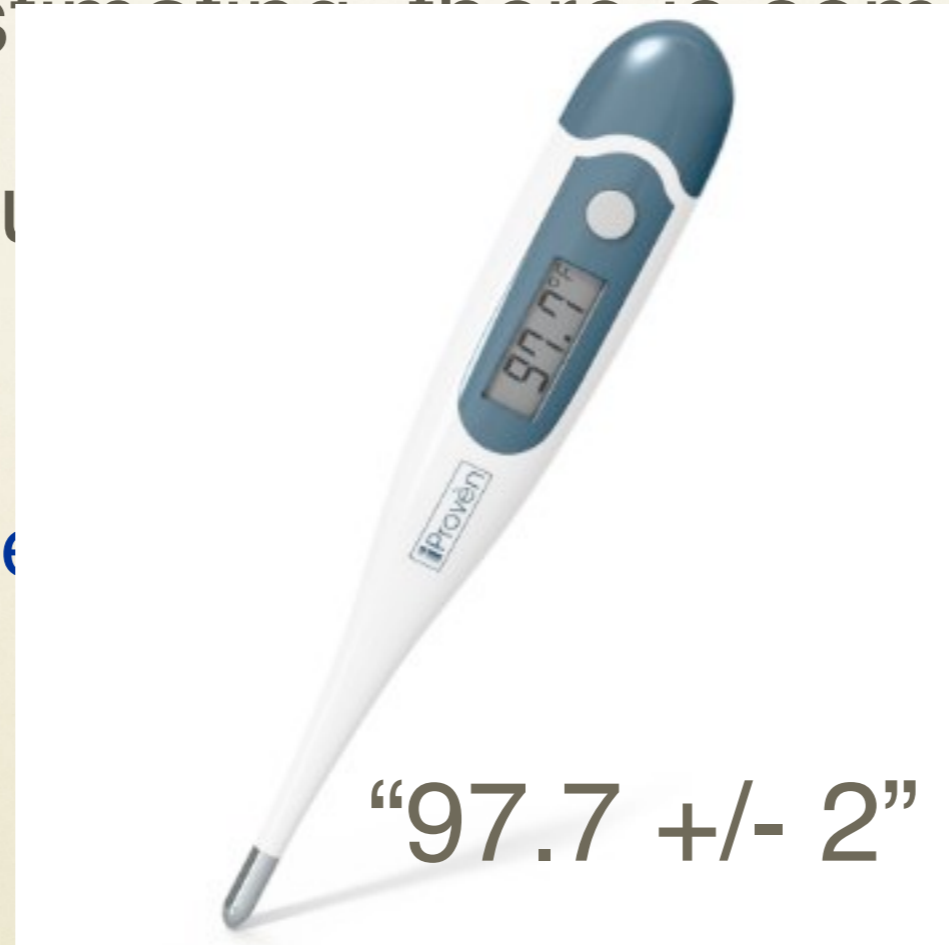
3 significant figures

Significant Figures

...nts are not typically perfect

...stimating there is some error

...gur...ate how
...u ...er

22 inches me... ...ne...

"97.7 +/- 2"

22.0 inches means accurate to 0.1 inch... to 22.1 inches)

3 significant figures

Significant Figures in Scientific Notation

- All Significant Figures should always appear when a number is in scientific notation.

- Examples:

Scientific notation

1204.730 1.204730×10^{3}

Significant Figures in Scientific Notation

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Scientific notation

1204.730 1.204730×10^3

How many significant figures are in this **number**?

1200….. is it   **1.2×10^3**   OR   **1.20×10^3**   OR   **1.200×10^3** ?

If needed, problem should state uncertainty

Significant Figures

- Sum or subtraction: use accuracy of least accurate number (decimal position)

    - 120.031 + 11.3 = 131.3

- Multiplication or division: use smallest number of significant digits.

    - 28.0 × 21.3 = 596

    - 28 × 21.3 = 600 or 6.0×10^2

- My tests and WebAssign will not explicitly test you on significant figures (3 or 4 will be fine).

- If use less, WA might give you an error.

Remember

- ALWAYS USE UNITS!

- Dimensional analysis

  - Treat units like a variable!

  - Both sides must match!

- Estimation

  - OK when data not precise.

- Significant figures

  - May save your life some day

Practice Conversions and Sig Figs

- A rectangular building lot measures 104 ft by 151 ft. Determine the area of this lot in square meters (m^2). Area = length x width

$$(1 \text{ m} = 3.28 \text{ ft})$$

Practice Conversions and Sig Figs

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- Two possible strategies. Convert ft to meters of each dimension before multiplying

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Practice Conversions and Sig Figs

- A rectangular building lot measures 104 ft by 151 ft. Determine the area of this lot in square meters (m^2). Area = length x width

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  OR

- Find the answer in square feet and then convert to square meters

$$(1 \text{ m} = 3.28 \text{ ft})$$

Practice Estimation:
The Importance of Recycling

Soft drinks are commonly sold in aluminum containers. **Estimate** how many such containers are thrown away or recycled each year by U.S. consumers?

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In some states, you can get 5 cents per can. Estimate how much money would you get if you recycled all of the cans in the US for one year?

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In some states, you can get 5 cents per can. Estimate how much money would you get if you recycled all of the cans in the US for one year?

About how much would the average US citizen get?

SOH CAH TOA!
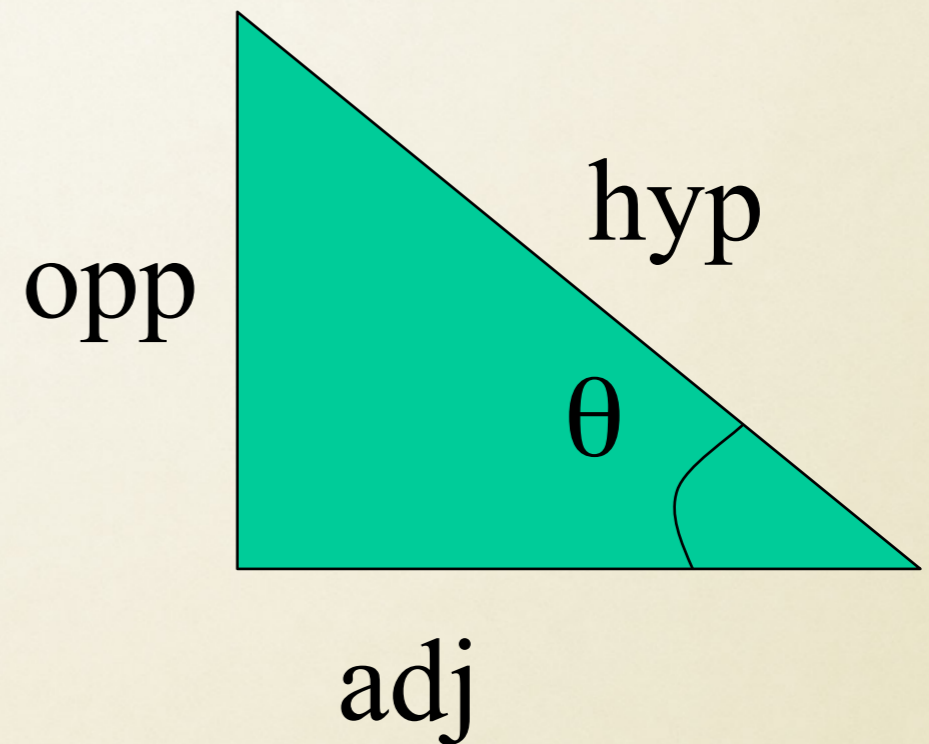
SOH CAH TOA!

For right triangles…
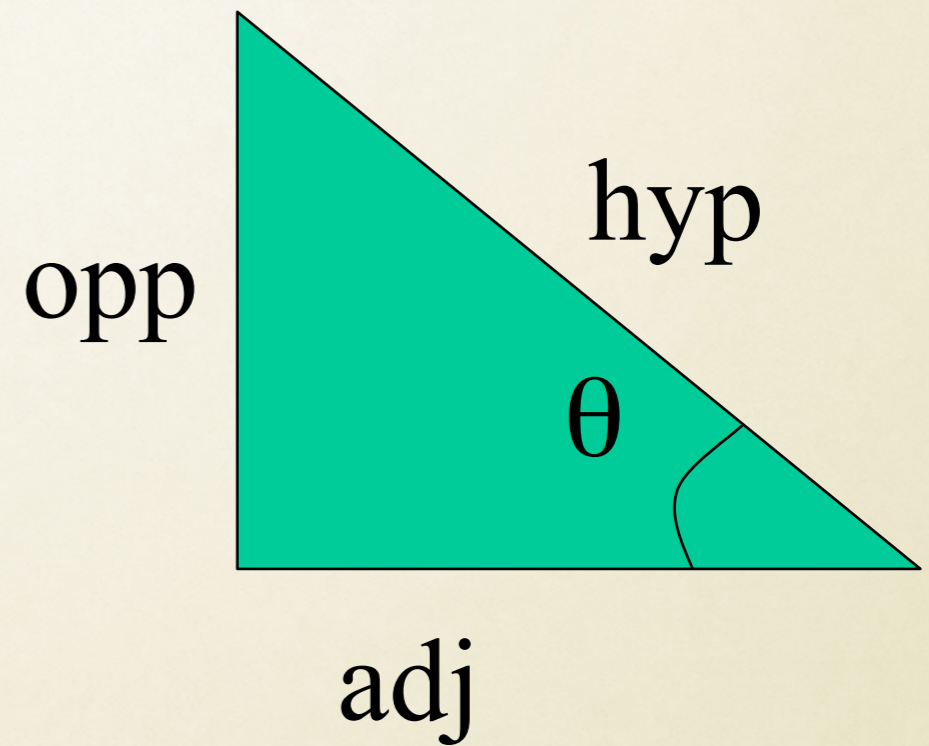
opp

hyp

θ

adj

SOH CAH TOA!

For right triangles…

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$
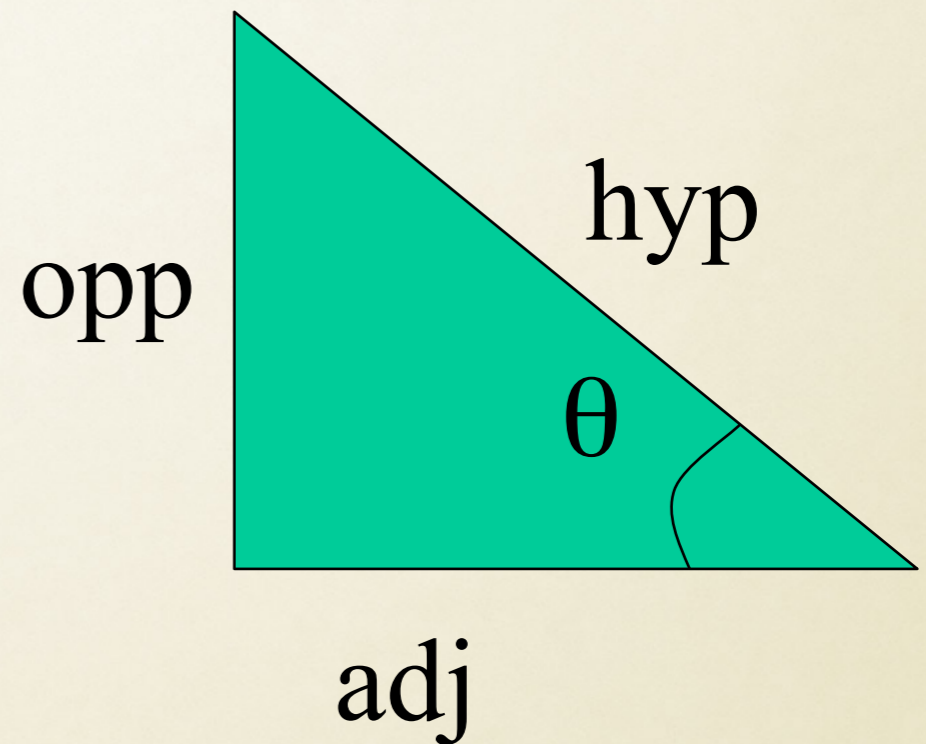
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$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$$

opp   hyp

θ

adj

$$a^2 + b^2 = c^2$$

(Pythagorean Thm.)

c = hypotenuse

Example: Surveying the River

A surveyor wants to measure the distance across a river. Starting directly across from a tree on the opposite bank, he walks 100 m along the riverbank to establish a baseline. Then, he sights across to a big tree. The angle from his baseline to the tree is 35 degrees. How wide is the river?
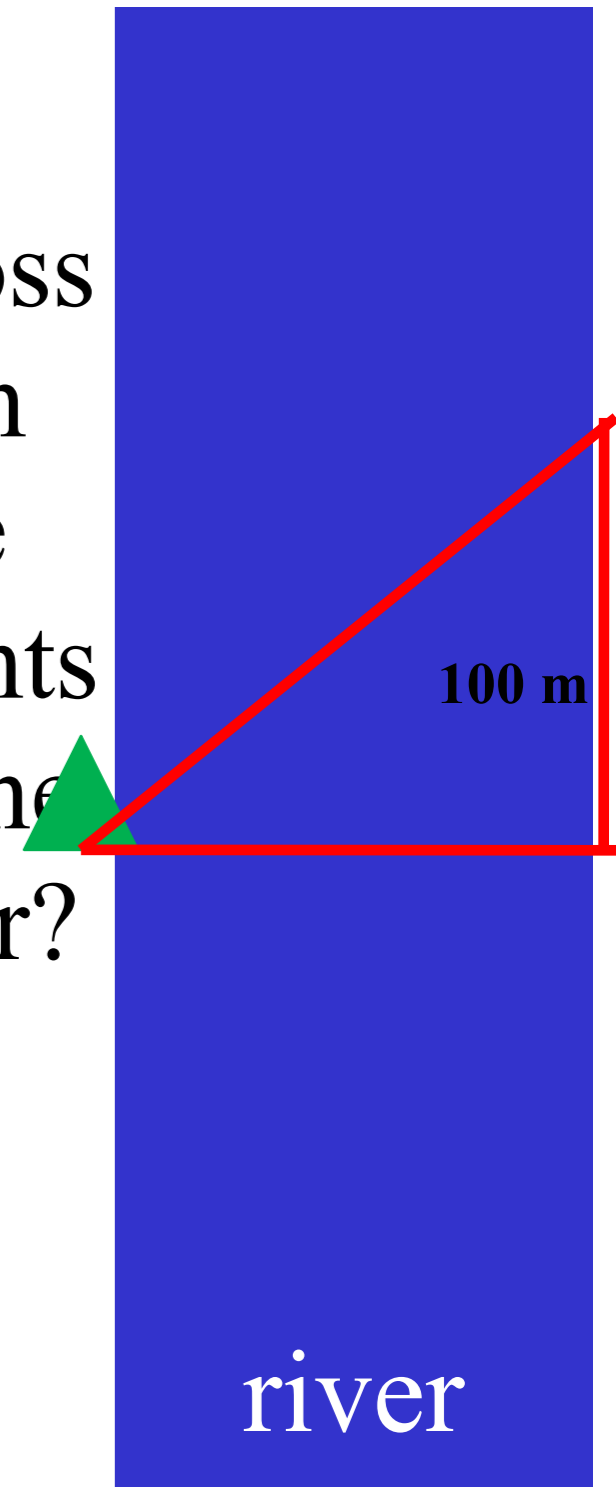
Draw a picture.

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Draw a picture.

100 m

river

Powerball 1.3 Billion ÷ U.S. Pop 300 Million

Everyone receives 4.33 mil
@Livesosa
Poverty Solved!!

- Philipe Andolini

Powerball "Math"

People often struggle with large number math.

Powerball 1.3 Billion 1.3×10^9

÷ U.S. Pop 300 Million 3.0×10^8

Everyone receives 4.33 mil

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POWERBALL "MATH"

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