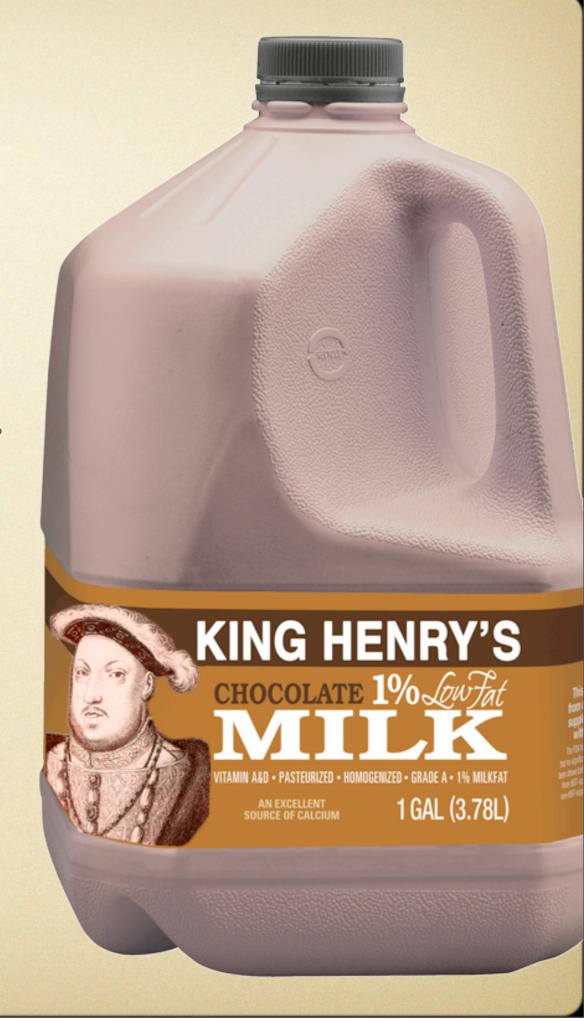# Math with Scientific Notation

Prefixes You Must Know

Power of 10	Exponent	Prefix	Symbol	Common Name
9	10^9	**giga**	G	billion
6	10^6	**mega**	M	million
3	10^3	**kilo**	k	thousand
2	10^2	**hecto**	h	hundred
1	10^1	**deca**	da	ten
-1	10^{-1}	**deci**	d	tenth
-2	10^{-2}	**centi**	c	hundredth
-3	10^{-3}	**milli**	m	thousandth
-6	10^{-6}	**micro**	μ	millionth
-9	10^{-9}	**nano**	n	billionth

Time to Forget Henry

- King Henry Did Usually Drink Chocolate Milk.. but that's for kids.

Scientific Notation

- A number in scientific notation looks like...

$$4.25 \times 10^3 \text{ m}$$

- Number
  - Must start with an integer from 1 to 9
  - 0.21×10^2 isn't quite right

- Power of 10

- Units
  - one of the most important parts

Easier to Read

300,000,000 m/s

- the speed of light is 300,000,000 meters each second

- Find the decimal

- Move the decimal - count how far it goes

- Use that for the exponent

Which is Easier to Read?

300,000,000 m/s   or..

3×10^8 m/s

Easier to Read

0.0000065 m

- Really small numbers work too

- Find the decimal

- Move the decimal - count how far it goes

- This time, the exponent is negative

Which is Appropriate?

0.0000065 m or..

6.5×10^{-6} m or..

6.5 μm

Not as Far To Go

$$8500 \times 10^6 \text{ g}$$

- This number isn't quite in scientific notation

- Find the decimal

- Move the decimal & count how far it goes

- Change the exponent by that much

$$8500 \ \text{x}10^6 \ \text{g}$$

- You moved the decimal **3** times

- The number **"looks"** *smaller*

- The exponent must become bigger by **3**

$$8.5 \ \text{x}10^9 \ \text{g}$$

$$8.5 \ \text{Gg} \quad 8.5 \ \text{x}10^6 \ \text{kg}$$

Practice

Change these into scientific notation

38,600 m

157,300 s

147 cm

93,000,000 miles

Change these into scientific notation

0.715 kg

0.00083 g

0.000025 s

0.00083 m

Change these OUT OF scientific notation

9.3×10^6 kg

3.75×10^2 m

8×10^4 N

2.39×10^{18} s

Change these OUT OF scientific notation

4.8×10^{-5} kg

7.21×10^{-3} m

3×10^{-2} N

5.9×10^{-9} s

Change these into the required power of ten
(does not require scientific notation)

(10^3) 38,600 m

(10^3) 1,450 g

(10^6) 540,000 Watts

(10^{-3}) 0.0253 s

Changing the Prefix

Conversions
powers of 10

- How many centimeters are in 6.8 meters?

- $1 \text{ m} = 1 \times 10^2 \text{ cm}$

  - (or $1 \text{ cm} = 1 \times 10^{-2} \text{ m}$)

- $6.8 \text{ m} = 6.8 \times 10^2 \text{ cm}$

  - and you can say 680 if you'd prefer

Two steps

- How many cm are in 5 km?

- Work with each prefix

  - 1 km = 1 x 10^3 m

  - 1 cm = 1 x 10^{-2} m

  - the two are 5 places apart

Watch Directions!

- Decision: How many cm are in 5 km?

- is it 5×10^5 or 5×10^{-5}

- a lot or only a part of one?

- 500,000 or 0.00005

- 5×10^5 cm in 5 km

Math with Exponents

Multiplication

- What is 640,000 times 20,000?

- $(6.4 \times 10^5) \times (2 \times 10^4)$

  - multiply the values $(6.4 \times 2 = 12.8)$

  - Add the exponents $5 + 4 = 9$

- state your answer 12.8×10^9

Division

- $(6.4 \times 10^5) / (2 \times 10^4)$

- divide the values $(6.4 / 2 = 3.2)$

- subtract the exponents $5 - 4 = 1$

- state your answer 3.2×10^1

  - Unless you MUST use scientific notation, simplify your answer to 32

Practice

$(7.2 \times 10^4) \times (3 \times 10^3)$

$(4.2 \times 10^5) \times (6 \times 10^{-2})$

$(6.3 \times 10^4) / (3 \times 10^3)$

$(4.8 \times 10^5) / (6 \times 10^{-2})$

What is...
1 dollar plus 1 dime?

- Is it **2** of **anything**?

- 1.10 dollars

- 11 dimes

- How do you get these answers?

Addition

- $(6.4 \times 10^5) + (2 \times 10^4)$

- Pick one to change

- $(64 \times 10^4) + (2 \times 10^4)$

- 66×10^4

  - or 6.6×10^5

Practice

$(3.5 \times 10^4) - (2.8 \times 10^3)$

$(5 \times 10^6) + (0.51 \times 10^8)$

$(6.0 \times 10^{-3}) + (5.0 \times 10^{-4})$

$(5.0 \times 10^9) + (3.0 \times 10^{-1})$

Does that last one seem strange to solve?