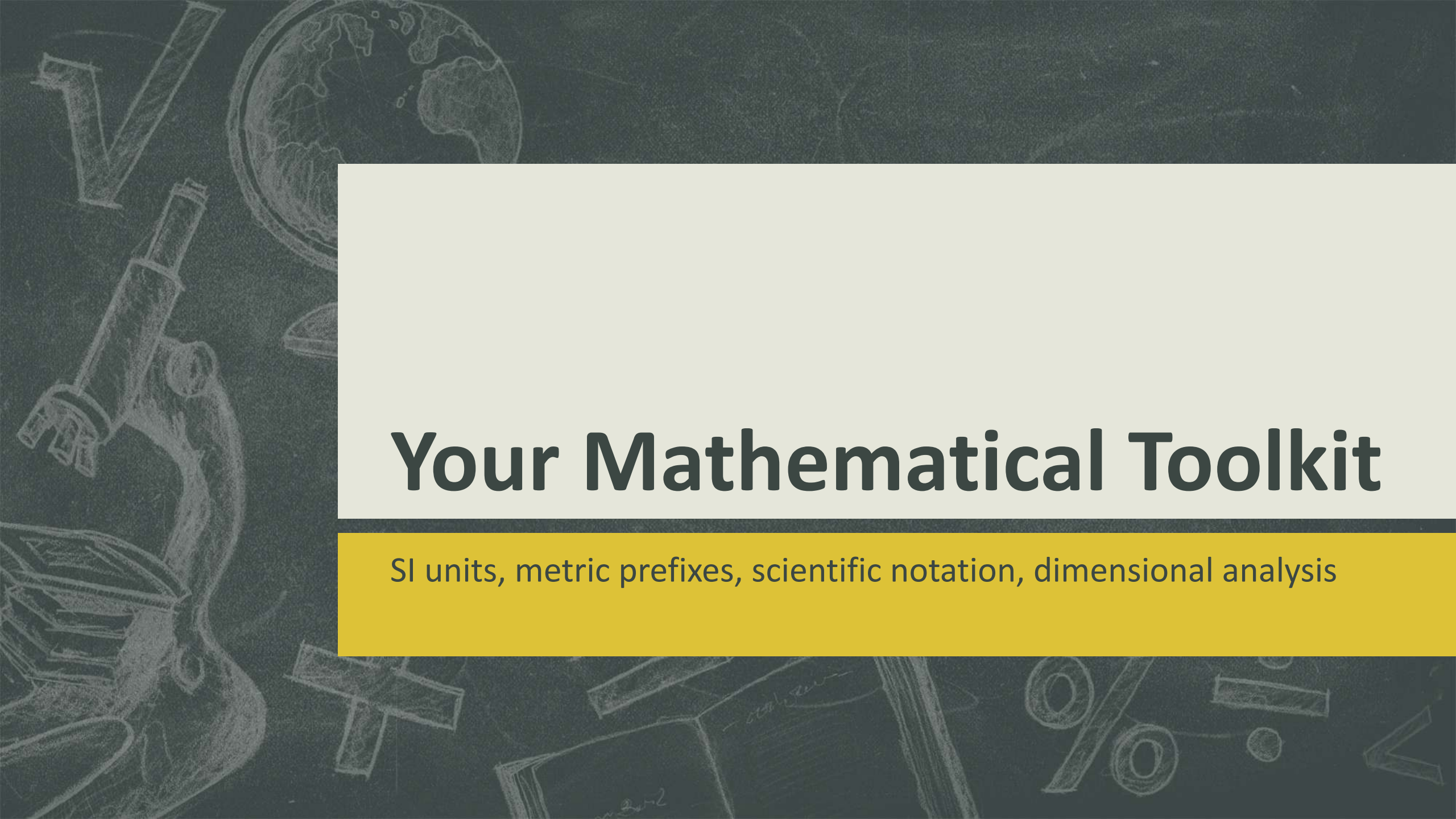
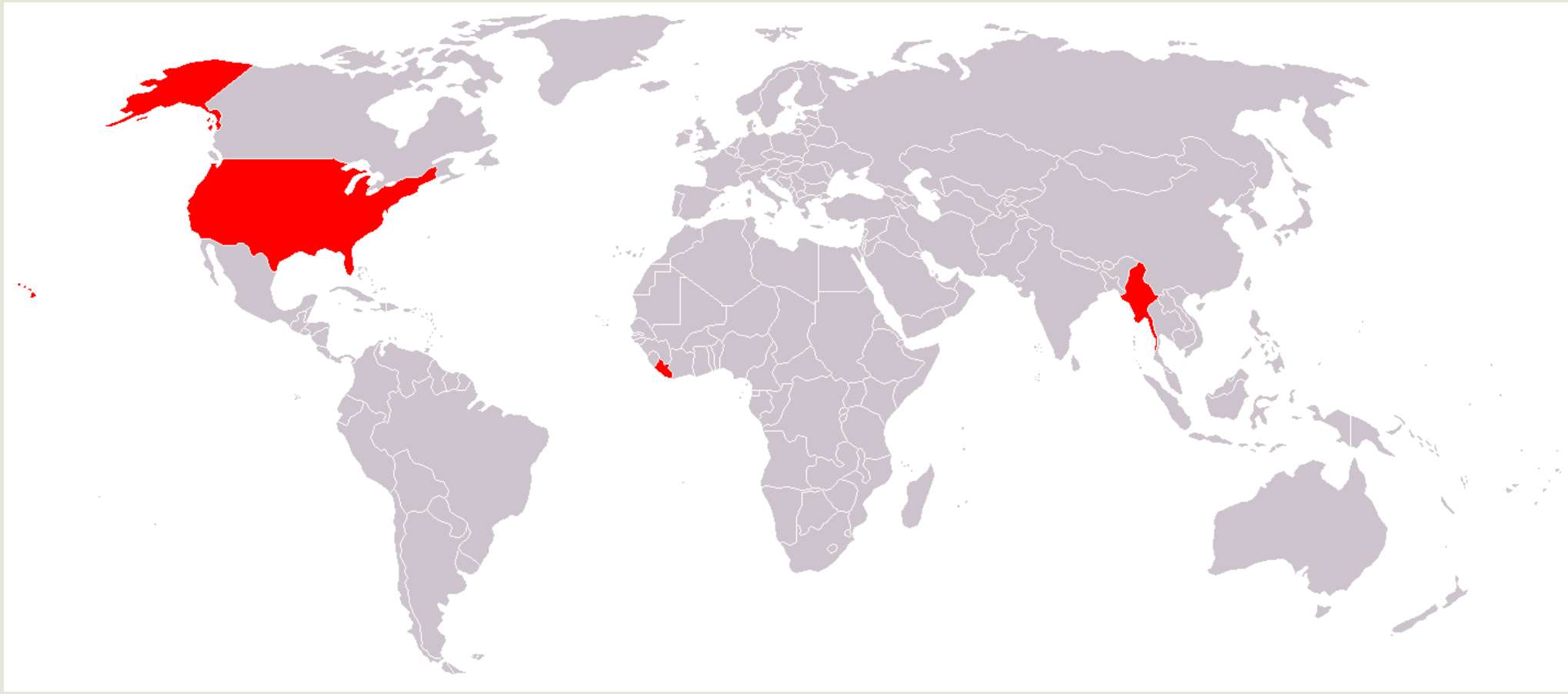


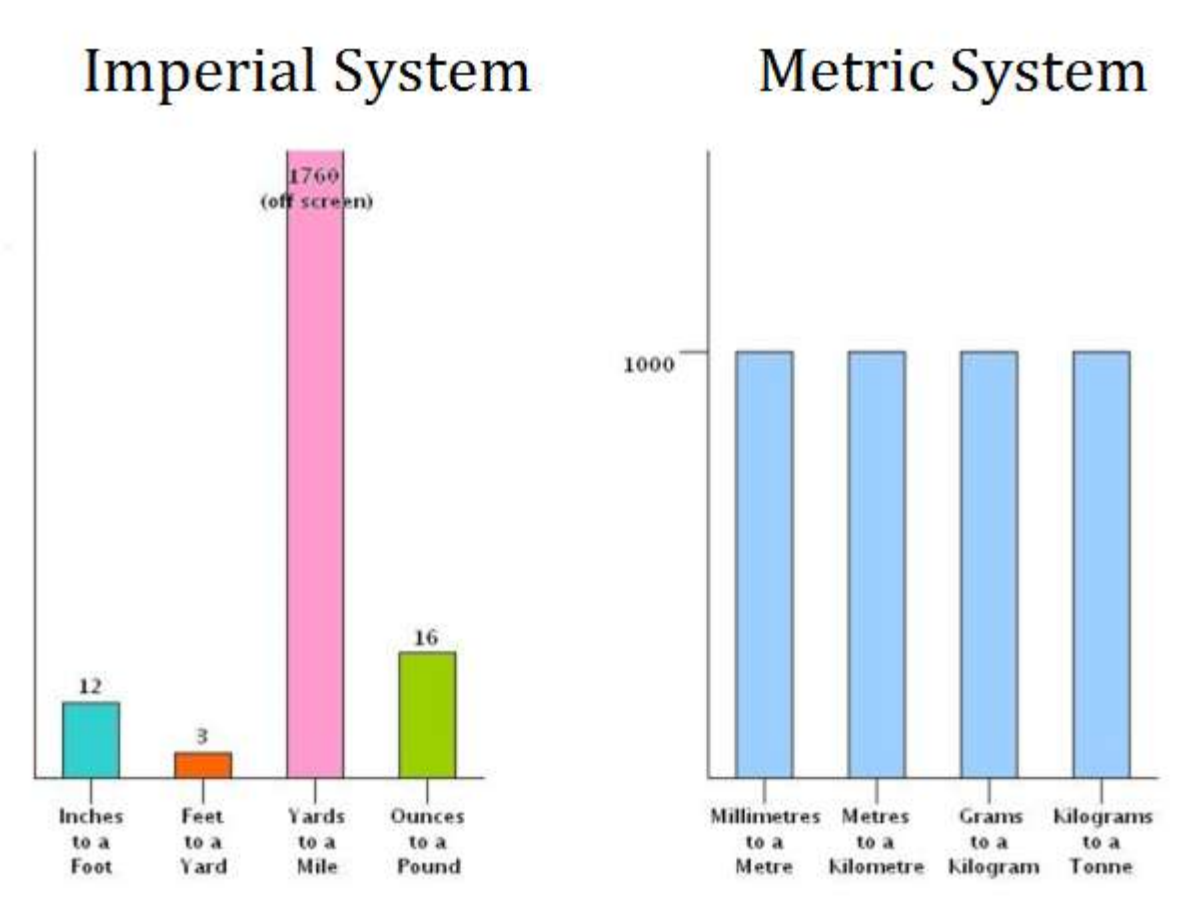
Your Mathematical Toolkit

SI units, metric prefixes, scientific notation, dimensional analysis

What do the United States, Myanmar, and Liberia have in common?



What is the metric system?



It consists of two things:

- SI Units
  - *Le Système international d'unites*
- Prefixes that increase by bases of 10.
  - Much easier and more consistent than 12, 3, and 1760.
  - Multiplying by 10 is easy!

SI Units

Quantity	Unit	Symbol	What does it measure?
Length	Meter	m	Distance between two points
Time	Second	s	Duration between two occurrences
Mass	Kilogram	kg	Amount of matter in an object

Prefixes used with length, time, and mass

Prefix	Symbol	Factor	Scale
Tera	T	10^{12} (1,000,000,000,000)	Trillion
Giga	G	10^{9} (1,000,000,000)	Billion
Mega	M	10^{6} (1,000,000)	Million
Kilo	k	10^{3} (1,000)	Thousand
Deci	d	10^{-1} (0.1)	one tenth
Centi	c	10^{-2} (0.01)	One hundredth
Milli	m	10^{-3} (0.001)	One thousandth
Micro	µ	10^{-6} (0.000001)	One millionth
Nano	n	10^{-9} (0.000000001)	One billionth
Pico	p	10^{-12} (0.000000000001)	One trillionth

Practice using SI Units and Prefixes

- Nanometer
- Megasecond
- Centimeter
- Picosecond
- Terabyte

Scientific Notation

- A method of expressing very large or very small quantities as powers of 10.
- Why do we use it?
  - Easily able to express very large or very small quantities.
  - Mass of an electron:
    - 0.000000000000000000000000000000911 kg
    - Orrrr… 9.11×10^{-31}

Converting between decimals and scientific notation

- General expression:

$$\#.\#\# \times 10^{\#}$$

- Move the decimal so that there is one number in front of the decimal.
- >1 ⇔ positive exponent
- <1 ⇔ negative exponent

Practice with Scientific Notation

- 6
- 7×10^{7}
- 9000000000
- .00000821
- .05

Multiplying and Dividing Scientific notation

- Multiplying:
  - Multiply coefficients
  - Add exponents

$(6.02 \times 10^{23})(2.9 \times 10^{2})$

$(3.14 \times 10^{5})(5.8 \times 10^{-8})$

- Division
  - Divide Coefficients
  - Subtract exponents

$$\frac{(6.02 \times 10^{23})}{(2.9 \times 10^{2})}$$

$$\frac{(3.14 \times 10^{5})}{(5.8 \times 10^{-8})}$$

Dimensional Analysis

- How many seconds are in a year?
- How many inches are in a meter? (1 inch= 2.54 centimeters)
- How many meters are in 55 miles? (1 mile = 1760 yards)
- How fast is 55 mph in m/s?

Solving for a variable

- Order of operations:
  - Parenthesis
  - Exponents
  - Multiplication
  - Division
  - Addition
  - Subtraction

- Solving for a variable: get rid of the farthest thing first.
- $7x+8 = 15$
- $(5x+8)^2 = 169$

Graphing

Positive, negative, no correlation