

Math!

WELCOME TO
BASIC
ASTRONOMY.
BEFORE WE
START, ARE
THERE ANY
QUESTIONS?

YEAH, LIKE,
WHAT MAKES
ASTRONOMY
DIFFERENT
FROM
ASTROLOGY?

LOTS
AND LOTS
OF
MATH

ASTRONOMY
101



The Metric System

- Based on powers of 10, easier than English system
- Mass = grams, length = meters
- 1 kilometer = 1000 meters (thousand)
- 1 meter = 100 centimeters (hundredth)
- 1 meter = 1000 millimeters (thousandth)
- 1 AU = 149,600,000 kilometers (Earth-Sun distance)

Conversions

- Sometimes we need to convert units so that our answer makes more sense
- Use conversion factor
- (what we want to convert) x (conversion factor) = converted answer

Conversions

- Ex. How many centimeters in 6 meters?

Conversions

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- **Answer:**

$$6\text{ m} \times \frac{100\text{ cm}}{1\text{ m}} = 600\text{ cm}$$

Conversions

- Need to be careful about units
- Make sure that your answer is in the units you want!

• Ex.

$$5 \text{ km} \times \frac{1000 \text{ m}}{1 \text{ km}} = 5000 \text{ m} \quad \text{Correct!}$$

$$5 \text{ km} \times \frac{1 \text{ km}}{1000 \text{ m}} = 0.005 \frac{\text{km}^2}{\text{m}} \quad \text{Wrong!}$$

Map Scales

- Ex. If the distance on the map is 3 cm, and the scale is 100 km per centimeter, how far is the distance in reality?

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- Ex. If the distance on the map is 3 cm, and the scale is 100 km per centimeter, how far is the distance in reality?
- **Answer:**

$$3\text{cm} \times \frac{100\text{km}}{1\text{cm}} = 300\text{km}$$

Do not use 100,000 cm = 1km!

Exponents

- Often we will need to multiply a number by itself several times
- $7 \times 7 = 7^2 = 49$ (7 squared)
- $9 \times 9 \times 9 = 9^3 = 729$ (9 cubed)
- The square root of a number is the number that when it is squared gives the original number (above the square root of 49 is 7)
- $\sqrt{49} = 49^{1/2} = 7$

Scientific Notation

- In scientific notation, these numbers become more compact
- Mass of Sun = 2.0×10^{33} grams
- Mass of a proton = 1.67×10^{-24} grams
- To put a number in scientific notation, move the decimal point so that it becomes a number between 1 and 10. Then count how many places you moved the decimal point to determine the exponent.
- Moving left means the exponent will be positive, moving right means it will be negative.

Scientific Notation

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 1.67×10^5
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- **Answer:** 167,000.0
 1.67×10^5
- Ex. What is 0.002 in scientific notation?
- **Answer:** 2.0×10^{-3}

Order of Operations

- The order in which math is done matters
- Please Excuse My Dear Aunt Sally
(Parentheses, Exponents, Multiply and Divide left to right, Add and Subtract left to right)
- Ex. $(6^2 + 4) \div 4 - 3 + 7 \times 5 = 40 \div 4 - 3 + 7 \times 5 = 10 - 3 + 35 = 42$

Plotting

- Time is always the x-axis, so make sure on your plot you make time the x-axis
- Label your axes (numbers don't mean anything without a label!)
- Pick a reasonable range for each axis
- Plot every other point
- For #26, use 6 AM – Noon for “morning”

Does This Make Sense?

- For this section, DO NOT do any exact calculations
- use common sense to determine the answer
- Explain why the answer you chose is correct (I will not give any points if you do not explain why you chose your answer!)

Tips

- Show your work!!
- Include units where applicable
- Answer all questions (make sure you answer #19 and #26)
- For #26, use 6 AM – Noon for “morning”
- **DO NOT HESITATE TO ASK QUESTIONS!!!!!!**