CLASS NOTES FOR TOPIC 1: DIMENSIONAL ANALYSIS

In this first topic, we're going to explore what happens in math when units come into play!

1.
   a) What's 60 times 5?

   b) Suppose you travel at an average speed of 60 miles per hour for 5 hours. How far have you traveled?

2.
   a) What's $\frac{1}{3}$ times 60?

   b) Suppose a gallon of unleaded gas costs $3. How many gallons could you buy for $60?

3. How are your answers to each pair of questions above alike? How are they different?

(Here's a video check-in to make sure we're on the same page!)

Today we'll get more comfortable with two different mathematical ideas: **ratios** and **rates**. As a reminder:

- A **ratio** is just a number (usually a fraction) that composed of two other numbers that are divided. Examples would be $\frac{1}{2}, \frac{1}{4}, \frac{2}{3}, 5$, and other numbers like that.
- A **rate** is a number (usually, again, in fraction form) where the numbers in the numerator and denominator have two different ***units*** attached to them. Examples would be $\frac{\text{65 miles}}{\text{1 hour}}$ (which is usually written as **65 MPH**), $\frac{\text{5 micrograms}}{\text{1 day}}$, and others.

Circle all the fractions below that are **ratios.**

$\frac{7}{10}$	$\frac{\$7}{\text{3 hours}}$	$\frac{20}{50}$
$\frac{\text{12 feet}}{\text{1 second}}$	$\frac{100}{99}$	$\frac{\text{3 throws}}{\$1}$
$\frac{\text{2500 watts}}{\text{day}}$	$\frac{1}{9}$	$\frac{\$1}{\text{3 throws}}$

Before we bring units into play in our calculations, let's review a couple of fraction math problems.

4. What's $\frac{6}{15} * \frac{1}{3}$? Make sure you do it step-by-step.
5. How about $\frac{7}{4} * 8$? Again, step-by-step.

Now, we'll bring units in.

6. Take a few moments and multiply the following two quantities. Think carefully about what happens with the units.

$$\frac{60 \text{ miles}}{1 \text{ hour}} * 5 \text{ hours}$$

7. What word in a math problem translates into a fraction bar (i.e., division)?

(Here's a video check in to make sure we're on the same page!)

8. If you're traveling at an average speed of 45 MPH for 4 hours, how far have you gone?
9. How about if you travel for 9 hours?
10. Again, let's take a few moments and try this one.

$$\frac{1 \text{ gallon}}{\$3} * \$60$$

11. Why did I write that first fraction as "1 gallon per $3" instead of "$3 per 1 gallon"?

If something is moving at 54 feet per second:

12. How far does it move in 10 seconds? 100 seconds? 1000 seconds?
13. How fast is it moving in feet per ***minute***?
14. How fast is it moving in feet per ***hour***?
15. How fast is it moving in ***miles*** per ***hour***? What rounding makes sense here?
16. Could we have gone straight from the first description of the speed to the last one? How?

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There are 2.2 pounds in a kilogram.

17. If someone weighs 180 pounds, how many ***kilograms*** do they weigh?

18. If someone weighs 100 kilograms, how many ***pounds*** do they weigh?

And now let's play around with some time spans.

19. How many minutes are there in a week?

20. How many seconds in a month? (months vary in length, so pick one you'd like to use!)

(Here's a video check-in to make sure we're on the same page!)