

1.4 Dimensional Analysis

Standards:

N.Q.1a

N.Q.1b

N.Q.1c

N.Q.2

N.Q.3



Old Multiplying Fractions

- cross reducing
- multiply across

$$\textcircled{1} \frac{2}{3} \cdot \frac{9}{10} = \frac{18}{30} = \frac{3}{5}$$

$$\textcircled{1} \frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{3}}} \cdot \frac{\overset{3}{\cancel{9}}}{\underset{5}{\cancel{10}}} = \frac{3}{5}$$

$$\textcircled{2} \frac{\underset{3}{\cancel{6}}}{5} \cdot \frac{\overset{1}{\cancel{2}}}{3} = \frac{5}{9}$$

$$\textcircled{3} \frac{\overset{4}{\cancel{12}}}{7} \cdot \frac{\underset{5}{\cancel{15}}}{35} = \frac{8}{35}$$

Let's discuss removing units:

How do we remove units in addition? $7 \text{ dogs} - 7 \text{ dogs} = 0.$

How do we remove units in multiplication? $\frac{7 \text{ dogs}}{7 \text{ dogs}} = 1$

new Dimensional Analysis

• Dimensional Analysis - is the process of converting one unit to another unit.

• This process involving using "known" rates & treating these rates as ratios.
(i.e. $60 \text{ minutes} = 1 \text{ hour}$)

can be expressed as either

$$\frac{60 \text{ mins}}{1 \text{ hr.}} \quad \swarrow \quad \searrow \quad \frac{1 \text{ hr.}}{60 \text{ mins}}$$

• Same concept as multiplying fractions, but the trick is to arrange the fractions so that the units are removed.

[Example 1] convert 3 hours to minutes

$$\frac{3 \text{ hours}}{1} \cdot \frac{60 \text{ minutes}}{1 \text{ hour}} = 180 \text{ minutes}$$

Relationship:

$$60 \text{ mins} = 1 \text{ hr.}$$

$$\begin{array}{ccc} & \swarrow & \searrow \\ \frac{60 \text{ min.}}{1 \text{ hr.}} & & \frac{1 \text{ hr.}}{60 \text{ mins}} \end{array}$$

[Example 2] convert 72 inches to feet

$$\frac{72 \text{ inches}}{1} \cdot \frac{1 \text{ ft}}{12 \text{ in}} = 6 \text{ ft.}$$

Relationship:

$$12 \text{ in} = 1 \text{ ft}$$

$$\begin{array}{ccc} & \swarrow & \searrow \\ \frac{12 \text{ in}}{1 \text{ ft}} & & \frac{1 \text{ ft}}{12 \text{ in}} \end{array}$$

[Example 3] convert 84 days to weeks

$$\frac{84 \text{ days}}{1} \cdot \frac{1 \text{ wk}}{7 \text{ days}} = 12 \text{ wks}$$

Relationship:

$$7 \text{ days} = 1 \text{ wk}$$

[Example 4] convert 3 hrs to seconds

$$\frac{3 \text{ hrs}}{1} \cdot \frac{60 \text{ mins}}{1 \text{ hr}} \cdot \frac{60 \text{ secs}}{1 \text{ min}} = 10,800 \text{ secs.}$$

Relationships:

$$1 \text{ hr} = 60 \text{ mins}$$

$$1 \text{ min} = 60 \text{ secs}$$

[Example 5] convert 84 days to months

$$\frac{84 \text{ days}}{1} \cdot \frac{1 \text{ wk}}{7 \text{ days}} \cdot \frac{1 \text{ mt}}{4 \text{ wks}} = 3 \text{ mts}$$

Relationships

$$7 \text{ days} = 1 \text{ wk}$$

$$4 \text{ wks} = 1 \text{ mt.}$$

Here's a list of relationships that you may need:

- 2 cups = 1 pint
- 2 pints = 1 quart
- 4 quarts = 1 gallon
- 12 inches = 1 foot
- 3 feet = 1 yard
- 5280 feet = 1780 yards
= 1 mile
- 1000 grams = 1 kilograms
- 16 ounces = 1 pound
- 200 pounds = 1 ton