Ratios and Rates and Proportions

Learning Goal:

By the end of today,

(i) I will be able to recognize the difference between a ratio and rate,

(ii) be able to change the setup of a ratio

(iii) recognize and solve a proportion (two ratios set equal to each other)

Ratios compare quantities with the same units or no units at all.

$$1:2$$

Rates show how one quantity changes with respect to another.

$$\frac{50km}{1hr}$$

A proportion is an equation that states two ratios or rates are equivalent.

$$3:4=6:8$$

The ratio of cats to dogs in a pet store was 14 cats to 16 dogs.

This ratio can be expressed in different forms.

14 to 16 or 14 : 16 or $\frac{14}{16}$

A rate is recognizable because it usually has different units.

For example, $\frac{5km}{2hr}$,

A "unit rate" is created by performing the division operation and ending up with a "1" in the denominator position.

For example, $\frac{200km}{4hr}$ becomes $\frac{50km}{1hr}$ and is written 50km/hr.

A ratio, like a fraction, can be expressed in lowest terms.

4 : 8 can be expressed in lowest terms as 1 : 2

Remembering that ratios can be expressed in a fraction form, the above example could also be written as:

$$\frac{4}{8} = \frac{1}{2}$$

This form can also be called a proportion (an equal sign between two ratios).

Solving Proportions - Find the missing value

$4 : 5 = \square : 35$

the missing term could also be replaced with a variable

$4 : 5 = n : 35$

and then rewritten in fraction form to solve

$\frac{4}{5} : \frac{n}{35}$

Watch the setup of the fraction form

$7 : 8 = 21 : n$

can be written in fraction form in two different ways

$\frac{7}{8} = \frac{21}{n}$ or $\frac{8}{7} = \frac{n}{21}$

the left setup is more challenging than the right to solve

Ratios can be rearranged to help us solve for the missing value.

$\frac{9}{7} = \frac{72}{n}$ to $9 : 7 = 72 : n$ to $\frac{7}{9} = \frac{n}{72}$

Solve

$5 : 9 = x : 81$

$2.1 : 7.4 = x : 22.2$

Rates

Eating 14 bananas a week results in a rate of:

$$\frac{14 \text{ bananas}}{7 \text{ days}} \text{ or a unit rate of } \frac{2 \text{ bananas}}{\text{day}}$$

Some rates make more sense than others:

For example, travelling 120km in 2 hours can be expressed as,

$\frac{120\text{km}}{2\text{ hrs}}$ or $\frac{60\text{km}}{\text{hr}}$ or $\frac{2\text{hr}}{120\text{km}}$ or $\frac{0.0166\text{hr}}{\text{km}}$

Mapping Problem

You are camping and the map you have has a scale of 1:50,000

This means that 1cm on the map is equal to 50,000cm in the real world.

You measure your distance to be 6cm away on your map.

How many **kilometers** away from your destination are you in the real world?

Two problems, the ratio and the different units.

Using the "total" number from a ratio.

If we investigate a gym class that has 12 basketball players and 14 volleyball players we can write a ratio of 12 : 14.

The total number of "athletes" in the class is the sum of the number of basketball and volleyball players, 12 + 14 = 26.

If we were asked what percent of athletes in the class are basketball players we could then investigate the percent calculation arising from,

$\frac{12}{26}$ =

Task - Ratios, Rates, Proportions