

PROPORTIONAL REASONING: RATIOS, RATES & PROPORTIONS

Ratio: A ratio is a numerical comparison of two or more concepts. For example, in a room, 2 people are monolingual, 5 are bilingual and 1 is trilingual. Their ratio would be:

Monolingual : Bilingual : Trilingual

$$2 : 5 : 1$$

Another way to word a ratio involves with word: **respectively**. This means that the order in which the list is worded will be identical to the order in which the numbers are given. For example: in a room there are Germanophones, Francophones and Anglophones such that they total 4, 10 and 3 respectively. The ratio will still read:

Germanophone : Francophone : Anglophone

$$4 : 10 : 3$$

A **proportion** is an algebraic statement that compares two or more ratios. For example, if a room has a ratio of boys to girls of 5 to 6 (boys : girls = 5:6), then we can determine the number of girls in a room that has 20 boys given the same ratio.

Boys : Girls

$$5 : 6$$

$$20 : x$$

where x is the number of girls in the room. We can now use algebra using the following proportion:

$$\frac{x}{20} = \frac{6}{5}$$

We now solve using algebra:

$$\frac{20x}{20} = \frac{(20)6}{5}$$

$$x = (4)(6)$$

$$x = 24$$

hence, in a room with 20 boys, there would be 24 girls.

A **rate** is a ratio that compares two different concepts. When you speak about your rate of pay in dollars per hour, you are comparing units of money against units of time. When you speak of the speed (or

velocity) of a vehicle, you are comparing the distance (in meters, kilometres, feet or miles) against time (in seconds, minutes or even hours). For example: Josée makes 75\$ per 5 hours or 75\$/5hrs. Maurice ran 10 km in 2 hours or 10km/2hr.

A **unit rate** is a comparison of two concepts where one of those concepts is set at a value of one. In the example of Josée we can say that she makes 15\$ per hour or 15\$/hr. We can also say that Maurice ran 5km/hr. Note how the denominator is always set at 1, hence the **UNI-T** rate.

The unit rate is also very essential when doing groceries to compare the costs against quantity of products. For example, which offers the better deal: 4.50\$/115g or 8.75\$/235g?

As a unit rate:

$$4.50\$/115g \approx 0.3913\$/g$$

$$8.75\$/235g = 0.3723\$/g$$

Hence the first offer has a greater dollar to quantity value for the buyer.

RULE OF THUMB: Always place money on top and always place time on the bottom

Scale is a ratio calculation that compares the diagram's measurement against the actual (or real) measurement.

Scale : diagram measurement : actual measurement