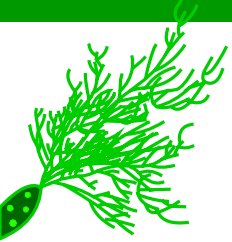# Ratios

A ratio shows the relative sizes of two or more like values. A ratio may compare a number of parts to another number of parts in the whole **or** compare a number of parts to the total number of parts in the whole.
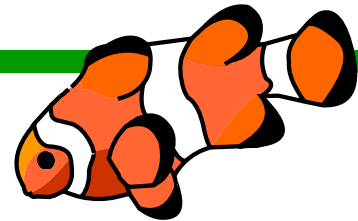
part-part

or

part-whole
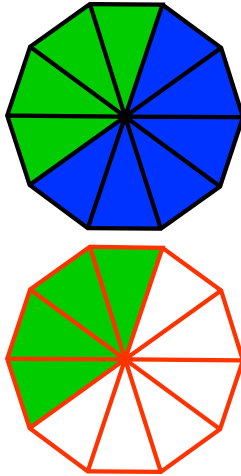
4:6 part-part

$\frac{4}{10}$ part-whole

A ratio can be written as:

4 to 6 or **4:6** or $\frac{4}{6}$

The numbers in a ratio are called terms.
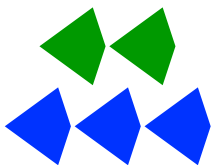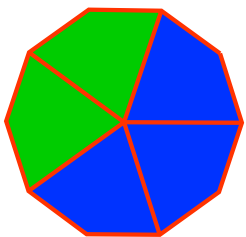A ratio may have more than two terms, e.g. 4:5:3:1

Simplifying a ratio.

Just like simplifying a fraction, a ratio is simplified by finding the highest common factor (HCF or GCF) to divide each term.

EXAMPLE: **4:6 = 2:3** both terms divided by 2

Writing part-part ratios as fractions.

When comparing two terms in a ratio, each term can be written as a fraction of the other.

2:3 $2 = \frac{2}{3} \times 3$ $3 = \frac{3}{2} \times 2$

Problem solving with ratios

Determining quantities when a part is known.

Step 1: Find the value of a single part of the ratio.

Step 2: Multiply this number by the other term(s) to find their share or quantity.

The ratio of slices of tomato to cucumber to onion in a salad is 5:4:2. If there are 20 tomato slices, how many slices of cucumber and onion are there?

Tomato: **5 parts = 20**
1 part = 20 ÷ 5
= 4

Cucumber: **4 parts = 4 x 4**
= 16

Onion: **2 parts = 2 x 4**
= 8
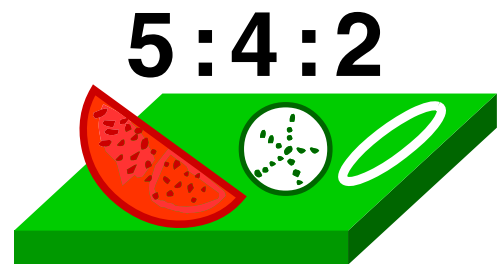
$$5 : 4 : 2$$

$$20 : 16 : 8$$

There are 16 cucumber slices and 8 slices of onion.

Determining quantities when the total is known.

Step 1: Add the terms to get the total of number of parts.

Step 2: Divide the total quantity by number of parts.

Step 3: Multiply this number by the other term(s) to find their share or quantity.

In a fruit bowl containing apples and oranges the ratio is 3:5. If there are 24 pieces of fruit in total, how many are oranges?

Total parts: **3 + 5 = 8**
Single part: **24 ÷ 8 = 3**
1 part = 3
Oranges: **5 parts = 5 x 3**
= 15
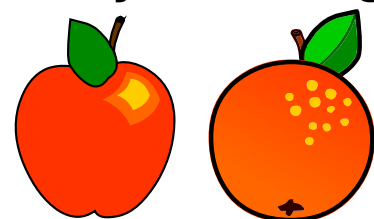
$$3 : 5 = 9 : 15$$

There are 15 oranges.

Rates

A **ratio** compares quantities which are measured
in the same units.
A **rate** compares quantities which are measured
in different units.

**A rate is written as the first quantity
per ONE of the second quantity.**

dollars **per** night
kilometres **per** hour
births **per** year
beats **per** minute
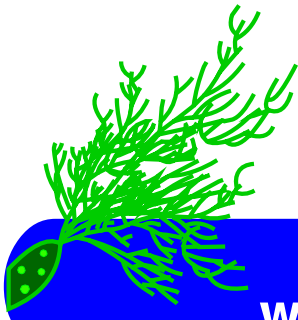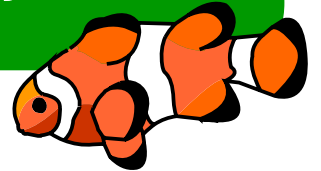
**Determining the first quantity
when the second quantity is known.**

Multiply the first quantity by the number of the second quantity.

Examples: **A hotel room costs $120.00 per night.
How much for 3 nights?**
$120.00 x 3 = $360.00

**A car travelled at an average of 80 km per hour.
How far would it travel in 5 hours?**
80 x 5 = 400 kilometres

**Determining the second quantity
when the first quantity is known.**

Divide the known quantity by the number of the first quantity.

Examples: **The annual birth rate is 2000 births per year.
How many years before there are 6000 births.**
6000 ÷ 2000 = 3 years
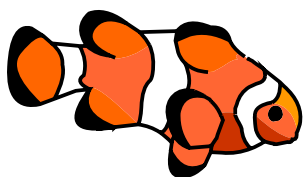
**A runner's heart rate was 140 beats per minute.
He counted 420 beats. How long did he count?**
420 ÷ 140 = 3 minutes

Equivalent ratios and rates

Equivalent ratios and rates are formed by multiplying or dividing all their terms by the same number.

x2 → x2 → x5 → x10 →

2:3   4:6   8:12   40:60   400:600

x2 → x2 → x5 → x10 →

÷10 → ÷5 → ÷2 → ÷2 →

800:1000   80:100   16:20   8:10   4:5

÷10 → ÷5 → ÷2 → ÷2 →

Tables are useful when comparing equivalent ratios and rates.

Ratio: Lemonade Recipe

Mix cups of water, lemon juice and sugar in the ratio 3:1:1.

Water	3	6	12	24	48
Lemon Juice	1	2	4	8	16
Sugar	1	2	4	8	16

In this table, the terms are doubled each time.

Rate: Hotel Room Rate

The cost of a deluxe room at Hotel Math is $120.00 per night.

Nights	1	2	3	4	5	6	7
Cost	$120	$240	$360	$480	$600	$720	$840

In this table, both terms are multiplied by the numbers 1 - 7.