f) Understanding Ratio

1 2 3 4

Step 1) Stating a Ratio

1 2 3 4

A ratio is a way of comparing numbers of different objects to each other. So if we had 2 cats and one dog, we would have a ratio of cats to dogs of 2:1. We write the numbers with a colon (:) between them. We can also right the type of things we are counting with a colon.

2 Cats　　　Cats : Dogs　　　1 Dog

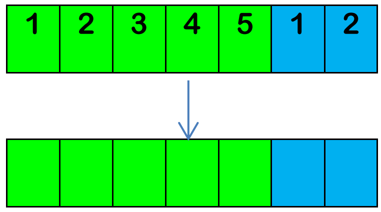
2 : 1

Colour a rectangle with parts in a ratio

Green : Blue

5 : 2

5 green parts & 2 blue parts



We can also use ratios where there are more than 2 different types of things. We can have 3 part, 4 part, or any number of parts in a ratio, each separated by a colon.

Here is a party themed 3-part ratio for balloon, crackers and party hats.

Balloons : Crackers : Hats

3 : 1 : 2

Step 2) Equivalent Ratios

1 2 3 4

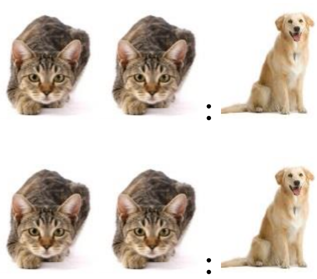
The ratios 2:1 and 4:2 are equivalent.

Let’s use our cats and dogs again.

Cats:Dogs

4 : 2

Can be rearranged like so…

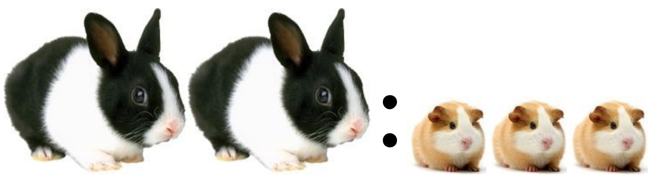


So we still have 4 cats per 2 dogs, but we have put them into 2 groups to show that we also have 2 cats for every 1 dog.

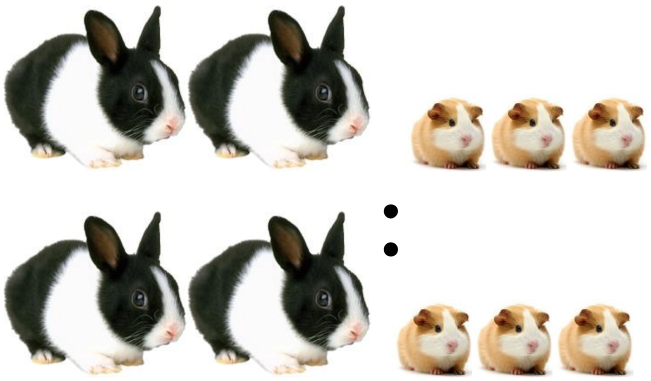
As long as we multiplied the number of cats and dogs by the same number, we could still group them into the same ratio as before we multiplied.

Let's look at 2 rabbits to every 3 guinea pigs.

Rabbits : Guinea Pigs



$$2:3 \xrightarrow{\times 2} 4:6$$



Our 4:6 rabbits to guinea pig can be thought of as 2 lots f 2:3 rabbits and guinea pigs.

We can make all sorts of other equivalent ratios to 2:3 in the same way.

$$2:3 \xrightarrow{\times 3} 6:9$$

$$2:3 \xrightarrow{\times 5} 10:15$$

$$2:3 \xrightarrow{\times 10} 20:30$$

So 2:3. 4:6, 6:9, 10:15 and 20:30 are all equivalent. This also means they can all be simplified to 2:3. We can simplify a ratio by dividing both parts by the same number, splitting them up into groups of the same simplified ratio.

Let's try and simplify 10:2

$$10:2 \xrightarrow{\div 2} 5:1$$

So 10:2 can be simplified to 5:1. We can't simplify it any more as there are no numbers that go into both 5 and 1.

3) Ratios to Fractions & Decimals

1 2 3 4

Let's look at these coloured triangles

The ratio Blue : Orange is 3 : 2

What fraction are blue and orange? And what about as a decimal or percentage.

A common error here is just to put one number on top and one number below.

Either $\frac{3}{2}$ or $\frac{2}{3}$. However we want the number of blue (or orange) triangles out of (or over) the total number of triangles. We get the total number of triangles by adding the number of blues and the number of oranges, 3 + 2 = 5 triangles in total.

Blue = $\frac{Blue}{Total\ Blue\ \&\ Orange} = \frac{3}{3+2} = \frac{3}{5}$

so $\frac{3}{5}$ of the triangles are blue.

Orange = $\frac{Orange}{Total\ Blue\ \&\ Orange} = \frac{2}{3+2} = \frac{2}{5}$

so $\frac{2}{5}$ of the triangles are orange.

It is usually easier to convert to a fraction first. From there we can turn the fraction into a decimal or %.

Blue = $\frac{3}{5} = 0.6 = 60\%$

so 0.6 of the triangles are blue

and 60% of the triangles are blue

Orange = $\frac{2}{5} = 0.4 = 40\%$

so 0.4 of the triangles are orange

and 40% of the triangles are orange

Step 4) Sharing in a Given Ratio

1 2 3 4

Share £45 between Albert and Bertha in the ratio 2:7.

So Albert : Bertha

2 : 7

The total number of parts here is 2 + 7 = 9. As each of the 9 parts must be allotted the same number of £s, we can simply dived the £45 by 9 to find the value of each part.

$$\frac{45}{9} = 5$$

So each part is worth £5 each.

Albert gets 2 of these parts (worth £5 each)

Albert gets 2 x 5 = £10

Bertha gets 7 of these parts (worth £5 each)

Bertha gets 7 x 5 = £35

If we write this as a ratio we get

Albert : Bertha

10 : 35

And this is the equivalent ratio to 2 : 7 we get when we multiply both sides by 5.

Another way of thinking of this problem is that we need to find an equivalent ratio where the all the shared out parts add up to the total being shared.

A final note is to notice that steps 3 and 4 both rely on seeing the overall ratio as a number of parts shared into (possibly) unequal sections divided by a colon. To work things out you need to find the total number of parts. This forms the bottom of your fraction when converting to fractions, and helps you find out the value of each part when sharing.