Ratios are a way of showing 2 or more things in proportion to one another.

For example,

If the ratio of X to Y is 1:2, this means for every **one** of X, there is **two** of Y.

As this is in effect the same as how a fraction works. It means the ratio of X to Y can be written as a fraction in the following ways

- There are $\frac{1}{2}$ as many X as Y
- There are $\frac{2}{1}$ as many Y as X
- $\frac{1}{3}$ of the total parts are X
- $\frac{2}{3}$ of the total parts are Y



Simplifying Ratios

Just like with fractions, if you multiply all parts of the ratio by the same amount or divide all parts of the ratio by the same amount, the ratio continues to mean the same thing.

For example if X, Y are in the ratio 1:2, that means you can also write it as 2:4, 3:6, 4:8 and so on as all of these still mean, for every 1 of x, there are 2 of y. When you multiply all parts of the ratio by the same amount, it is known as scaling

Just like with fractions, you can simply a ratio if you can divide all parts by the same amount and when this is no longer possible, the ratio is in its simplest form

a,b and c are in the ratio 100:120:160. Write this in its simplest form.

$$\begin{array}{c}
100:120:160\\
10:12:16\\
5:6:8\\
\end{array} \begin{array}{c}
\\
\end{array} \begin{array}{c}
\\
\end{array} \begin{array}{c}
\\
\\
\end{array} \begin{array}{c}
\end{array} \begin{array}{c}
\end{array} \begin{array}{c}
\\
\end{array} \begin{array}{c}
\end{array} \end{array}$$
 \end{array}



Extracting Ratios

You may get a question where you are provided with information about three people and items and you need to convert this into a ratio.

For example, Richard has 4 times as much money as Naomi but half as much as Mathew. Write a ratio of the amount of money Richard has, to the amount Naomi has to the amount Mathew has.

To solve a question like this, first write the letters of the ratio out in order, then mark the person who has the least (Naomi) as 1, and then work out everyone else's parts in proportion to this.





Questions:

Amol, Gemma and Harry each have a number of sweets.

The number of sweets that Gemma has is 6 times the number of sweets that Amol has.

The number of sweets that Harry has is half the number of sweets that Gemma has.

Write down the ratio of the number of sweets each person has in the order

Amol : Gemma : Harry

Adam, Linda and Rytis share an amount of money. Linda gets three times as much money as Rytis gets. Linda gets half as much money as Adam gets.

What fraction of the amount of money does Linda get?



1:n Form

Sometimes a question asks you to write a ratio in this form. All this means is that the left-hand side of the ratio must be 1 and the right-hand side must be in proportion, even if it is not an integer (whole number)

Example:

Write the ratio 12:30 in the form 1:n

30 ∶12 = 2.5 = n

Question:

There are 60 people in a choir. Half of the people in the choir are women.

The number of women in the choir is 3 times the number of men in the choir. The rest of the people in the choir are children.

The number of children : the number of men = n : 1

Work out the value of n.



Dividing into Ratios

This is a key skill that comes up regularly. It is very similar to working out a fraction of an amount. To do this, if you have a total, divide by total parts to find one part and then multiply by individual parts to find them.

Example:

Amy, Beth and Colin share 36 sweets in the ratio 2:3:4

Work out the number of sweets that each of them receives.

2 + 3 + 4 = 99 parts ---> 36 1 part ---> 4

2:3:4 8:12:16 x 4

Note: the order the names appear relates to the order of the numbers in the ratio.

Amy gets 8 sweets, Beth gets 12 sweets and Colin gets 16 sweets.



Questions:

£360 is shared between Abby, Ben, Chloe and Denesh.

The ratio of the amount Abby gets to the amount Ben gets is 2:7

Chloe and Denesh each get 1.5 times the amount Abby gets.

Work out the amount of money that Ben gets.



A shop sells packs of black, red and green pens.

There are

- 2 pens in each pack of black pens
- 5 pens in each pack of red pens
- 6 pens in each pack of green pens

On Monday,

number of packs:number of packs:number of packs= 7:3:4of black pens soldof red pens soldof green pens soldof green pens sold

A total of 212 pens were sold.

Work out the number of green pens sold.



Difference Between Ratios

Sometimes rather than given a total of a ratio, you will be given a difference between 2 people's parts.

Example:

Josh, James and John share sweets in the ratio 1 : 2 : 4. Josh has 9 sweets less than John. How many sweets does James have?

9 sweets = John's sweets - Josh's sweets = 4 - 1 = 3 parts

3 parts = 9 λ	1:2:4 🥆
) : 3) x 3
1 part = 3 🖌	3:6:12 🗸

James gets 6 sweets.



Questions:

Pat and Julie share some money in the ratio 2:5 Julie gets £45 more than Pat.

How much money did Pat get?

Rosie, Matilda and Ibrahim collect stickers.

number of stickers : number of stickers : number of stickers = 4 : 7 : 15 Rosie has Matilda has Ibrahim has

Ibrahim has 24 more stickers than Matilda.

Ibrahim has more stickers than Rosie. How many more?



Worded Problems - Combining Topics

To finish this class, we will look at some past paper questions including ones that combine ratios with other skills.

Questions:

There are only blue, green and red pens in a box.

The ratio of the number of blue pens to the number of green pens is 2:5 The ratio of the number of green pens to the number of red pens is 4:1

There are less than 100 pens in the box.

What is the greatest possible number of red pens in the box?



Last year Kerry's take home pay was £15,000 She spent 40% of her take home pay on rent.

She used the rest of her take home pay for living expenses, clothes and entertainment in the ratio 3:1:2

How much did Kerry spend on entertainment last year?



There are 240 cans of drink on a shelf. Each can contains cola or lemonade or orange.

number of cans : number of cans : number of cans = 5 : 3 : 2 of cola of lemonade of orange

 $\frac{1}{2}$ of the cans of lemonade and $\frac{1}{12}$ of the cans of orange are removed from the shelf.

Work out the number of cans of cola as a percentage of the total number of cans of drink remaining on the shelf.

