

**RATIOS ARE USED TO MAKE COMPARISONS
BETWEEN TWO THINGS**

**WHEN WE EXPRESS RATIOS IN WORDS WE USE
THE WORD "TO" -- WE SAY, "THE RATIO OF
SOMETHING TO SOMETHING ELSE**

**FOR EXAMPLE, IF THE RATIO OF BOYS TO GIRLS
IN THE CLASS WAS 2 TO 1, THIS MEANS THAT
THERE ARE TWICE AS MANY BOYS AS GIRLS IN
THE CLASS. THE ACTUAL NUMBER OF
STUDENTS MIGHT BE 16 TO 8, 10 TO 5, OR 4 TO 2,
BOYS TO GIRLS.**

Multiplying or dividing each term by the same nonzero number will give an equal ratio. For example, the ratio 2:4 is equal to the ratio 1:2. To tell if two ratios are equal, use a calculator and divide. If the division gives the same answer for both ratios, then they are equal.

MULTIPLICATION

FOR EXAMPLE, IF YOU HAVE A RATIO OF

$$\frac{3}{5} \quad \begin{array}{l} \times 2 \\ \times 2 \end{array} = \frac{6}{10}$$

AND YOU WANT TO CREATE PROPORTIONAL (OR EQUAL) RATIOS, JUST MULTIPLY BOTH THE NUMERATOR AND DENOMINATOR BY THE SAME NUMBER SUCH AS 2.

DIVISION

FOR EXAMPLE, IF YOU HAVE A RATIO OF

$$\frac{24}{36} \quad \begin{array}{l} \div 12 \\ \div 12 \end{array} = \frac{2}{3} \quad \begin{array}{l} \text{*when you divide by the} \\ \text{GCF, we call the ratio} \\ \text{"simplified."} \end{array}$$

AND YOU WANT TO CREATE PROPORTIONAL (OR EQUAL) RATIOS, JUST **DIVIDE** BOTH THE NUMERATOR AND DENOMINATOR BY THE SAME NUMBER SUCH AS 12 (this is the greatest common multiple or GCF).

*ARE THE RATIOS
PROPORTIONAL OR
EQUAL?*

*WE CROSS MULTIPLY TO FIND
OUT. IF THE PRODUCT (this is
what we call the result when we
multiply numbers) OF THE
NUMERATOR OF ONE RATIO
AND THE DENOMINATOR OF
THE OTHER RATIO IS EQUAL
THE PRODUCT OF THE
DENOMINATOR OF THE FIRST
RATIO AND THE NUMERATOR OF
THE LAST, THEN THE RATIOS
ARE PROPORTIONAL .*

$$4 \times 20 = 80$$

$$16 \times 5 = 80$$

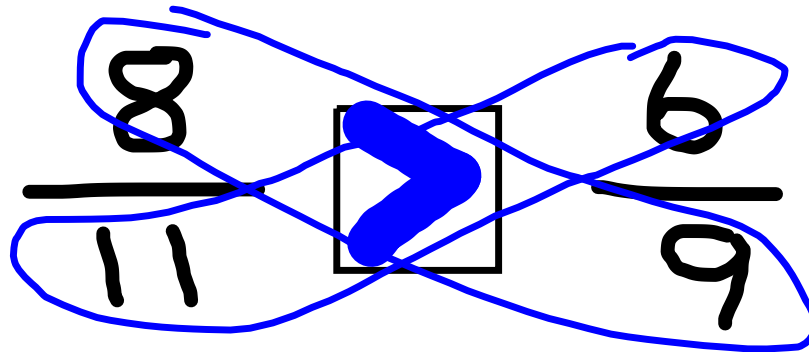
A handwritten equation $\frac{4}{5} = \frac{16}{20}$ is shown. The numbers 4 and 16 are circled in red, as are the numbers 5 and 20. A large red 'X' is drawn over the entire equation, including the equals sign, indicating that the ratios are not proportional.

WHAT IF CROSS MULTIPLICATION DOES NOT
RESULT IN EQUAL PROPORTIONS?

THE LARGER PRODUCT WOULD BE ABOVE THE
LARGER RATIO AND WE USE THE GREATER THAN
> OR LESS THAN < SIGN.

$$8 \times 9 = 72$$

$$6 \times 11 = 66$$



8/11 is the larger ratio
because 72 is greater than
66.

WE SHOULD ALWAYS SIMPLIFY RATIOS FIRST
BEFORE WE ATTEMPT TO COMPARE THEM TO
OTHER RATIOS.

$$\frac{48}{64} \square \frac{81}{108}$$

we could attempt to multiply 64 and 81, compare the product to the product of 48 and 108 (we would get a product of 5,184 in both cases)

Or we could simplify both ratios first; 48/64 has a GCF of 16 so we divide the numerator and denominator by 16 and get 3/4; 81/108 has a GCF of 27 so we divide the numerator and denominator by 27 and get 3/4; the ratios are proportional

Of course, when we cross multiply we get $12 = 12$.

$$\begin{array}{ccc} 12 & & 12 \\ \frac{3}{4} & \square = & \frac{3}{4} \end{array}$$