Operation on rational numbers

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A. Addition or Subtraction of Rational Number

Rational Numbers with the Same Denominator

To add/subtract rational numbers with the same denominator, simply add/subtract their numerators keeping the common denominators as such.

Let us understand with some examples:

Example: Add $\frac{4}{7}$ and $\frac{13}{7}$?

Solution: Given Rational Numbers are $\frac{4}{7}$ and $\frac{13}{7}$

Adding them we get $\frac{4}{7} + \frac{13}{7} = (\frac{4+13}{7}) = \frac{17}{7}$

Therefore, the Sum of $\frac{4}{7}$ and $\frac{13}{7}$ is $\frac{17}{7}$.

B. Rational Numbers with the Different Denominator

Follow these simple steps

Step 1: Find the LCM of the denominators.

Step 2: Write the equivalent rational numbers with the LCM as their common denominator.

Step 3: Add/Subtract them as rational numbers with same denominators.

Let us understand with some examples:

Example: Add $\frac{4}{5}$ and $\frac{7}{9}$?

Solution: Clearly, the denominators are different and we need to figure out the LCM of Denominators. LCM (5, 9) is 45

Express the Given Rational Numbers with a Common Denominator using the LCM obtained.

$\frac{4}{5} = \frac{4 \times 9}{5 \times 9} = \frac{36}{45}$

$\frac{7}{9} = \frac{7 \times 5}{9 \times 5} = \frac{35}{45}$

Add the Numerators of the Rational Numbers while keeping the Denominator unchanged to get the sum of Rational Numbers.

$= \frac{36}{45} + \frac{35}{45}$

$= \frac{71}{45}$

Therefore, the sum of $\frac{4}{5}$ and $\frac{7}{9}$ is $\frac{71}{45}$.

Example: Example: Subtract $\frac{2}{3}$ from $\frac{4}{5}$?

Solution: Subtracting $\frac{4}{5}$ from $\frac{2}{3}$

$= \frac{4}{5} - \frac{2}{3}$

$= \frac{4}{5} + (\frac{-2}{3})$

$= \frac{4 \times 3}{5 \times 3} + (\frac{-2 \times 5}{3 \times 5})$

$= \frac{12}{15} + (\frac{-10}{15})$

$= (\frac{12 - 10}{15})$

= 2/15

Therefore, $\frac{4}{5} - \frac{2}{3} = \frac{2}{15}$.

C. Multiplication of Rational Numbers

The product of two rational numbers is a rational number whose numerator is the product of the two numerators and whose denominator is the product of the two denominators. If $\frac{p}{q}$ and $\frac{r}{s}$ are two rational numbers, then

$$\frac{p}{q} \times \frac{r}{s} = \frac{p \times r}{q \times s} = \frac{\text{Product of numerator}}{\text{Product of denominator}}$$

Let us understand with an example:

Example: Find the product of $\frac{-8}{9} \times \frac{5}{7}$.

Solution: $\frac{-8}{9} \times \frac{5}{7} = \frac{-8 \times 5}{9 \times 7} = \frac{-40}{63}$

Division of Rational Number

We know that division is the inverse of multiplication, i.e., if a and b are two integers, then a ÷ b = a × $\frac{1}{b}$. It means we multiply the dividend by the multiplicative inverse of the divisor.

We apply the same rule for division of rational numbers. If $\frac{p}{q}$ and $\frac{r}{s}$ are two rational numbers.

Then $\frac{p}{q} \div \frac{r}{s} = \frac{p}{q} \times \frac{s}{r} = \frac{p \times s}{q \times r}$ ($\frac{r}{s} \neq 0$)

Let us understand with an example:

Example: Divide $\frac{3}{5}$ by $\frac{4}{9}$.

Solution: $\frac{3}{5} \div \frac{4}{9} = \frac{3}{5} \times \frac{9}{4} = \frac{3 \times 9}{5 \times 4} = \frac{27}{20}$