Chapter 5

Operations on Rational Numbers

Introduction

Addition of Rational Numbers

There are two cases:

Case 1: If the rational numbers have same denominators, then we will add as follows: $\frac{p}{q} + \frac{r}{q} = \frac{p+r}{q}$

Case 2: If the rational numbers have different denominators, then first we will make the denominator positive and then make the denominations same by taking their LCM and then add using case 1.

Examples

Example 1: Add $\frac{3}{5}$ *and* $\frac{13}{5}$

Solution: We can see that denominators of both rational numbers are same.

Thus, we have $\frac{3}{5} + \frac{13}{5} = \frac{3+13}{5} = \frac{16}{5}$

Example 2: Add $\frac{7}{9}$ *and* $\frac{-12}{9}$

Solution: We can see that denominators of both rational numbers are same.

Thus, we have $\frac{7}{9} + \frac{-12}{9} = \frac{7+(-12)}{9} = \frac{7-12}{9} = \frac{-5}{9}$ (since (+, -) = - and minus sign comes with the solution because greater number is subtracted from smaller one)

Example 3: Add $\frac{-5}{9}$ *and* $\frac{-17}{9}$

Solution: We can see that denominators of both rational numbers are same.

Thus, we have $\frac{-5}{9}+\frac{-17}{9}=\frac{-5+(-17)}{9}=\frac{-5-17}{9}=\frac{-22}{9}$ (since (-, -) = + but minus sign comes with the answer)

Example 4: Add $\frac{4}{-11}$ *and* $\frac{7}{11}$

Solution: Firstly, we will make denominator positive in $\frac{4}{-11}$ as follows:

$\frac{4}{-11}=\frac{4\times(-1)}{-11\times(-1)}=\frac{-4}{11}$ (Multiplying each term by -1)

Now, we can see that denominators of both rational numbers are same.

Thus, we have $\frac{-4}{11}+\frac{7}{11}=\frac{-4+7}{11}=\frac{3}{11}$ (since (-, +) = -)

Example 5: Add $\frac{5}{12}$ *and* $\frac{3}{8}$

Solution: We can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (12 and 8) is 24 and we will make 24 as denominator in both rational numbers.

Thus, we have $\frac{5}{12}=\frac{5\times2}{12\times2}=\frac{10}{24}$ (Multiplying each term by 2)

$\frac{3}{8}=\frac{3\times3}{8\times3}=\frac{9}{24}$ (Multiplying each term by 3)

Now, we add them as follows:

=> $\frac{10}{24}+\frac{9}{24}=\frac{10+9}{24}=\frac{19}{24}$

Example 6: Add $\frac{7}{9}$ *and* 4

Solution: We have $\frac{7}{9}$ *and* $\frac{4}{1}$

We can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (9 and 1) is 9 and we will make 9 as denominator in both rational numbers.

Thus, we have $\frac{7}{9} = \frac{7\times1}{9\times1} = \frac{7}{9}$ (Multiplying each term by 1)

$\frac{4}{1} = \frac{4\times9}{1\times9} = \frac{36}{9}$ (Multiplying each term by 9)

Now, we add them as follows:

=> $\frac{7}{9} + \frac{36}{9} = \frac{7+36}{9} = \frac{43}{9}$

Example 7: Add $\frac{3}{8}$ *and* $\frac{-5}{12}$

Solution: We can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (8 and 12) is 24 and we will make 24 as denominator in both rational numbers.

Thus, we have $\frac{3}{8} = \frac{3\times3}{8\times3} = \frac{9}{24}$ (Multiplying each term by 3)

$\frac{-5}{12} = \frac{-5\times2}{12\times2} = \frac{-10}{24}$ (Multiplying each term by 2)

Now, we add them as follows:

=> $\frac{9}{24} + \frac{-10}{24} = \frac{9+(-10)}{24} = \frac{9-10}{24} = \frac{-1}{24}$ (since (+, -) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

Example 8: Add $\frac{8}{-15} + \frac{4}{-3}$

Solution: Firstly, we will make denominator positive as follows:

$\frac{8}{-15} = \frac{8\times(-1)}{-15\times(-1)} = \frac{-8}{15}$ (Multiplying each term by -1)

$\frac{4}{-3} = \frac{4\times(-1)}{-3\times(-1)} = \frac{-4}{3}$ (Multiplying each term by -1)

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (15 and 3) is 15 and we will make 15 as denominator in both rational numbers.

Thus, we have $\frac{-8}{15} = \frac{-8\times1}{15\times1} = \frac{-8}{15}$ (Multiplying each term by 1)

$\frac{-4}{3} = \frac{-4\times5}{3\times5} = \frac{-20}{15}$ (Multiplying each term by 5)

Now, we add them as follows:

=> $\frac{-8}{15} + \frac{-20}{15} = \frac{-8+(-20)}{15} = \frac{-8-20}{15} = \frac{-28}{15}$ (since (-, -) = + but minus sign comes with the answer)

Example 9: Add $\frac{7}{-26} + \frac{16}{39}$

Solution: Firstly, we will make denominator positive in $\frac{7}{-26}$ as follows:

$\frac{7}{-26} = \frac{7\times(-1)}{-26\times(-1)} = \frac{-7}{26}$ (Multiplying each term by -1)

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (26 and 39) is 78 and we will make 78 as denominator in both rational numbers.

Thus, we have $\frac{-7}{26} = \frac{-7\times3}{26\times3} = \frac{-21}{78}$ (Multiplying each term by 3)

$\frac{16}{39} = \frac{16\times2}{39\times2} = \frac{32}{78}$ (Multiplying each term by 2)

Now, we add them as follows:

=> $\frac{-21}{78} + \frac{32}{78} = \frac{-21+32}{78} = \frac{11}{78}$

Exercise 5.1

Question 1 – Add the following rational numbers:

(i) $\frac{-5}{7}$ *and* $\frac{3}{7}$

Solution: We can see that denominators of both rational numbers are same.

Thus, we have $\frac{-5}{7} + \frac{3}{7} = \frac{-5+3}{7} = \frac{-2}{7}$ (since (+, -) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

(ii) $\frac{-15}{4}$ ***and*** $\frac{7}{4}$

Solution: We can see that denominators of both rational numbers are same.

Thus, we have $\frac{-15}{4} + \frac{7}{4} = \frac{-15+7}{4} = \frac{-8}{4} = -2$ (since (+, -) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

(iii) $\frac{-8}{11}$ ***and*** $\frac{-4}{11}$

Solution: We can see that denominators of both rational numbers are same.

Thus, we have $\frac{-8}{11} + \frac{-4}{11} = \frac{-8-4}{11} = \frac{-12}{11}$ (since (-, -) = + but minus sign comes with the answer)

(iv) $\frac{6}{13}$ ***and*** $\frac{-9}{13}$

Solution: We can see that denominators of both rational numbers are same.

Thus, we have $\frac{6}{13} + \frac{-9}{13} = \frac{6+(-9)}{13} = \frac{6-9}{13} = \frac{-3}{13}$ (since (-, +) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

Question 2 – Add the following rational numbers:

(i) $\frac{3}{4}$ ***and*** $\frac{-3}{5}$

Solution: We can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (4 and 5) is 20 and we will make 20 as denominator in both rational numbers.

Thus, we have $\frac{3}{4} = \frac{3\times5}{4\times5} = \frac{15}{20}$ (Multiplying each term by 5)

$\frac{-3}{5} = \frac{-3\times4}{5\times4} = \frac{-12}{20}$ (Multiplying each term by 4)

Now, we add them as follows:

=> $\frac{15}{20} + \frac{-12}{20} = \frac{15+(-12)}{20} = \frac{15-12}{20} = \frac{3}{20}$ (since (+, -) = -)

(ii) $-3 and \frac{3}{5}$

Solution: We can write $-3 = \frac{-3}{1}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (1 and 5) is 5 and we will make 5 as denominator in both rational numbers.

Thus, we have $\frac{-3}{1} = \frac{-3\times5}{1\times5} = \frac{-15}{5}$ (Multiplying each term by 5)

$\frac{3}{5} = \frac{3\times1}{5\times1} = \frac{3}{5}$ (Multiplying each term by 1)

Now, we add them as follows:

=> $\frac{-15}{5} + \frac{3}{5} = \frac{-15+3}{5} = \frac{-12}{5}$ (since (+, -) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

(iii) $\frac{-7}{27} and \frac{11}{18}$

Solution: Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (27 and 18) is 54 and we will make 54 as denominator in both rational numbers.

Thus, we have $\frac{-7}{27} = \frac{-7\times2}{27\times2} = \frac{-14}{54}$ (Multiplying each term by 2)

$\frac{11}{18} = \frac{11\times3}{18\times3} = \frac{33}{54}$ (Multiplying each term by 3)

Now, we add them as follows:

=> $\frac{-14}{54} + \frac{33}{54} = \frac{-14+33}{54} = \frac{19}{54}$

(iv) $\frac{31}{-4} and \frac{-5}{8}$

Solution: Firstly, we will make denominator positive in $\frac{31}{-4}$as follows:

$\frac{31}{-4} = \frac{31\times(-1)}{-4\times(-1)} = \frac{-31}{4}$ (Multiplying each term by -1)

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (4 and 8) is 8 and we will make 8 as denominator in both rational numbers.

Thus, we have $\frac{-31}{4} = \frac{-31\times2}{4\times2} = \frac{-62}{8}$ (Multiplying each term by 2)

$\frac{-5}{8} = \frac{-5\times1}{8\times1} = \frac{-5}{8}$ (Multiplying each term by 1)

Now, we add them as follows:

=> $\frac{-62}{8} + \frac{-5}{8} = \frac{-62+(-5)}{8} = \frac{-62-5}{8} = \frac{-67}{8}$ (since (-, -) = + but minus sign comes with the answer)

Question 3 – Simplify:

(i) $\mathbf{\frac{8}{9} + \frac{-11}{6}}$

Solution: We can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (9 and 6) is 18 and we will make 18 as denominator in both rational numbers.

Thus, we have $\frac{8}{9} = \frac{8\times2}{9\times2} = \frac{16}{18}$ (Multiplying each term by 2)

$\frac{-11}{6} = \frac{-11\times3}{6\times3} = \frac{-33}{18}$ (Multiplying each term by 3)

Now, we add them as follows:

=> $\frac{16}{18} + \frac{-33}{18} = \frac{16+(-33)}{18} = \frac{16-33}{18} = \frac{-17}{18}$ (since (-, +) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

(ii) $\mathbf{\frac{-5}{16} + \frac{7}{24}}$

Solution: We can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (16 and 24) is 48 and we will make 48 as denominator in both rational numbers.

Thus, we have $\frac{-5}{16} = \frac{-5\times3}{16\times3} = \frac{-15}{48}$ (Multiplying each term by 3)

$\frac{7}{24} = \frac{7\times2}{24\times2} = \frac{14}{48}$ (Multiplying each term by 2)

Now, we add them as follows:

=> $\frac{-15}{48} + \frac{14}{48} = \frac{-15+14}{48} = \frac{-1}{48}$ (since (-, +) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

(iii) $\mathbf{\frac{1}{-12} + \frac{2}{-15}}$

Solution: Firstly, we will make denominator positive as follows:

$\frac{1}{-12} = \frac{1\times(-1)}{-12\times(-1)} = \frac{-1}{12}$ (Multiplying each term by -1)

$\frac{2}{-15} = \frac{2\times(-1)}{-15\times(-1)} = \frac{-2}{15}$ (Multiplying each term by -1)

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (12 and 15) is 60 and we will make 60 as denominator in both rational numbers.

Thus, we have $\frac{-1}{12} = \frac{-1\times5}{12\times5} = \frac{-5}{60}$ (Multiplying each term by 5)

$\frac{-2}{15} = \frac{-2\times4}{15\times4} = \frac{-8}{60}$ (Multiplying each term by 4)

Now, we add them as follows:

=> $\frac{-5}{60} + \frac{-8}{60} = \frac{-5+(-8)}{60} = \frac{-5-8}{60} = \frac{-13}{60}$ (since (-, -) = + but minus sign comes with the answer)

(iv) $\mathbf{\frac{-8}{19} + \frac{-4}{57}}$

Solution: We can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (19 and 57) is 57 and we will make 57 as denominator in both rational numbers.

Thus, we have $\frac{-8}{19} = \frac{-8\times3}{19\times3} = \frac{-24}{57}$ (Multiplying each term by 3)

$\frac{-4}{57} = \frac{-4\times1}{57\times1} = \frac{-4}{57}$ (Multiplying each term by 1)

Now, we add them as follows:

=> $\frac{-24}{57} + \frac{-4}{57} = \frac{-24+(-4)}{57} = \frac{-24+(-4)}{57} = \frac{-24-4}{57} = \frac{-28}{57}$ (since (-, -) = + but minus sign comes with the answer)

Question 4 – Add and express the sum as a mixed fraction:

(i) $\frac{-12}{5} + \frac{43}{10}$

Solution: We can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (5 and 10) is 10 and we will make 10 as denominator in both rational numbers.

Thus, we have $\frac{-12}{5} = \frac{-12\times2}{5\times2} = \frac{-24}{10}$ (Multiplying each term by 2)

$\frac{43}{10} = \frac{43\times1}{10\times1} = \frac{43}{10}$ (Multiplying each term by 1)

Now, we add them as follows:

=> $\frac{-24}{10} + \frac{43}{10} = \frac{-24+43}{10} = \frac{19}{10} = 1\frac{9}{10}$

(ii) $\frac{24}{7} + \frac{-11}{4}$

Solution: We can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (7 and 4) is 28 and we will make 28 as denominator in both rational numbers.

Thus, we have $\frac{24}{7} = \frac{24\times4}{7\times4} = \frac{96}{28}$ (Multiplying each term by 4)

$\frac{-11}{4} = \frac{-11\times7}{4\times7} = \frac{-77}{28}$ (Multiplying each term by 7)

Now, we add them as follows:

=> $\frac{96}{28} + \frac{-77}{28} = \frac{96+(-77)}{28} = \frac{96-77}{28} = \frac{19}{28}$

(iii) $\frac{-31}{6} + \frac{-27}{8}$

Solution: We can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (6 and 8) is 24 and we will make 24 as denominator in both rational numbers.

Thus, we have $\frac{-31}{6} = \frac{-31\times4}{6\times4} = \frac{-124}{24}$ (Multiplying each term by 4)

$\frac{-27}{8} = \frac{-27\times3}{8\times3} = \frac{-81}{24}$ (Multiplying each term by 3)

Now, we add them as follows:

=> $\frac{-124}{24} + \frac{-81}{24} = \frac{-124+(-81)}{28} = \frac{-124-81}{24} = \frac{-205}{24} = -8\frac{13}{24}$ (since (-, -) = + but minus sign comes with the answer)

Subtraction of rational numbers: Let $\frac{a}{b} and \frac{c}{d}$ are two rational numbers then subtraction of $\frac{c}{d}$ from $\frac{a}{b}$ is expressed as: $\frac{a}{b} - \frac{c}{d}$.

We can also write it as $\frac{a}{b} - \frac{c}{d} = \frac{a}{b} + \left(\frac{-c}{d}\right)$ where $\frac{-c}{d}$ is the additive inverse of $\frac{c}{d}$

Examples

Example 1 – Subtract $\frac{3}{4}$ from $\frac{5}{6}$

Solution: We can write it as: $\frac{5}{6} - \frac{3}{4}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (6 and 4) is 12 and we will make 12 as denominator in both rational numbers.

Thus, we have $\frac{5}{6} = \frac{5\times2}{6\times2} = \frac{10}{12}$ (Multiplying each term by 2)

$\frac{3}{4} = \frac{3\times3}{4\times3} = \frac{9}{12}$ (Multiplying each term by 3)

Now, we subtract them as follows:

$=> \frac{10}{12} - \frac{9}{12} = \frac{10-9}{12} = \frac{1}{12}$

Example 2 – Subtract $\frac{-3}{8}$ *from* $\frac{-5}{7}$

Solution: We can write it as: $\frac{-5}{7} - \frac{(-3)}{8} = \frac{-5}{7} + \frac{3}{8}$ (Since (-, - = +))

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (7 and 8) is 56 and we will make 56 as denominator in both rational numbers.

Thus, we have $\frac{-5}{7} = \frac{-5\times8}{7\times8} = \frac{-40}{56}$ (Multiplying each term by 8)

$\frac{3}{8} = \frac{3\times7}{8\times7} = \frac{21}{56}$ (Multiplying each term by 7)

Now, we solve as follows:

$=>\frac{-5}{7} + \frac{3}{8} = \frac{-40}{56} + \frac{21}{56} = \frac{-40+21}{56} = \frac{-19}{56}$ (since (-, +) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

Example 3 – Subtract $\frac{-3}{5}$ *from* $\frac{9}{10}$

Solution: We can write it as: $\frac{9}{10} - \frac{(-3)}{5} = \frac{9}{10} + \frac{3}{5}$ (Since (-, - = +))

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (10 and 5) is 10 and we will make 10 as denominator in both rational numbers.

Thus, we have $\frac{9}{10} = \frac{9\times1}{10\times1} = \frac{9}{10}$ (Multiplying each term by 1)

$\frac{3}{5} = \frac{3\times2}{5\times2} = \frac{6}{10}$ (Multiplying each term by 2)

Now, we solve as follows:

$=>\frac{9}{10} + \frac{3}{5} = \frac{9}{10} + \frac{6}{10} = \frac{9+6}{10} = \frac{15}{10} = \frac{3}{2}$

Example 4 – The sum of two rational numbers is $\frac{-3}{5}$. If one of the numbers is $\frac{-9}{20}$, find the other.

Solution: Let the other number be 'x'

It is given that one number = $\frac{-9}{20}$

Sum of two rational numbers = $\frac{-3}{5}$

=> $x + \left(\frac{-9}{20}\right) = \frac{-3}{5}$

=> $x - \frac{9}{20} = \frac{-3}{5}$ (Since (+, - = -))

=> $x = \frac{-3}{5} + \frac{9}{20}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (5 and 20) is 20 and we will make 20 as denominator in both rational numbers.

Thus, we have $\frac{-3}{5} = \frac{-3\times4}{5\times4} = \frac{-12}{20}$ (Multiplying each term by 4)

$\frac{9}{20} = \frac{9\times1}{20\times1} = \frac{9}{20}$ (Multiplying each term by 1)

Now, we solve as follows:

=>$\frac{-12}{20} + \frac{9}{20} = \frac{-12+9}{10} = \frac{-3}{20}$ (since (-, +) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

Therefore, other number = $\frac{-3}{20}$

Example 5 – What number should be added to $\frac{-5}{8}$ so as to get $\frac{5}{9}$?

Solution: Let the required number be 'x'

Then according to question, we have

=> $\frac{-5}{8} + x = \frac{5}{9}$

=> $x = \frac{5}{9} - (\frac{-5}{8})$ (Since (-, - = +))

=> $x = \frac{5}{9} + \frac{5}{8}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (9 and 8) is 72 and we will make 72 as denominator in both rational numbers.

Thus, we have $\frac{5}{9} = \frac{5\times8}{9\times8} = \frac{40}{72}$ (Multiplying each term by 8)

$\frac{5}{8} = \frac{5\times9}{8\times9} = \frac{45}{72}$ (Multiplying each term by 9)

Now, we solve as follows:

=>$x = \frac{5}{9} + \frac{5}{8} = \frac{40}{72} + \frac{45}{72} = \frac{40+45}{72} = \frac{85}{72}$

Therefore, required number = $\frac{85}{72}$

Example 6 – What should be subtracted from $\frac{-3}{4}$ so as to get $\frac{5}{6}$?

Solution: Let the required number be 'x'

Then according to question, we have

=> $\frac{-3}{4} - x = \frac{5}{6}$

=> $\frac{-3}{4} - \frac{5}{6} = x$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (4 and 6) is 12 and we will make 12 as denominator in both rational numbers.

Thus, we have $\frac{-3}{4} = \frac{-3\times3}{4\times3} = \frac{-9}{12}$ (Multiplying each term by 3)

$\frac{5}{6} = \frac{5\times2}{6\times2} = \frac{10}{12}$ (Multiplying each term by 2)

Now, we solve as follows:

$=>x = \frac{-3}{4} - \frac{5}{6} = \frac{-9}{12} - \frac{10}{12} = \frac{-9-10}{12} = \frac{-19}{12}$

Therefore, required number = $\frac{-19}{12}$

Example 7 – Simplify:

(i) $\frac{-2}{3} + \frac{5}{9} - \frac{-7}{6}$

Solution: We can write it as: $\frac{-2}{3} + \frac{5}{9} + \frac{7}{6}$ (Since (-, - = +))

Now, we can see that denominators in all the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (3, 9 and 6) is 18 and we will make 18 as denominator in all rational numbers.

Thus, we have $\frac{-2}{3} = \frac{-2\times6}{3\times6} = \frac{-12}{18}$ (Multiplying each term by 6)

$\frac{5}{9} = \frac{5\times2}{9\times2} = \frac{10}{18}$ (Multiplying each term by 2)

$\frac{7}{6} = \frac{7\times3}{6\times3} = \frac{21}{18}$ (Multiplying each term by 3)

Now, we solve as follows:

$=>\frac{-2}{3} + \frac{5}{9} + \frac{7}{6} = \frac{-12}{18} + \frac{10}{18} + \frac{21}{18} = \frac{-12+10+21}{18} = \frac{-12+31}{18} = \frac{19}{18}$

(ii) $\frac{5}{12} + \frac{-5}{18} - \frac{7}{24}$

Solution: We can write it as: $\frac{5}{12} - \frac{5}{18} - \frac{7}{24}$ (Since (+, - = -))

Now, we can see that denominators in all the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (12, 18 and 24) is 72 and we will make 72 as denominator in all rational numbers.

Thus, we have $\frac{5}{12} = \frac{5\times6}{12\times6} = \frac{30}{72}$ (Multiplying each term by 6)

$\frac{5}{18} = \frac{5\times4}{18\times4} = \frac{20}{72}$ (Multiplying each term by 4)

$\frac{7}{24} = \frac{7\times3}{24\times3} = \frac{21}{72}$ (Multiplying each term by 3)

Now, we solve as follows:

$=>\frac{5}{12} - \frac{5}{18} - \frac{7}{24} = \frac{30}{72} - \frac{20}{72} - \frac{21}{72} = \frac{30-20-21}{72} = \frac{10-21}{72} = \frac{-11}{72}$ (since (-, +) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

Exercise 5.2

Question 1 – Subtract the first rational number from the second in each of the following:

(i) $\frac{3}{8}, \frac{5}{8}$

Solution: We will solve: $\frac{5}{8} - \frac{3}{8}$

Here, denominators of both rational numbers are same, thus we solve it as follows:

$=> \frac{5}{8} - \frac{3}{8} = \frac{5-3}{8} = \frac{2}{8} = \frac{1}{4}$

(ii) $\frac{-7}{9}, \frac{4}{9}$

Solution: We will solve: $\frac{4}{9} - \frac{(-7)}{9} = \frac{4}{9} + \frac{7}{9}$ (Since (-, - = +))

Here, denominators of both rational numbers are same, thus we solve it as follows:

$=> \frac{4}{9} + \frac{7}{9} = \frac{4+7}{9} = \frac{11}{9}$

(iii) $\frac{-2}{11}, \frac{-9}{11}$

Solution: We will solve: $\frac{-9}{11} - \frac{(2)}{11} = \frac{-9}{11} + \frac{2}{11}$ (Since (-, - = +))

Here, denominators of both rational numbers are same, thus we solve it as follows:

=> $\frac{-9}{11}+\frac{2}{11}=\frac{-9+2}{11}=\frac{-7}{11}$ (since (-, +) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

(iv) $\frac{\mathbf{11}}{\mathbf{13}},\frac{\mathbf{-4}}{\mathbf{13}}$

Solution: We will solve: $\frac{-4}{13}-\frac{11}{13}=\frac{-4}{13}-\frac{11}{13}$

Here, denominators of both rational numbers are same, thus we solve it as follows:

=> $\frac{-4}{13}-\frac{11}{13}=\frac{-4-11}{13}=\frac{-15}{13}$ (since (-, -) = + but minus sign comes with the answer)

Question 2 – Evaluate each of the following:

(i) $\frac{\mathbf{2}}{\mathbf{3}}-\frac{\mathbf{3}}{\mathbf{5}}$

Solution: Here, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (3 and 5) is 15 and we will make 15 as denominator in both rational numbers.

Thus, we have $\frac{2}{3}=\frac{2\times5}{3\times5}=\frac{10}{15}$ (Multiplying each term by 5)

$\frac{3}{5}=\frac{3\times3}{5\times3}=\frac{9}{15}$ (Multiplying each term by 3)

Now, we solve as follows:

=>$\frac{2}{3}-\frac{3}{5}=\frac{10}{15}-\frac{9}{15}=\frac{10-9}{15}=\frac{1}{15}$

(ii) $-\frac{\mathbf{4}}{\mathbf{7}}-\frac{\mathbf{2}}{\mathbf{-3}}$

Solution: We can write $\frac{2}{-3}=\frac{2\times(-1)}{-3\times(-1)}=\frac{-2}{3}$

Then, we have: $\frac{-4}{7}-\frac{-2}{3}=\frac{-4}{7}+\frac{2}{3}$ (Since (-, - = +))

Here, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (7 and 3) is 21 and we will make 21 as denominator in both rational numbers.

Thus, we have $\frac{-4}{7} = \frac{-4\times3}{7\times3} = \frac{-12}{21}$ (Multiplying each term by 3)

$\frac{2}{3} = \frac{2\times7}{3\times7} = \frac{14}{21}$ (Multiplying each term by 7)

Now, we solve as follows:

$=>\frac{-4}{7} + \frac{2}{3} = \frac{-12}{21} + \frac{14}{21} = \frac{-12+14}{21} = \frac{2}{21}$

(iii) $\mathbf{\frac{4}{7} - \frac{-5}{-7}}$

Solution: We can write $\frac{-5}{-7} = \frac{-5\times(-1)}{-7\times(-1)} = \frac{5}{7}$

Then, we have: $\frac{4}{7} - \frac{5}{7}$

Here, we can see that denominators in both the rational numbers are same thus, we will solve this as follows:

$=>\frac{4}{7} - \frac{5}{7} = \frac{4-5}{7} = \frac{-1}{7}$ (since (-, +) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

(iv) $\mathbf{-2 - \frac{5}{9}}$

Solution: We can write $-2 = \frac{-2}{1}$

Then, we have: $\frac{-2}{1} - \frac{5}{9}$

Here, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (1 and 9) is 9 and we will make 9 as denominator in both rational numbers.

Thus, we have $\frac{-2}{1} = \frac{-2\times9}{1\times9} = \frac{-18}{9}$ (Multiplying each term by 9)

$\frac{5}{9} = \frac{5\times1}{9\times1} = \frac{5}{9}$ (Multiplying each term by 1)

Now, we solve as follows:

$=>\frac{-2}{1}-\frac{5}{9}=\frac{-18}{9}-\frac{5}{9}=\frac{-18-5}{9}=\frac{-23}{9}$

Question 3 – The sum of the two numbers is $\frac{5}{9}$. If one of the numbers is $\frac{1}{3}$, find the other.

Solution: Let the other number be 'x'

It is given that one number = $\frac{1}{3}$

Sum of two rational numbers = $\frac{5}{9}$

$=> x+\left(\frac{1}{3}\right)=\frac{5}{9}$

$=> x=\frac{5}{9}-\frac{1}{3}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (3 and 9) is 9 and we will make 9 as denominator in both rational numbers.

Thus, we have $\frac{1}{3}=\frac{1\times3}{3\times3}=\frac{3}{9}$ (Multiplying each term by 3)

$\frac{5}{9}=\frac{5\times1}{9\times1}=\frac{5}{9}$ (Multiplying each term by 1)

Now, we solve as follows:

$=>x=\frac{5}{9}-\frac{1}{3}=\frac{5}{9}-\frac{3}{9}=\frac{5-3}{9}=\frac{2}{9}$

Therefore, other number = $\frac{2}{9}$

Question 4 – The sum of the two numbers is $\frac{-1}{3}$. If one of the numbers is $\frac{-12}{3}$, find the other.

Solution: Let the other number be 'x'

It is given that one number = $\frac{-12}{3}$

Sum of two rational numbers = $\frac{-1}{3}$

=> $x + \left(\frac{-12}{3}\right) = \frac{-1}{3}$

=> $x - \frac{12}{3} = \frac{-1}{3}$ (Since (+, - = -))

=> $x = \frac{-1}{3} + \frac{12}{3}$

Now, we can see that denominators in both the rational numbers are same thus, we will solve as follows:

=> $x = \frac{-1}{3} + \frac{12}{3} = \frac{-1+12}{3} = \frac{11}{3}$

Therefore, other number = $\frac{11}{3}$

Question 5 – The sum of the two numbers is$\frac{-4}{3}$. If one of the numbers is -5, find the other.

Solution: Let the other number be 'x'

It is given that one number = -5

Sum of two rational numbers = $\frac{-4}{3}$

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

=> $x - 5 = \frac{-4}{3}$ (Since (+, - = -))

=> $x = \frac{-4}{3} + 5 = \frac{-4}{3} + \frac{5}{1}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (3 and 1) is 3 and we will make 3 as denominator in both rational numbers.

Thus, we have $\frac{-4}{3} = \frac{-4\times1}{3\times1} = \frac{-4}{3}$ (Multiplying each term by 1)

$\frac{5}{1} = \frac{5\times3}{1\times3} = \frac{15}{3}$ (Multiplying each term by 3)

Now, we solve as follows:

$=>x = \frac{-4}{3} + \frac{5}{1} = \frac{-4}{3} + \frac{15}{3} = \frac{-4+15}{3} = \frac{11}{3}$

Therefore, other number = $\frac{11}{3}$

Question 6 – The sum of two rational numbers is -8. If one of the numbers is $\frac{-15}{7}$, find the other.

Solution: Let the other number be 'x'

It is given that one number = $\frac{-15}{7}$

Sum of two rational numbers = -8

$=> x + \left(\frac{-15}{7}\right) = -8$

$=> x - \frac{15}{7} = -8$ (Since (+, - = -))

$=> x = -8 + \frac{15}{7} = \frac{-8}{1} + \frac{15}{7}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (1 and 7) is 7 and we will make 7 as denominator in both rational numbers.

Thus, we have $\frac{15}{7} = \frac{15\times1}{7\times1} = \frac{15}{7}$ (Multiplying each term by 1)

$\frac{-8}{1} = \frac{-8\times7}{1\times7} = \frac{-56}{7}$ (Multiplying each term by 7)

Now, we solve as follows:

$=>x = \frac{-8}{1} + \frac{15}{7} = \frac{-56}{7} + \frac{15}{7} = \frac{-56+15}{7} = \frac{-41}{7}$

Therefore, other number = $\frac{-41}{7}$

Question 7 – What should be added to $\frac{-7}{8}$ so as to get $\frac{5}{9}$?

Solution: Let the required number be 'x'

Then according to question, we have

=> $\frac{-7}{8} + x = \frac{5}{9}$

=> $x = \frac{5}{9} - (\frac{-7}{8})$ (Since (-, - = +))

=> $x = \frac{5}{9} + \frac{7}{8}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (9 and 8) is 72 and we will make 72 as denominator in both rational numbers.

Thus, we have $\frac{5}{9} = \frac{5\times8}{9\times8} = \frac{40}{72}$ (Multiplying each term by 8)

$\frac{7}{8} = \frac{7\times9}{8\times9} = \frac{63}{72}$ (Multiplying each term by 9)

Now, we solve as follows:

=>$x = \frac{5}{9} + \frac{7}{8} = \frac{40}{72} + \frac{63}{72} = \frac{40+45}{72} = \frac{103}{72}$

Therefore, required number = $\frac{103}{72}$

Question 8 – What number should be added to $\frac{-5}{11}$ so as to get $\frac{26}{33}$?

Solution: Let the required number be 'x'

Then according to question, we have

=> $\frac{-5}{11} + x = \frac{26}{33}$

=> $x = \frac{26}{33} - (\frac{-5}{11})$ (Since (-, - = +))

$=> x = \frac{26}{33} + \frac{5}{11}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (33 and 11) is 33 and we will make 33 as denominator in both rational numbers.

Thus, we have $\frac{26}{33} = \frac{26\times1}{33\times1} = \frac{26}{33}$ (Multiplying each term by 1)

$\frac{5}{11} = \frac{5\times3}{11\times3} = \frac{15}{33}$ (Multiplying each term by 3)

Now, we solve as follows:

$=> x = \frac{26}{33} + \frac{5}{11} = \frac{26}{33} + \frac{15}{33} = \frac{26+15}{33} = \frac{41}{33}$

Therefore, required number = $\frac{41}{33}$

Question 9 – What number should be added to $\frac{-5}{7}$ to get $\frac{-2}{3}$?

Solution: Let the required number be 'x'

Then according to question, we have

$=> \frac{-5}{7} + x = \frac{-2}{3}$

$=> x = \frac{-2}{3} - (\frac{-5}{7})$ (Since (-, - = +))

$=> x = \frac{-2}{3} + \frac{5}{7}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (3 and 7) is 21 and we will make 21 as denominator in both rational numbers.

Thus, we have $\frac{-2}{3} = \frac{-2\times7}{3\times7} = \frac{-14}{21}$ (Multiplying each term by 7)

$\frac{5}{7} = \frac{5\times3}{7\times3} = \frac{15}{21}$ (Multiplying each term by 3)

Now, we solve as follows:

$=> x = \frac{-2}{3} + \frac{5}{7} = \frac{-14}{21} + \frac{15}{21} = \frac{-14+15}{21} = \frac{1}{21}$

Therefore, required number = $\frac{1}{21}$

Question 10 – What number should be subtracted from $\frac{-5}{3}$ to get $\frac{5}{6}$?

Solution: Let the required number be 'x'

Then according to question, we have

$=> \frac{-5}{3} - x = \frac{5}{6}$

$=> \frac{-5}{3} - \frac{5}{6} = x$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (3 and 6) is 6 and we will make 6 as denominator in both rational numbers.

Thus, we have $\frac{-5}{3} = \frac{-5\times2}{3\times2} = \frac{-10}{6}$ (Multiplying each term by 2)

$\frac{5}{6} = \frac{5\times1}{6\times1} = \frac{5}{6}$ (Multiplying each term by 1)

Now, we solve as follows:

$=> x = \frac{-5}{3} - \frac{5}{6} = \frac{-10}{6} - \frac{5}{6} = \frac{-10-5}{6} = \frac{-15}{6} = \frac{-5}{2}$

Therefore, required number = $\frac{-5}{2}$

Question 11 – What number should be subtracted from $\frac{3}{7}$ to get $\frac{5}{4}$?

Solution: Let the required number be 'x'

Then according to question, we have

$=> \frac{3}{7} - x = \frac{5}{4}$

$\Rightarrow \frac{3}{7} - \frac{5}{4} = x$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (7 and 4) is 28 and we will make 28 as denominator in both rational numbers.

Thus, we have $\frac{3}{7} = \frac{3\times4}{7\times4} = \frac{12}{28}$ (Multiplying each term by 4)

$\frac{5}{4} = \frac{5\times7}{4\times7} = \frac{35}{28}$ (Multiplying each term by 7)

Now, we solve as follows:

$\Rightarrow x = \frac{3}{7} - \frac{5}{4} = \frac{12}{28} - \frac{35}{28} = \frac{12-35}{28} = \frac{-23}{28}$ (since (-, +) = - and minus sign comes with the answer because greater number is subtracted from smaller one)

Therefore, required number = $\frac{-23}{28}$

Question 12 – What should be added to$(\frac{2}{3} + \frac{3}{5})$ to get$\frac{-2}{15}$?

Solution: Let the required number be 'x'

Then according to question, we have

$\Rightarrow \left(\frac{2}{3} + \frac{3}{5}\right) + x = \frac{-2}{15}$

We will first solve $\frac{2}{3} + \frac{3}{5}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (3 and 5) is 15 and we will make 15 as denominator in both rational numbers.

Thus, we have $\frac{2}{3} = \frac{2\times5}{3\times5} = \frac{10}{15}$ (Multiplying each term by 5)

$\frac{3}{5} = \frac{3\times3}{5\times3} = \frac{9}{15}$ (Multiplying each term by 3)

Now, we solve as follows:

$=>\frac{2}{3}+\frac{3}{5}=\frac{10}{15}+\frac{9}{15}=\frac{10+9}{15}=\frac{19}{15}$

Now, we have $\left(\frac{2}{3}+\frac{3}{5}\right)+x=\frac{-2}{15}$

$=>\frac{19}{15}+x=\frac{-2}{15}$

$=>x=\frac{-2}{15}-\frac{19}{15}$

Here, we see that denominators of both rational numbers are same. Thus, we will solve this as follows: $x=\frac{-2}{15}-\frac{19}{15}=\frac{-2-19}{15}=\frac{-21}{15}=\frac{-7}{5}$

Therefore, required number = $\frac{-7}{5}$

Question 13 – What should be added to$\left(\frac{1}{2}+\frac{1}{3}+\frac{1}{5}\right)$ to get 3?

Solution: Let the required number be 'x'

Then according to question, we have

$=>\left(\frac{1}{2}+\frac{1}{3}+\frac{1}{5}\right)+x=3$

We will first solve $\frac{1}{2}+\frac{1}{3}+\frac{1}{5}$

Now, we can see that denominators in all the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (2, 3 and 5) is 30 and we will make 15 as denominator in both rational numbers.

Thus, we have $\frac{1}{2}=\frac{1\times15}{2\times15}=\frac{15}{30}$ (Multiplying each term by 15)

$\frac{1}{3}=\frac{1\times10}{3\times10}=\frac{10}{30}$ (Multiplying each term by 10)

$\frac{1}{5}=\frac{1\times6}{5\times6}=\frac{6}{30}$ (Multiplying each term by 6)

Now, we solve as follows:

$=>\frac{1}{2}+\frac{1}{3}+\frac{1}{5}=\frac{15}{30}+\frac{10}{30}+\frac{6}{30}=\frac{15+10+6}{30}=\frac{31}{30}$

Now, we have $\left(\frac{1}{2}+\frac{1}{3}+\frac{1}{5}\right)+x=3$

=> $\frac{31}{30}+x=3$

=> $x=3-\frac{31}{30}=\frac{3}{1}-\frac{31}{30}$

Here, we see that denominators of both rational numbers are different. Thus, we will solve this by taking LCM of the denominators as follows:

Now, LCM of (1 and 30) is 30 and we will make 30 as denominator in both rational numbers.

Thus, we have $\frac{3}{1}=\frac{3\times30}{1\times30}=\frac{90}{30}$ (Multiplying each term by 30)

$\frac{31}{30}=\frac{31\times1}{30\times1}=\frac{31}{30}=$ (Multiplying each term by 1)

Now, we solve as follows:

=> $x=\frac{3}{1}-\frac{31}{30}=\frac{90}{30}-\frac{31}{30}=\frac{90-31}{30}=\frac{59}{30}$

Therefore, required number = $\frac{59}{30}$

Question 14 – What should be subtracted from $\left(\frac{3}{4}-\frac{2}{3}\right)$ to get $\frac{-1}{6}$?

Solution: Let the required number be 'x'

Then according to question, we have

=> $\left(\frac{3}{4}-\frac{2}{3}\right)-x=\frac{-1}{6}$

We will first solve $\frac{3}{4}-\frac{2}{3}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (4 and 3) is 12 and we will make 12 as denominator in both rational numbers.

Thus, we have $\frac{2}{3}=\frac{2\times4}{3\times4}=\frac{8}{12}$ (Multiplying each term by 4)

$\frac{3}{4} = \frac{3\times3}{4\times3} = \frac{9}{12}$ (Multiplying each term by 3)

Now, we solve as follows:

$=>\frac{3}{4} - \frac{2}{3} = \frac{9}{12} - \frac{8}{12} = \frac{9-8}{12} = \frac{1}{12}$

Now, we have $\left(\frac{3}{4} - \frac{2}{3}\right) - x = \frac{-1}{6}$

$=> \frac{1}{12} - x = \frac{-1}{6}$

$=> x = \frac{1}{12} + \frac{1}{6}$

Here, we see that denominators of both rational numbers are different. Thus, we will solve this by taking LCM of the denominators as follows:

Now, LCM of (12 and 6) is 12 and we will make 12 as denominator in both rational numbers.

Thus, we have $\frac{1}{12} = \frac{1\times1}{12\times1} = \frac{1}{12}$ (Multiplying each term by 1)

$\frac{1}{6} = \frac{1\times2}{6\times2} = \frac{2}{12}$ (Multiplying each term by 2)

Now, we solve as follows:

$=> x = \frac{1}{12} + \frac{1}{6} = \frac{1}{12} + \frac{2}{12} = \frac{1+2}{12} = \frac{3}{12} = \frac{1}{4}$

Therefore, required number = $\frac{1}{4}$

Question 15 – Simplify:

(i) $\frac{-3}{2} + \frac{5}{4} - \frac{7}{4}$

Solution: We can write it as: $\frac{-3}{2} + \frac{5}{4} - \frac{7}{4}$

Now, we can see that denominators in all the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (2, 4 and 4) is 4 and we will make 4 as denominator in all rational numbers.

Thus, we have $\frac{-3}{2} = \frac{-3\times2}{2\times2} = \frac{-6}{4}$ (Multiplying each term by 2)

$\frac{5}{4} = \frac{5\times1}{4\times1} = \frac{5}{4}$ (Multiplying each term by 1)

$\frac{7}{4} = \frac{7\times1}{4\times1} = \frac{7}{4}$ (Multiplying each term by 1)

Now, we solve as follows:

$=>\frac{-3}{2} + \frac{5}{4} - \frac{7}{4} = \frac{-6}{4} + \frac{5}{4} - \frac{7}{4} = \frac{-6+5-7}{4} = \frac{-1-7}{4} = \frac{-8}{4} = -2$ (Since (-, + = -) and (-, - = +))

(ii) $\mathbf{\frac{5}{3} - \frac{7}{6} + \frac{-2}{3}}$

Solution: We can write it as: $\frac{5}{3} - \frac{7}{6} - \frac{2}{3}$ (Since (+, - = -))

Now, we can see that denominators in all the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (3, 6 and 3) is 6 and we will make 6 as denominator in all rational numbers.

Thus, we have $\frac{5}{3} = \frac{5\times2}{3\times2} = \frac{10}{6}$ (Multiplying each term by 2)

$\frac{7}{6} = \frac{7\times1}{6\times1} = \frac{7}{6}$ (Multiplying each term by 1)

$\frac{2}{3} = \frac{2\times2}{3\times2} = \frac{4}{6}$ (Multiplying each term by 2)

Now, we solve as follows:

$=>\frac{5}{3} - \frac{7}{6} - \frac{2}{3} = \frac{10}{6} - \frac{7}{6} - \frac{4}{6} = \frac{10-7-4}{6} = \frac{3-4}{6} = \frac{-1}{6}$ (Since (-, - = +))

(iii) $\mathbf{\frac{5}{4} - \frac{7}{6} - \frac{-2}{3}}$

Solution: We can write it as: $\frac{5}{4} - \frac{7}{6} + \frac{2}{3}$ (Since (-, - = +))

Now, we can see that denominators in all the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (4, 6 and 3) is 12 and we will make 12 as denominator in all rational numbers.

Thus, we have $\frac{5}{4} = \frac{5\times3}{4\times3} = \frac{15}{12}$ (Multiplying each term by 3)

$\frac{7}{6} = \frac{7\times2}{6\times2} = \frac{14}{12}$ (Multiplying each term by 2)

$\frac{2}{3} = \frac{2\times4}{3\times4} = \frac{8}{12}$ (Multiplying each term by 4)

Now, we solve as follows:

$=>\frac{5}{4} - \frac{7}{6} + \frac{2}{3} = \frac{15}{12} - \frac{14}{12} + \frac{8}{12} = \frac{15-14+8}{12} = \frac{1+8}{12} = \frac{9}{12} = \frac{3}{4}$

(iv) $\mathbf{\frac{-2}{5} - \frac{-3}{10} - \frac{-4}{7}}$

Solution: We can write it as: $\frac{-2}{5} + \frac{3}{10} + \frac{4}{7}$ (Since (-, - = +))

Now, we can see that denominators in all the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (5, 10 and 7) is 70 and we will make 70 as denominator in all rational numbers.

Thus, we have $\frac{-2}{5} = \frac{-2\times14}{5\times14} = \frac{-28}{70}$ (Multiplying each term by 14)

$\frac{3}{10} = \frac{3\times7}{10\times7} = \frac{21}{70}$ (Multiplying each term by 7)

$\frac{4}{7} = \frac{4\times10}{7\times10} = \frac{40}{70}$ (Multiplying each term by 10)

Now, we solve as follows:

$=>\frac{-2}{5} + \frac{3}{10} + \frac{4}{7} = \frac{-28}{70} + \frac{21}{70} + \frac{40}{70} = \frac{-28+21+40}{70} = \frac{-28+61}{70} = \frac{33}{70}$

Question 16 – Fill in the blanks:

(i) $\mathbf{\frac{-4}{13} - \frac{-3}{26}} = \cdots$

Solution: We have: $\frac{-4}{13} - \frac{-3}{26} = \frac{-4}{13} + \frac{3}{26}$ (Since (-, - = +))

Now, we can see that denominators in all the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (13 and 26) is 26 and we will make 26 as denominator in all rational numbers.

Thus, we have $\frac{-4}{13} = \frac{-4\times2}{13\times2} = \frac{-8}{26}$ (Multiplying each term by 2)

$\frac{3}{26} = \frac{3\times1}{26\times1} = \frac{3}{26}$ (Multiplying each term by 1)

Now, we solve as follows:

$=>\frac{-4}{13} + \frac{3}{26} = \frac{-8}{26} + \frac{3}{26} = \frac{-8+3}{26} = \frac{-5}{26}$

(ii) $\mathbf{\frac{-9}{14} + \cdots = -1}$

Solution: Let the number in blank space be 'x'

Then, we have $\frac{-9}{14} + x = -1$

$=> x = -1 - \frac{-9}{14} = -1 + \frac{9}{14} = \frac{-1}{1} + \frac{9}{14}$ (Since (-, - = +))

Now, we can see that denominators in all the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (1 and 14) is 14 and we will make 14 as denominator in all rational numbers.

Thus, we have $-\frac{1}{1} = \frac{-1\times14}{1\times14} = \frac{-14}{14}$ (Multiplying each term by 14)

$\frac{9}{14} = \frac{9\times1}{14\times1} = \frac{9}{14}$ (Multiplying each term by 1)

Now, we solve as follows:

$=>\frac{-1}{1} + \frac{9}{14} = \frac{-14}{14} + \frac{9}{14} = \frac{-14+9}{14} = \frac{-5}{14}$

Therefore, $x = \frac{-5}{14}$

(iii) $\mathbf{\frac{-7}{9} + \cdots = 3}$

Solution: Let the number in blank space be 'x'

Then, we have $\frac{-7}{9} + x = 3$

$=> x = 3 - \frac{-7}{9} = 3 + \frac{7}{9} = \frac{3}{1} + \frac{7}{9}$ (Since (-, - = +))

Now, we can see that denominators in all the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (1 and 9) is 9 and we will make 9 as denominator in all rational numbers.

Thus, we have $\frac{3}{1} = \frac{3\times9}{1\times9} = \frac{27}{9}$ (Multiplying each term by 9)

$\frac{7}{9} = \frac{7\times1}{9\times1} = \frac{7}{9}$ (Multiplying each term by 1)

Now, we solve as follows:

$=>\frac{3}{1} + \frac{7}{9} = \frac{27}{9} + \frac{7}{9} = \frac{27+7}{9} = \frac{34}{9}$

Therefore, $x = \frac{34}{9}$

(iv) $\ldots. + \frac{15}{23} = 4$

Solution: Let the number in blank space be 'x'

Then, we have $x + \frac{15}{23} = 4$

$=> x = 4 - \frac{15}{23} = \frac{4}{1} - \frac{15}{23}$

Now, we can see that denominators in all the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (1 and 23) is 23 and we will make 23 as denominator in all rational numbers.

Thus, we have $\frac{4}{1} = \frac{4\times23}{1\times23} = \frac{92}{23}$ (Multiplying each term by 23)

$\frac{15}{23} = \frac{15\times1}{23\times1} = \frac{15}{23}$ (Multiplying each term by 1)

Now, we solve as follows:

$=>\frac{4}{1} - \frac{15}{23} = \frac{92}{23} - \frac{15}{23} = \frac{92-15}{23} = \frac{77}{23}$

Therefore, $x = \frac{77}{23}$

Multiplication of Rational Numbers

In order to multiply two rational numbers, we will use the result as follows:

Product of two rational numbers = $\frac{Product\ of\ their\ numerators}{Product\ of\ their\ denominators}$

Let us take two rational numbers as $\frac{a}{b}\ and\ \frac{c}{d}, then\ we\ have$

=> $\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}$

Examples

Example 1 – Multiply:

(i) $\frac{3}{4}$ **by** $\frac{5}{7}$

Solution: We have: $\frac{3}{4} \times \frac{5}{7} = \frac{3 \times 5}{4 \times 7} = \frac{15}{28}$

(ii) $\frac{3}{7}$ **by** $(\frac{-4}{5})$

Solution: We have: $\frac{3}{7} \times (\frac{-4}{5}) = \frac{3 \times (-4)}{7 \times 5} = \frac{-12}{35}$

(iii) $\left(\frac{-5}{9}\right)$ **by 4**

Solution: We have: $\frac{-5}{9} \times 4 = \frac{-5}{9} \times \frac{4}{1} = \frac{-5 \times 4}{9 \times 1} = \frac{-20}{9}$

(iv) $(\frac{-36}{7})$ **by** $(\frac{-28}{9})$

Solution: We have: $\left(\frac{-36}{7}\right) \times \left(\frac{-28}{9}\right) = \frac{(-36) \times (-28)}{7 \times 9}$

We can solve this as follows:

-4 -4

=> $\frac{(-\cancel{36}) \times (-\cancel{28})}{\cancel{7} \times \cancel{9}}$

=> $(-4) \times (-4) = 16$

Example 2 – Simplify:

(i) $\frac{-8}{7} \times \frac{14}{5}$

Solution: We have: $\frac{-8}{7} \times \frac{14}{5} = \frac{(-8)\times \overset{2}{\cancel{14}}}{\cancel{7}\times 5}$

$= \frac{(-8)\times 2}{5} = \frac{-16}{5}$

(ii) $\frac{13}{6} \times \frac{-18}{91}$

Solution: We have: $\frac{13}{6} \times \frac{-18}{91} = \frac{\cancel{13}\times(\overset{-3}{\cancel{-18}})}{\cancel{6}\times\overset{7}{\cancel{91}}}$

$= \frac{1\times(-3)}{1\times 7} = \frac{-3}{7}$

(iii) $\frac{-5}{9} \times \frac{72}{-125}$

Solution: We have: $\frac{-5}{9} \times \frac{72}{-125} = \frac{(\overset{-1}{\cancel{-5}})\times \overset{8}{\cancel{72}}}{\cancel{9}\times(\underset{-25}{\cancel{-125}})}$

$= \frac{-1\times 8}{1\times(-25)} = \frac{-8}{-25} = \frac{8}{25}$

(iv) $\frac{-22}{9} \times \frac{-51}{-88}$

Solution: We have: $\frac{-22}{9} \times \frac{-51}{-88} = \frac{(\overset{-1}{\cancel{-22}})\times(\overset{-17}{\cancel{-51}})}{\cancel{9}\times(\underset{-4}{\cancel{-88}})}$

$= \frac{-1\times(-17)}{3\times(-4)} = \frac{17}{-12} = \frac{-17}{12}$

Example 3 – Simplify:

(i) $\left(\frac{-16}{5} \times \frac{20}{8}\right) - \left(\frac{15}{5} \times \frac{-35}{5}\right)$

Solution: We have: $\left(\frac{-16}{5} \times \frac{20}{8}\right) - \left(\frac{15}{5} \times \frac{-35}{5}\right)$

$= \left(\frac{\overset{-2}{\cancel{-16}}\times \overset{4}{\cancel{20}}}{5\times\cancel{8}}\right) - \left(\frac{\overset{3}{\cancel{15}}\times(\overset{-7}{\cancel{-35}})}{\cancel{5}\times 5}\right)$

$= ((-2) \times 4) - (3 \times (-7))$

$= -8 - (-21) = -8 + 21 = 13$

(ii) $\left(\frac{-3}{2} \times \frac{4}{5}\right) + \left(\frac{9}{5} \times \frac{-10}{3}\right) - \left(\frac{1 \times 3}{2 \times 4}\right)$

Solution: We have: $\left(\frac{-3}{2} \times \frac{4}{5}\right) + \left(\frac{9}{5} \times \frac{-10}{3}\right) - \left(\frac{1 \times 3}{2 \times 4}\right)$

$= \left(\frac{-3 \times \cancel{4}^{2}}{\cancel{2} \times 5}\right) + \left(\frac{\cancel{9}^{3} \times (\cancel{-10}^{-2})}{5 \times \cancel{3}}\right) - \left(\frac{1 \times 3}{2 \times 4}\right)$

$= \left(\frac{-3 \times 2}{5}\right) + \left(3 \times (-2)\right) - \left(\frac{3}{8}\right)$

$= \frac{-6}{5} + (-6) - \frac{3}{8} = \frac{-6}{5} - \frac{6}{1} - \frac{3}{8}$

Now, we can see that denominators of all rational numbers are different, thus we will make the denominators same by taking their LCM as follows:

LCM of (5, 1 and 8) is 40

$\Rightarrow \frac{-6}{5} = \frac{-6 \times 8}{5 \times 8} = \frac{-48}{40}$

$\Rightarrow \frac{6}{1} = \frac{6 \times 40}{1 \times 40} = \frac{240}{40}$

$\Rightarrow \frac{3}{8} = \frac{3 \times 5}{8 \times 5} = \frac{15}{40}$

Thus we have, $\frac{-6}{5} - \frac{6}{1} - \frac{3}{8} = \frac{-48}{40} - \frac{240}{40} - \frac{15}{40}$

$\Rightarrow \frac{-48-240-15}{40} = \frac{-303}{40}$

Exercise 5.3

Question 1 – Multiply:

(i) $\frac{7}{11}$ **by** $\frac{5}{4}$

Solution: We have: $\frac{7}{11} \times \frac{5}{4} = \frac{7 \times 5}{11 \times 4} = \frac{35}{44}$

(ii) $\frac{5}{7}$ **by** $(\frac{-3}{4})$

Solution: We have: $\frac{5}{7} \times \frac{-3}{4} = \frac{5 \times (-3)}{7 \times 4} = \frac{-15}{28}$

(iii) $\left(\frac{-2}{9}\right)$ **by** $\frac{5}{11}$

Solution: We have: $\frac{-2}{9} \times \frac{5}{11} = \frac{-2 \times 5}{9 \times 11} = \frac{-10}{99}$

(iv) $\left(\frac{-3}{17}\right)$ **by** $(\frac{-5}{-4})$

Solution: We have: $\frac{-3}{17} \times \frac{-5}{-4} = \frac{-3 \times -5}{17 \times (-4)} = \frac{-15}{68}$

Question 2 – Multiply:

(i) $\frac{-5}{17}$ **by** $\frac{51}{-60}$

Solution: We have: $\frac{-5}{17} \times \frac{51}{-60} = \frac{\overset{-1}{\cancel{-5}} \times \overset{3}{\cancel{51}}}{\underset{-12}{\cancel{17} \times (\cancel{-60})}}$

$= \frac{-1 \times 3}{1 \times (-12)} = \frac{-3}{-12} = \frac{3}{12} = \frac{1}{4}$

(ii) $\frac{-6}{11}$ **by** $\frac{-55}{36}$

Solution: We have: $\frac{-6}{11} \times \frac{-55}{36} = \frac{\overset{-1}{\cancel{-6}} \times (\overset{-5}{\cancel{-55}})}{\underset{6}{\cancel{11} \times \cancel{36}}}$

$= \frac{-1 \times -5}{1 \times 6} = \frac{5}{6}$

(iii) $\frac{-8}{25}$ by $\frac{-5}{16}$

Solution: We have: $\frac{-8}{25} \times \frac{-5}{16} = \frac{\overset{-1}{\cancel{-8}} \times \overset{-1}{(\cancel{-5})}}{\underset{5}{\cancel{25}} \times \underset{2}{\cancel{16}}}$

$= \frac{-1 \times -1}{5 \times 2} = \frac{1}{10}$

(iv) $\frac{6}{7}$ by $\frac{-49}{36}$

Solution: We have: $\frac{6}{7} \times \frac{-49}{36} = \frac{\overset{}{\cancel{6}} \times \overset{-7}{(\cancel{-49})}}{\underset{}{\cancel{7}} \times \underset{6}{\cancel{36}}}$

$= \frac{1 \times -7}{1 \times 6} = \frac{-7}{6}$

Question 3 – Simplify each of the following and express the result as a rational number in standard form:

(i) $\frac{-16}{21} \times \frac{14}{5}$

Solution: We have: $\frac{-16}{21} \times \frac{14}{5} = \frac{(-16) \times \overset{2}{\cancel{14}}}{\underset{3}{\cancel{21}} \times 5}$

$= \frac{-16 \times 2}{3 \times 5} = \frac{-32}{15}$

(ii) $\frac{7}{6} \times \frac{-3}{28}$

Solution: We have: $\frac{7}{6} \times \frac{-3}{28} = \frac{\overset{}{\cancel{7}} \times \overset{-1}{(\cancel{-3})}}{\underset{2}{\cancel{6}} \times \underset{4}{\cancel{28}}}$

$= \frac{1 \times -1}{2 \times 4} = \frac{-1}{8}$

(iii) $\frac{-19}{36} \times 16$

Solution: We have: $\frac{-19}{36} \times 16 = \frac{-19 \times \overset{4}{\cancel{16}}}{\underset{9}{\cancel{36}} \times 1}$

$= \frac{-19 \times 4}{9 \times 1} = \frac{-76}{9}$

(iv) $\frac{-13}{9} \times \frac{27}{-26}$

Solution: We have: $\frac{-13}{9} \times \frac{27}{-26} = \frac{\overset{-1}{\cancel{-13}} \times \overset{3}{\cancel{27}}}{\underset{-2}{\cancel{9} \times (\cancel{-26})}}$

$= \frac{-1 \times 3}{1 \times (-2)} = \frac{-3}{-2} = \frac{3}{2}$

Question 4 – Simplify:

(i) $(-5 \times \frac{2}{15}) - (-6 \times \frac{2}{9})$

Solution: We have $(-\frac{5}{1} \times \frac{2}{15}) - (-\frac{6}{1} \times \frac{2}{9})$

=> $\left(\frac{-5 \times 2}{1 \times 15}\right) - \left(\frac{-6 \times 2}{1 \times 9}\right)$

=> $\left(\frac{-10}{15}\right) - \left(\frac{-12}{9}\right)$

=> $\frac{-10}{15} + \frac{12}{9}$ (Since (-, - = +))

Now we can see that denominators of both rational numbers are not same. Thus we will make them same by taking their LCM as follows:

LCM of (15 and 9) is 45

Thus, we have $\frac{-10}{15} = \frac{-10 \times 3}{15 \times 3} = \frac{-30}{45}$ (Multiplying each term by 3)

=> $\frac{12}{9} = \frac{12 \times 5}{9 \times 5} = \frac{60}{45}$ (Multiplying each term by 5)

Now, $\frac{-10}{15} + \frac{12}{9} = \frac{-30}{45} + \frac{60}{45} = \frac{-30+60}{45} = \frac{30}{45} = \frac{2}{3}$

(ii) $\left(\frac{-9}{4} \times \frac{5}{3}\right) + (\frac{13}{2} \times \frac{5}{6})$

Solution: We have $\left(\frac{-9}{4} \times \frac{5}{3}\right) + (\frac{13}{2} \times \frac{5}{6})$

=> $\left(\frac{-9 \times 5}{4 \times 3}\right) + \left(\frac{13 \times 5}{2 \times 6}\right)$

=> $\left(\frac{-45}{12}\right) + \left(\frac{65}{12}\right)$

=> $\frac{-45}{12} + \frac{65}{12}$

Now we can see that denominators of both rational numbers are same. Thus we will solve as follows:

Now, $\frac{-45}{12} + \frac{65}{12} = \frac{-45+65}{12} = \frac{20}{12} = \frac{5}{3}$

Question 5 – Simplify:

(i) $\left(\frac{13}{9} \times \frac{-15}{2}\right) + \left(\frac{7}{3} \times \frac{8}{5}\right) + \left(\frac{3}{5} \times \frac{1}{2}\right)$

Solution: We have: $\left(\frac{13}{9} \times \frac{-15}{2}\right) + \left(\frac{7}{3} \times \frac{8}{5}\right) + (\frac{3}{5} \times \frac{1}{2})$

$= \left(\frac{13 \times -15}{9 \times 2}\right) + \left(\frac{7 \times 8}{3 \times 5}\right) + (\frac{3 \times 1}{5 \times 2})$ (-5 over 15, 9 over 3)

$= \left(\frac{13 \times -5}{3 \times 2}\right) + \left(\frac{7 \times 8}{3 \times 5}\right) + (\frac{3 \times 1}{5 \times 2})$ (3 over 9)

$= \frac{-65}{6} + \frac{56}{15} + \frac{3}{10}$

Now, we can see that denominators of all rational numbers are different, thus we will make the denominators same by taking their LCM as follows:

LCM of (6, 15 and 10) is 30

=> $\frac{-65}{6} = \frac{-65 \times 5}{6 \times 5} = \frac{-325}{30}$ (Multiplying each term by 5)

=> $\frac{56}{15} = \frac{56 \times 2}{15 \times 2} = \frac{112}{30}$ (Multiplying each term by 2)

=> $\frac{3}{10} = \frac{3 \times 3}{10 \times 3} = \frac{9}{30}$ (Multiplying each term by 3)

Thus we have, $\frac{-65}{6} + \frac{56}{15} + \frac{3}{10} = \frac{-325}{30} + \frac{112}{30} + \frac{9}{30}$

=> $\frac{-325+112+9}{30} = \frac{-325+121}{30} = \frac{-204}{30} = \frac{-102}{15} = \frac{-34}{5}$ (Since (-, + = -) and minus sign comes with the answer because greater number is subtracted from smaller one)

(ii) $\left(\frac{3}{11} \times \frac{5}{6}\right) - \left(\frac{9}{12} \times \frac{4}{3}\right) + \left(\frac{5}{13} \times \frac{6}{15}\right)$

Solution: We have: $\left(\frac{3}{11} \times \frac{5}{6}\right) - \left(\frac{9}{12} \times \frac{4}{3}\right) + \left(\frac{5}{13} \times \frac{6}{15}\right)$

$= \left(\frac{\cancel{3}\times 5}{11\times\cancel{6}_{2}}\right) - \left(\frac{\cancel{9}^{3}\times\cancel{4}}{\cancel{12}_{3}\times\cancel{3}}\right) + \left(\frac{\cancel{5}\times\cancel{6}^{2}}{13\times\cancel{15}_{3}}\right)$

$= \left(\frac{1\times 5}{11\times 2}\right) - (1) + \left(\frac{1\times 2}{13\times 1}\right)$

$= \frac{5}{22} - \frac{1}{1} + \frac{2}{13}$

Now, we can see that denominators of all rational numbers are different, thus we will make the denominators same by taking their LCM as follows:

LCM of (22, 1 and 13) is 286

=> $\frac{5}{22} = \frac{5\times 13}{22\times 13} = \frac{65}{286}$ (Multiplying each term by 13)

=> $\frac{1}{1} = \frac{1\times 286}{1\times 286} = \frac{286}{286}$ (Multiplying each term by 286)

=> $\frac{2}{13} = \frac{2\times 22}{13\times 22} = \frac{44}{286}$ (Multiplying each term by 22)

Thus we have, $\frac{5}{22} - \frac{1}{1} + \frac{2}{13} = \frac{65}{286} - \frac{286}{286} + \frac{44}{286}$

=> $\frac{65-286+44}{286} = \frac{109-286}{286} = \frac{-177}{286}$ (Since (-, + = -) and minus sign comes with the answer because greater number is subtracted from smaller one)

Reciprocal of a Non-Zero Rational Number

Suppose $\frac{a}{b}$ be any non-zero rational number then there exist $\frac{b}{a}$ such that $\frac{a}{b} \times \frac{b}{a} = 1$ where $\frac{b}{a}$ is the reciprocal or multiplicative inverse of $\frac{a}{b}$ and it is denoted by $\left(\frac{a}{b}\right)^{-1}$

Division of rational numbers: Let $\frac{a}{b} and \frac{c}{d}$ are two rational numbers then their division is expressed as $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$

Examples

Example 1 – Divide:

(i) $\frac{3}{5} by \frac{4}{25}$

Solution: We have $\frac{3}{5} \div \frac{4}{25}$

$$\Rightarrow \frac{3}{\cancel{5}_{1}} \times \frac{\overset{5}{\cancel{25}}}{4}$$

$$= \frac{3\times5}{4} = \frac{15}{4}$$

(ii) $\frac{-8}{9} by \frac{4}{3}$

Solution: We have $\frac{-8}{9} \div \frac{4}{3}$

$$\Rightarrow \frac{\overset{2}{\cancel{-8}}}{\cancel{9}_{3}} \times \frac{\cancel{3}^{1}}{\cancel{4}_{1}}$$

$$= \frac{-2\times1}{3} = \frac{-2}{3}$$

(iii) $\frac{-16}{21} by \frac{4}{3}$

Solution: We have $\frac{-16}{21} \div \frac{4}{3}$

$$\Rightarrow \frac{\overset{-4}{\cancel{-16}}}{\cancel{21}_{7}} \times \frac{\cancel{3}^{1}}{\cancel{4}_{1}}$$

$$= \frac{-4\times1}{7\times4} = \frac{-4}{28}$$

(iv) $\frac{-8}{13}$ *by* $\frac{3}{-26}$

Solution: We have $\frac{-8}{13} \div \frac{3}{-26}$

$$\Rightarrow \frac{-8}{\cancel{13}} \times \frac{\overset{-2}{\cancel{-26}}}{3}$$

$$= \frac{-8 \times -2}{1 \times 3} = \frac{16}{3}$$

Example 2 – The product of two rational numbers is $\frac{-28}{81}$. If one of the numbers is $\frac{14}{27}$, find the other.

Solution: Let the other number be 'x'

It is given that, one number = $\frac{14}{27}$

Product of two numbers = $\frac{-28}{81}$

$$\Rightarrow x \times \frac{14}{27} = \frac{-28}{81}$$

$$\Rightarrow x = \frac{-28}{81} \div \frac{14}{27}$$

$$\Rightarrow x = \frac{\overset{-2}{\cancel{-28}}}{\cancel{81}} \times \frac{\cancel{27}}{\cancel{14}}$$

$$\Rightarrow x = \frac{-2}{3}$$

Therefore, other number = $\frac{-2}{3}$

Example 3 – By what number should we multiply $\frac{3}{-14}$, so that the product may be $\frac{5}{12}$

Solution: Let the required number be 'x'

Then according to given question

$$\Rightarrow x \times \frac{3}{-14} = \frac{5}{12}$$

$\Rightarrow x = \frac{5}{12} \div \frac{3}{-14}$

$\Rightarrow x = \frac{5}{12} \times \frac{-14}{3}$ (-7)

$\Rightarrow x = \frac{5 \times -7}{6 \times 3}$ (6)

$\Rightarrow x = \frac{-35}{18}$

Therefore, required number = $\frac{-35}{18}$

Exercise 5.4

Question 1 – Divide:

(i) 1 *by* $\frac{1}{2}$

Solution: We have $1 \div \frac{1}{2} = 1 \times \frac{2}{1} = 1 \times 2 = 2$

(ii) 5 *by* $\frac{-5}{7}$

Solution: We have $5 \div \frac{-5}{7} = 5 \times \frac{7}{-5} = \frac{7}{-1} = -7$ (-1)

(iii) $\frac{-3}{4}$ *by* $\frac{9}{-16}$

Solution: We have $\frac{-3}{4} \div \frac{9}{-16} = \frac{-3}{4} \times \frac{-16}{9} = \frac{-1 \times -4}{3} = \frac{4}{3}$ (-1, -4, 3)

(iv) $\frac{-7}{8}$ *by* $\frac{-21}{16}$

Solution: We have $\frac{-7}{8} \div \frac{-21}{16} = \frac{-7}{8} \times \frac{16}{-21} = \frac{-1 \times 2}{-3} = \frac{-2}{-3} = \frac{2}{3}$ (-1, 2, -3)

(v) $\frac{7}{-4}$ *by* $\frac{63}{64}$

Solution: We have $\frac{7}{-4} \div \frac{63}{64} = \frac{7}{-4} \times \frac{64}{63} = \frac{1 \times 16}{-1 \times 9} = \frac{16}{-9} = \frac{-16}{9}$ (16, -1, 9)

(vi) $0\ by\ \frac{-7}{5}$

Solution: We have $0 \div \frac{-7}{5} = 0 \times \frac{5}{-7} = \frac{0\times5}{1\times7} = \frac{0}{7} = 0$

(vii) $\frac{-3}{4}\ by\ -6$

Solution: We have $\frac{-3}{4} \div \frac{-6}{1} = \frac{-3}{4} \times \frac{1}{-6} = \frac{-1\times1}{4\times-2} = \frac{-1}{-8} = \frac{1}{8}$

(-1, -2)

(viii) $\frac{2}{3}\ by \frac{-7}{12}$

Solution: We have $\frac{2}{3} \div \frac{-7}{12} = \frac{2}{3} \times \frac{12}{-7} = \frac{2\times4}{1\times-7} = \frac{8}{-7} = \frac{-8}{7}$

(4)

Question 2 – Find the value and express as a rational number in standard form:

(i) $\frac{2}{5} \div \frac{26}{15}$

Solution: We have $\frac{2}{5} \div \frac{26}{15} = \frac{2}{5} \times \frac{15}{26} = \frac{3}{13}$

(3, 13)

(ii) $\frac{10}{3} \div \frac{-35}{12}$

Solution: We have $\frac{10}{3} \div \frac{-35}{12} = \frac{10}{3} \times \frac{12}{-35} = \frac{2\times4}{-7} = \frac{8}{-7} = \frac{-8}{7}$

(2, 4, -7)

(iii) $-6 \div (\frac{-8}{17})$

Solution: We have $-6 \div \frac{-8}{17} = \frac{6}{1} \times \frac{17}{-8} = \frac{3\times17}{-4} = \frac{51}{-4} = \frac{-51}{4}$

(3, -4)

(iv) $\frac{40}{98} \div (-20)$

Solution: We have $\frac{40}{98} \div \frac{-20}{1} = \frac{40}{98} \times \frac{1}{-20} = \frac{2\times1}{98\times-1} = \frac{1}{-49} = \frac{-1}{49}$

(2, -1, 49)

Question 3 – The product of two rational numbers is 15. If one of the numbers is -10, find the other.

Solution: Let the other number be 'x'

It is given that, one number = -10

Product of two numbers = 15

=> $x \times (-10) = 15$

=> $x = 15 \div (-10)$

=> $x = \frac{\overset{3}{\cancel{15}}}{1} \times \frac{1}{\underset{-2}{\cancel{-10}}}$

=> $x = \frac{3}{-2} = \frac{-3}{2}$

Therefore, other number = $\frac{-3}{2}$

Question 4 – The product of two rational numbers is $\frac{-8}{9}$. If one of the numbers is $\frac{-4}{15}$, find the other.

Solution: Let the other number be 'x'

It is given that, one number = $\frac{-4}{15}$

Product of two numbers = $\frac{-8}{9}$

=> $x \times \frac{-4}{15} = \frac{-8}{9}$

=> $x = \frac{-8}{9} \div \frac{-4}{15}$

=> $x = \frac{\overset{-2}{\cancel{-8}}}{\underset{3}{\cancel{9}}} \times \frac{15}{\underset{-1}{\cancel{-4}}}^{5}$

=> $x = \frac{-2 \times 5}{3 \times -1}$

$\Rightarrow x = \frac{-10}{-3} = \frac{10}{3}$

Therefore, other number = $\frac{10}{3}$

Question 5 – By what number should we multiply $\frac{-1}{6}$ so that the product may be $\frac{-23}{9}$?

Solution: Let the required number be 'x'

Then according to given question

$\Rightarrow x \times \frac{-1}{6} = \frac{-23}{9}$

$\Rightarrow x = \frac{-23}{9} \div \frac{-1}{6}$

$\Rightarrow x = \frac{-23}{\cancel{9}_{3}} \times \frac{\cancel{6}^{2}}{-1}$

$\Rightarrow x = \frac{-23 \times 2}{3 \times -1}$

$\Rightarrow x = \frac{-46}{-3} = \frac{46}{3}$

Therefore, required number = $\frac{46}{3}$

Question 6 – By what number should we multiply $\frac{-15}{28}$ so that the product may be $\frac{-5}{7}$?

Solution: Let the required number be 'x'

Then according to given question

$\Rightarrow x \times \frac{-15}{28} = \frac{-5}{7}$

$\Rightarrow x = \frac{-5}{7} \div \frac{-15}{28}$

$\Rightarrow x = \frac{\cancel{-5}^{-1}}{\cancel{7}} \times \frac{\cancel{28}^{4}}{\cancel{-15}_{-3}}$

$\Rightarrow x = \frac{-1 \times 4}{1 \times -3}$

$\Rightarrow x = \frac{-4}{-3} = \frac{4}{3}$

Therefore, required number = $\frac{4}{3}$

Question 7 - By what number should we multiply $\frac{-8}{13}$ so that the product may be 24?

Solution: Let the required number be 'x'

Then according to given question

$\Rightarrow x \times \frac{-8}{13} = 24$

$\Rightarrow x = 24 \div \frac{-8}{13}$

$\Rightarrow x = \frac{24}{1} \times \frac{13}{-8}$ (3 over 24, -1 under -8)

$\Rightarrow x = \frac{3 \times 13}{1 \times -1}$

$\Rightarrow x = \frac{39}{-1} = -39$

Therefore, required number = -39

Question 8 – By what number should $\frac{-3}{4}$ be multiplied in order to produce $\frac{2}{3}$?

Solution: Let the required number be 'x'

Then according to given question

$\Rightarrow x \times \frac{-3}{4} = \frac{2}{3}$

$\Rightarrow x = \frac{2}{3} \div \frac{-3}{4}$

$\Rightarrow x = \frac{2}{3} \times \frac{4}{-3}$

$\Rightarrow x = \frac{2 \times 4}{3 \times -3}$

=> $x = \frac{8}{-9} = \frac{-8}{9}$

Therefore, required number = $\frac{-8}{9}$

Question 9 – Find $(x + y) \div (x - y)$, if

(i) $x = \frac{2}{3}, y = \frac{3}{2}$

Solution: We have $\left(\frac{2}{3} + \frac{3}{2}\right) \div \left(\frac{2}{3} - \frac{3}{2}\right)$

Now, we can see that denominators of both rational numbers are not same. Thus we will make them same by taking their LCM as follows:

LCM of (3 and 2) is 6

=> $\frac{2}{3} = \frac{2\times2}{3\times2} = \frac{4}{6}$ (Multiplying each term by 2)

=> $\frac{3}{2} = \frac{3\times3}{2\times3} = \frac{9}{6}$ (Multiplying each term by 3)

Thus we have, $\left(\frac{2}{3} + \frac{3}{2}\right) \div \left(\frac{2}{3} - \frac{3}{2}\right) = (\frac{4}{6} + \frac{9}{6}) \div (\frac{4}{6} - \frac{9}{6})$

=> $(\frac{4+9}{6}) \div (\frac{4-9}{6})$

=> $\frac{13}{6} \div \frac{-5}{6}$

=> $\frac{13}{\cancel{6}} \times \frac{\cancel{6}}{-5}$

=> $\frac{13}{-5} = \frac{-13}{5}$

(ii) $x = \frac{2}{5}, y = \frac{1}{2}$

Solution: We have $\left(\frac{2}{5} + \frac{1}{2}\right) \div \left(\frac{2}{5} - \frac{1}{2}\right)$

Now, we can see that denominators of both rational numbers are not same. Thus we will make them same by taking their LCM as follows:

LCM of (5 and 2) is 10

=> $\frac{2}{5} = \frac{2\times2}{5\times2} = \frac{4}{10}$ (Multiplying each term by 2)

=> $\frac{1}{2} = \frac{1\times5}{2\times5} = \frac{5}{10}$ (Multiplying each term by 5)

Thus we have, $\left(\frac{2}{5} + \frac{1}{2}\right) \div \left(\frac{2}{5} - \frac{1}{2}\right) = (\frac{4}{10} + \frac{5}{10}) \div (\frac{4}{10} - \frac{5}{10})$

=> $(\frac{4+5}{10}) \div (\frac{4-5}{10})$

=> $\frac{9}{10} \div \frac{-1}{10}$

=> $\frac{9}{\cancel{10}} \times \frac{\cancel{10}}{-1}$

=> $\frac{9}{-1} = -9$

(iii) $\boldsymbol{x = \frac{5}{4}, y = \frac{-1}{3}}$

Solution: We have $\left(\frac{5}{4} + \frac{-1}{3}\right) \div \left(\frac{5}{4} - \frac{-1}{3}\right) = (\frac{5}{4} - \frac{1}{3}) \div (\frac{5}{4} + \frac{1}{3})$ (Since (+, - = -) and (-, - = +))

Now, we can see that denominators of both rational numbers are not same. Thus we will make them same by taking their LCM as follows:

LCM of (4 and 3) is 12

=> $\frac{5}{4} = \frac{5\times3}{4\times3} = \frac{15}{12}$ (Multiplying each term by 3)

=> $\frac{1}{3} = \frac{1\times4}{3\times4} = \frac{4}{12}$ (Multiplying each term by 4)

Thus we have, $(\frac{5}{4} - \frac{1}{3}) \div (\frac{5}{4} + \frac{1}{3}) = (\frac{15}{12} - \frac{4}{12}) \div (\frac{15}{12} + \frac{4}{12})$

=> $(\frac{15-4}{12}) \div (\frac{15+4}{12})$

=> $\frac{11}{12} \div \frac{19}{12}$

$=> \frac{11}{\cancel{12}} \times \frac{\cancel{12}}{19}$

$=> \frac{11}{19}$

Question 10 – The cost of $7\frac{2}{3}$ metres of rope is Rs$12\frac{3}{4}$. Find its cost per metre.

Solution: It is given that, Cost of $7\frac{2}{3}$ metres of rope = Rs$12\frac{3}{4}$

=> Cost of 1 metre of rope = Rs$(12\frac{3}{4} \div 7\frac{2}{3})$

First we will convert the mixed fraction into improper fraction as follows:

$= (\frac{(12\times4)+3}{4} \div \frac{(7\times3)+2}{3})$

$= (\frac{48+3}{4} \div \frac{21+2}{3})$

$= \frac{51}{4} \div \frac{23}{3}$

$= \frac{51}{4} \times \frac{3}{23}$

$= \frac{153}{92}$

$= Rs1\frac{61}{92}$

Therefore, cost of 1 metre of rope = $Rs1\frac{61}{92}$

Question 11 – The cost of $2\frac{1}{3}$ metres of cloth is $Rs75\frac{1}{4}$. Find the cost of cloth per metre.

Solution: It is given that, Cost of $2\frac{1}{3}$ metres of cloth = Rs$75\frac{1}{4}$

=> Cost of 1 metre of cloth = Rs$(75\frac{1}{4} \div 2\frac{1}{3})$

First we will convert the mixed fraction into improper fraction as follows:

$= (\frac{(75\times4)+1}{4} \div \frac{(2\times3)+1}{3})$

$= (\frac{300+1}{4} \div \frac{6+1}{3})$

$= \frac{301}{4} \div \frac{7}{3}$

43

$= \frac{301}{4} \times \frac{3}{7}$

$= \frac{43 \times 3}{4} = \frac{139}{4} =$

$= Rs32\frac{1}{4}$

Therefore, cost of 1 metre of cloth = $Rs32\frac{1}{4}$

Question 12 – By what number should $\frac{-33}{16}$ be divided to get $\frac{-11}{4}$?

Solution: Let the required number be 'x'

Then, according to given question

$=> \frac{-33}{16} \div x = \frac{-11}{4}$

$=> \frac{-33}{16} \times \frac{1}{x} = \frac{-11}{4}$

$=> \frac{1}{x} = \frac{-11}{4} \div \frac{-33}{16}$

-1 4

$=> \frac{1}{x} = \frac{-11}{4} \times \frac{16}{-33}$

$=> \frac{1}{x} = \frac{-1 \times 4}{-3}$ -3

$=> \frac{1}{x} = \frac{-4}{-3} = \frac{4}{3}$

$=> x = \frac{3}{4}$

Therefore, required number = $\frac{3}{4}$

Question 13 – Divide the sum of $\frac{-13}{5}$ *and* $\frac{12}{7}$ by the product of $\frac{-31}{7}$ *and* $\frac{-1}{2}$

Solution: We will solve: $(\frac{-13}{5} + \frac{12}{7}) \div (\frac{-31}{7} \times \frac{-1}{2})$

Firstly we will solve $\left(\frac{-13}{5} + \frac{12}{7}\right)$

We can see that denominators in both the rational numbers are not same thus we will make them same by taking their LCM as follows:

LCM of (5 and 7) = 35

=> $\frac{-13}{5} = \frac{-13\times7}{5\times7} = \frac{-91}{35}$ (Multiplying each term by 7)

=> $\frac{12}{7} = \frac{12\times5}{7\times5} = \frac{60}{35}$ (Multiplying each term by 5)

Thus we have, $\left(\frac{-13}{5} + \frac{12}{7}\right) = \frac{-91}{35} + \frac{60}{35} = \frac{-91+60}{35} = \frac{-31}{35}$

Now, we will solve $\left(\frac{-31}{7} \times \frac{-1}{2}\right)$

$= \frac{-31\times-1}{7\times2} = \frac{31}{14}$

Now, the problem reduces to $\left(\frac{-13}{5} + \frac{12}{7}\right) \div \left(\frac{-31}{7} \times \frac{-1}{2}\right) = \frac{-31}{35} \div \frac{31}{14}$

$= \frac{-31}{35} \times \frac{14}{31}$ (-1 over 35, 2 over 14, 31 over 31)

$= \frac{-1\times2}{5} = \frac{-2}{5}$ (5)

Question 14 – Divide the sum of $\frac{65}{12}$ *and* $\frac{8}{3}$ by their difference.

Solution: We will solve: $(\frac{65}{12} + \frac{8}{3}) \div (\frac{65}{12} - \frac{8}{3})$

Now, we can see that denominators in both the rational numbers are not same thus we will make them same by taking their LCM as follows:

LCM of (12 and 3) = 12

=> $\frac{65}{12} = \frac{65\times1}{12\times1} = \frac{65}{12}$ (Multiplying each term by 1)

=> $\frac{8}{3} = \frac{8\times4}{3\times4} = \frac{32}{12}$ (Multiplying each term by 4)

Now, the problem reduces to $\left(\frac{65}{12} + \frac{8}{3}\right) \div \left(\frac{65}{12} - \frac{8}{3}\right) = \left(\frac{65}{12} + \frac{32}{12}\right) \div \left(\frac{65}{12} - \frac{32}{12}\right)$

$= \frac{(65+32)}{12} \times \frac{(65-32)}{12}$

$= \frac{97}{12} \div \frac{33}{12}$

$= \frac{97}{\cancel{12}} \times \frac{\cancel{12}}{33}$

$= \frac{97}{33}$

Question 15 – If 24 trousers of equal size can be prepared in 54 metres of cloth, what length of cloth is required for each trouser?

Solution: It is given that total length of cloth = 54 metres

Number of trousers to be prepared = 24

=> Length of cloth required for each trouser = $54 \div 24$

$$\Rightarrow \frac{\overset{9}{\cancel{54}}}{1} \times \frac{1}{\underset{4}{\cancel{24}}}$$

$= \frac{9}{4}$

Therefore, length of cloth required for each trouser = $\frac{9}{4}$ metres.

Insertion of rational numbers between two given rational numbers:

Between any two rational numbers m and n, we can insert $(m - n - 1)$ rational numbers.

Let us understand this concept through examples:

Example 1 - Insert 10 rational numbers between $\frac{-3}{11}$ and $\frac{8}{11}$

Solution: Firstly, we can see that the integers lie between -3 and 8 are

$-2, -1, 0, 1, 2, 3, 4, 5, 6$ and 7

Thus, 10 rational numbers lying between $\frac{-3}{11}$ and $\frac{8}{11}$ are $\frac{-2}{11}, \frac{-1}{11}, \frac{0}{11}, \frac{1}{11}, \frac{2}{11}, \frac{3}{11}, \frac{4}{11}, \frac{5}{11}, \frac{6}{11}, \frac{7}{11}$

Example 2 – Insert 100 rational numbers between $\frac{-3}{13}$ and $\frac{9}{13}$

Solution: When we have to insert larger number of rational numbers between two rational numbers, we will multiply each term by 10

$\frac{-3}{13} = \frac{-3\times10}{13\times10} = \frac{-30}{130}$ and $\frac{9}{13} = \frac{9\times10}{13\times10} = \frac{90}{130}$

Now, 100 integers between -30 and 90 are $-29 < -28 < -27 < -26 \ldots\ldots -1 < 0 < 1 < 2 \ldots\ldots < 69 < 70$

Thus, 100 rational numbers lying between $\frac{-3}{13}$ and $\frac{9}{13}$ are $\frac{-29}{130}, \frac{-28}{130}, \frac{-27}{130} \ldots\ldots \frac{0}{130}, \frac{1}{130}, \ldots\ldots \frac{70}{130}$

Exercise 5.5

Question 1 - Find six rational numbers between $\frac{-4}{8}$ and $\frac{3}{8}$

Solution: Firstly, we can see that the integers lie between -4 and 3 are $-3, -2, -1, 0, 1$ and 2

Thus, 6 rational numbers lying between $\frac{-4}{8}$ and $\frac{3}{8}$ are $\frac{-3}{8}, \frac{-2}{8}, \frac{-1}{8}, \frac{0}{8}, \frac{1}{8}, \frac{2}{11}$

Question 2 – Find 10 rational numbers between $\frac{7}{13}$ and $\frac{-4}{13}$

Solution: Firstly, we can see that the integers lie between -4 and 7 are

$-3, -2, -1, 0, 1, 2, 3, 4, 5$ and 6

Thus, 10 rational numbers lying between $\frac{-4}{13}$ and $\frac{7}{13}$ are $\frac{-3}{13}, \frac{-2}{13}, \frac{-1}{13}, \frac{0}{13}, \frac{1}{13}, \frac{2}{13}, \frac{3}{13}, \frac{4}{13}, \frac{5}{13}, \frac{6}{13}$

Question 3 – State true or false:

(i) Between any two distinct integers there is always an integer.

Solution: False

Reasoning: There is a condition that the integers must be non-consecutive.

(ii) Between any two distinct rational numbers there is always a rational number.

Solution: True

(iii) Between any two distinct rational numbers there are infinitely many rational numbers.

Solution: True

Reasoning: This property of rational numbers is known as dense property.

Objective type questions:

Question 1 – What should be added to $\frac{-7}{9}$ to get 2?

Solution: Let the required number be 'x'

Then according to question, we have

=> $\frac{-7}{9} + x = 2$

=> $x = 2 - (\frac{-7}{9})$ (Since (-, - = +))

=> $x = \frac{2}{1} + \frac{7}{9}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (1 and 9) is 9 and we will make 9 as denominator in both rational numbers.

Thus, we have $\frac{2}{1} = \frac{2\times9}{1\times9} = \frac{18}{9}$ (Multiplying each term by 9)

$\frac{7}{9} = \frac{7\times1}{9\times1} = \frac{7}{9}$ (Multiplying each term by 1)

Now, we solve as follows:

$=>x = \frac{2}{1} + \frac{7}{9} = \frac{18}{9} + \frac{7}{9} = \frac{18+7}{9} = \frac{25}{9}$

Therefore, required number = $\frac{25}{9}$

Question 2 – What should be subtracted from $\frac{-2}{3}$ to get $\frac{4}{5}$?

Solution: Let the required number be 'x'

Then according to question, we have

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

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

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (3 and 5) is 15 and we will make 15 as denominator in both rational numbers.

Thus, we have $\frac{-2}{3} = \frac{-2\times5}{3\times5} = \frac{-10}{15}$ (Multiplying each term by 5)

$\frac{4}{5} = \frac{4\times3}{5\times3} = \frac{12}{15}$ (Multiplying each term by 3)

Now, we solve as follows:

$=>x = \frac{-2}{3} - \frac{4}{5} = \frac{-10}{15} - \frac{12}{15} = \frac{-10-12}{15} = \frac{-22}{15}$

Therefore, required number = $\frac{-22}{15}$

Question 3 – Reciprocal of $\frac{-3}{4}$ is?

Solution: Reciprocal of $\frac{-3}{4}$ is $\frac{4}{-3} = \frac{-4}{3}$

Question 4 – The multiplicative inverse of $\frac{4}{-5}$ is?

Solution: The multiplicative inverse of $\frac{4}{-5}$ is $\frac{-5}{4} = \frac{5}{-4}$

Question 5: $1 \div \frac{-5}{7}$ =?

Solution: We have $1 \div \frac{-5}{7} = 1 \times \frac{7}{-5} = \frac{7}{-5} = \frac{-7}{5}$

Question 6: $\frac{-5}{13} + ? = -1$

Solution: Let the number in blank space be 'x'

Then we have, $\frac{-5}{13} + x = -1$

=> $x = -1 - \frac{-5}{13}$

=> $x = -1 + \frac{5}{13}$ (Since (-, - = +))

=> $x = \frac{-1}{1} + \frac{5}{13}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (1 and 13) is 13 and we will make 13 as denominator in both rational numbers.

Thus, we have $\frac{-1}{1} = \frac{-1 \times 13}{1 \times 13} = \frac{-13}{13}$ (Multiplying each term by 13)

$\frac{5}{13} = \frac{5 \times 1}{13 \times 1} = \frac{5}{13}$ (Multiplying each term by 1)

Now, we solve as follows:

=>$x = \frac{-1}{1} + \frac{5}{13} = \frac{-13}{13} + \frac{5}{13} = \frac{-13+5}{13} = \frac{-8}{13}$

Question 7: $0 \div \frac{3}{5}$ =?

Solution: We have $0 \div \frac{3}{5} = 0 \times \frac{5}{3} = \frac{0 \times 5}{3} = \frac{0}{3} = 0$

Question 8: $\mathbf{-2\frac{3}{7}+4}$ =?

Solution: We have $-2\frac{3}{7}+4=\frac{(-2\times7)+3}{7}+\frac{4}{1}$

$=>\frac{-14+3}{7}+\frac{4}{1}=\frac{-11}{7}+\frac{4}{1}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (7 and 1) is 7 and we will make 7 as denominator in both rational numbers.

Thus, we have $\frac{-11}{7}=\frac{-11\times1}{7\times1}=\frac{-11}{7}$ (Multiplying each term by 1)

$\frac{4}{1}=\frac{4\times7}{1\times7}=\frac{28}{7}$ (Multiplying each term by 7)

Now, we solve as follows:

$=>x=\frac{-11}{7}+\frac{4}{1}=\frac{-11}{7}+\frac{28}{7}=\frac{-11+28}{7}=\frac{-17}{7}$

Question 9: If the product of two non-zero rational numbers is 1, then they are

- **(a) additive inverse of each other**
- **(b) multiplicative inverse of each other**
- **(c) reciprocal of each other**
- **(d) both (b) and (c)**

Solution: Both (b) and (c)

Question 10 – The product $\mathbf{3\frac{1}{7}\times1\frac{5}{6}\times1\frac{2}{5}\times1\frac{1}{11}}$ **is equal to?**

Solution: We have $\mathbf{3\frac{1}{7}\times1\frac{5}{6}\times1\frac{2}{5}\times1\frac{1}{11}}$

$=>\frac{(3\times7)+1}{7}\times\frac{(1\times6)+5}{6}\times\frac{(1\times5)+2}{5}\times\frac{(1\times11)+1}{11}$

$=>\frac{21+1}{7}\times\frac{6+5}{6}\times\frac{5+2}{5}\times\frac{11+1}{11}$

$=>\frac{22}{\cancel{7}}\times\frac{\cancel{11}}{\cancel{6}}\times\frac{\cancel{7}}{5}\times\frac{\cancel{12}}{\cancel{11}}^{2}$

$= \frac{22}{1} \times \frac{1}{1} \times \frac{1}{5} \times \frac{2}{1} = \frac{22 \times 2}{5} = 8\frac{4}{5}$

Question 11: $\frac{-7}{13} - \left(\frac{-8}{15}\right) = ?$

Solution: We have $\frac{-7}{13} - \left(\frac{-8}{15}\right)$

$\Rightarrow \frac{-7}{13} + \frac{8}{15}$ (Since (-, - = +))

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (13 and 15) is 195 and we will make 195 as denominator in both rational numbers.

Thus, we have $\frac{-7}{13} = \frac{-7 \times 15}{13 \times 15} = \frac{-105}{195}$ (Multiplying each term by 15)

$\frac{8}{15} = \frac{8 \times 13}{15 \times 13} = \frac{104}{195}$ (Multiplying each term by 13)

Now, we solve as follows:

$\Rightarrow \frac{-7}{13} + \frac{8}{15} = \frac{-105}{195} + \frac{104}{195} = \frac{-105+104}{195} = \frac{-1}{195}$

Question 12: $\mathbf{1 \div \frac{1}{3}} = ?$

Solution: We have $1 \div \frac{1}{3} = 1 \times \frac{3}{1} = \frac{1 \times 3}{1} = \frac{3}{1} = 3$

Question 13: $\mathbf{(-2) \div \left(-\frac{5}{3}\right)} = ?$

Solution: We have $\mathbf{\left(-2\right) \div \left(-\frac{5}{3}\right)}$

$\Rightarrow (-2) \times \left(-\frac{3}{5}\right) = \frac{-2 \times (-3)}{5} = \frac{6}{5}$

Question 14: If $\mathbf{\frac{x}{2} + \frac{1}{3} = 1}$**, then x =?**

Solution: We have $\frac{x}{2} + \frac{1}{3} = 1$

$\Rightarrow \frac{x}{2} = 1 - \frac{1}{3} = \frac{1}{1} - \frac{1}{3}$

Now, we can see that denominators in both the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (1 and 3) is 3 and we will make 3 as denominator in both rational numbers.

Thus, we have $\frac{1}{1} = \frac{1\times3}{1\times3} = \frac{3}{3}$ (Multiplying each term by 3)

$\frac{1}{3} = \frac{1\times1}{3\times1} = \frac{1}{3}$ (Multiplying each term by 1)

Now, we solve as follows:

$=>\frac{x}{2} = \frac{1}{1} - \frac{1}{3} = \frac{3}{3} - \frac{1}{3} = \frac{3-1}{3} = \frac{2}{3}$

$=> \frac{x}{2} = \frac{2}{3}$

$=> x = 2 \times \frac{2}{3} = \frac{4}{3}$

Question 15: $\frac{5}{4} - \frac{7}{6} - \frac{-2}{3}$ =?

Solution: We have $\frac{5}{4} - \frac{7}{6} - \frac{-2}{3}$

$=> \frac{5}{4} - \frac{7}{6} + \frac{2}{3}$ (Since (-, - = +))

Now, we can see that denominators in all the rational numbers are different thus, we will make them same by taking their LCM as follows:

Now, LCM of (4, 6 and 3) is 12 and we will make 12 as denominator in both rational numbers.

Thus, we have $\frac{5}{4} = \frac{5\times3}{4\times3} = \frac{15}{12}$ (Multiplying each term by 3)

$\frac{7}{6} = \frac{7\times2}{6\times2} = \frac{14}{12}$ (Multiplying each term by 2)

$\frac{2}{3} = \frac{2\times4}{3\times4} = \frac{8}{12}$ (Multiplying each term by 4)

Now, we solve as follows:

$=>\frac{5}{4} - \frac{7}{6} + \frac{2}{3} = \frac{15}{12} - \frac{14}{12} + \frac{8}{12} = \frac{15-14+8}{12} = \frac{1+8}{12} = \frac{9}{12} = \frac{3}{4}$