9 Rational Numbers

Learn and Remember

1. **A rational number** can be expressed in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$.
2. All integers and fractions are rational numbers.
3. To convert a rational number to an equivalent rational number either multiply and divide both numerator and denominator by a non-zero integer.
4. A rational number is positive if numerator and denominator are either both positive or negative integers whereas a rational number is negative if either the numerator or the denominator is a negative integer.
5. A rational number is said to be in **standard form** if its denominator is a positive integer and the numerator and denominator have no common factor other than 1.
6. There are infinite rational numbers between two rational numbers.
7. Two rational numbers can be added and subtracted by taking the L.C.M. of their denominator and then converting the rational numbers to their equivalent forms having the L.C.M. as denominator.
8. $\frac{p}{q} + \left(\frac{-p}{q}\right) = 0$, $\frac{-p}{q}$ is said to be **additive inverse** of $\frac{p}{q}$.
9. **Multiplicative inverse** means reciprocal of rational number.

   i.e., $a \times \frac{1}{a} = 1$, $\frac{1}{a}$ is said to be multiplicative inverse of a, where a is rational number.
10. To multiply two rational numbers,

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

11. To divide one rational number by the other non-zero rational number. We multiply the rational number by the reciprocal of the other rational number.

TEXTBOOK QUESTIONS SOLVED

Exercise 9.1 *(Page No. 182-184)*

Q1. List five rational numbers between:

(*i*) – 1 and 0 **(*ii*) – 2 and – 1**

(*iii*) $\frac{-4}{5}$ and $\frac{-2}{3}$ **(*iv*) $-\frac{1}{2}$ and $\frac{2}{3}$.**

Sol. (*i*) – 1 and 0

Let us write – 1 and 0 as rational numbers with denominator 6.

We have, $-1 = \frac{-6}{6}$ and $0 = \frac{0}{6} = 0$.

So, $\frac{-6}{6} < \frac{-5}{6} < \frac{-4}{6} < \frac{-3}{6} < \frac{-2}{6} < \frac{-1}{6} < 0$

or $-1 < \frac{-5}{6} < \frac{-2}{3} < \frac{-1}{2} < \frac{-1}{3} < \frac{-1}{6} < 0$

The five rational numbers between – 1 and 0 would be

$$\frac{-5}{6}, \frac{-2}{3}, \frac{-1}{2}, \frac{-1}{3}, \frac{-1}{6}.$$

(*ii*) – 2 and – 1

Let us write – 2 and – 1 as rational numbers with denominator 6.

We have, $-2 = \frac{-12}{6}$ and $-1 = \frac{-6}{6}$

So, $\frac{-12}{6} < \frac{-11}{6} < \frac{-10}{6} < \frac{-9}{6} < \frac{-8}{6} < \frac{-7}{6} < \frac{-6}{6}$

or $-2 < \frac{-11}{6} < \frac{-5}{3} < \frac{-3}{2} < \frac{-4}{3} < \frac{-7}{6} < -1$

Thus, the five rational numbers between – 2 and – 1 would be

$$\frac{-11}{6}, \frac{-5}{3}, \frac{-3}{2}, \frac{-4}{3}, \frac{-7}{6}.$$

(*iii*) $\frac{-4}{5}$ and $\frac{-2}{3}$

Let us write $\frac{-4}{5}$ and $\frac{-2}{3}$ into rational numbers with same denominators.

So, $\frac{-4}{5} = \frac{-36}{45}$ and $\frac{-2}{3} = \frac{-30}{45}$

We have,

$$\frac{-36}{45} < \frac{-35}{45} < \frac{-34}{45} < \frac{-33}{45} < \frac{-32}{45} < \frac{-31}{45} < \frac{-30}{45}$$

or $$\frac{-4}{5} < \frac{-7}{9} < \frac{-34}{45} < \frac{-11}{15} < \frac{-32}{45} < \frac{-31}{45} < \frac{-2}{3}$$

Thus, the five rational numbers between $\frac{-4}{5}$ and $\frac{-2}{3}$ would be

$$\frac{-7}{9}, \frac{-34}{45}, \frac{-11}{15}, \frac{-32}{45}, \frac{-31}{45}.$$

(*iv*) $-\frac{1}{2}$ and $\frac{2}{3}$

Let us write $-\frac{1}{2}$ and $\frac{2}{3}$ into rational numbers with same denominators.

So, $\frac{-1}{2} = \frac{-3}{6}$ and $\frac{2}{3} = \frac{4}{6}$

We have, $\frac{-3}{6} < \frac{-2}{6} < \frac{-1}{6} < 0 < \frac{1}{6} < \frac{2}{6} < \frac{3}{6} < \frac{4}{6}$

or $\frac{-1}{2} < \frac{-1}{3} < \frac{-1}{6} < 0 < \frac{1}{6} < \frac{1}{3} < \frac{1}{2} < \frac{2}{3}$

Thus, the five rational numbers between $\frac{-1}{2}$ and $\frac{2}{3}$ would be

$$\frac{-1}{3}, \frac{-1}{6}, 0, \frac{1}{6}, \frac{1}{3}.$$

Q2. Write four more rational numbers in each of the following patterns:

(*i*) $\frac{-3}{5}, \frac{-6}{10}, \frac{-9}{15}, \frac{-12}{20}, \ldots\ldots$ (*ii*) $\frac{-1}{4}, \frac{-2}{8}, \frac{-3}{12}, \ldots\ldots$

(*iii*) $\frac{-1}{6}, \frac{2}{-12}, \frac{3}{-18}, \frac{4}{-24}, \ldots\ldots$

(*iv*) $\frac{-2}{3}, \frac{2}{-3}, \frac{4}{-6}, \frac{6}{-9}, \ldots\ldots .$

Sol. (*i*) We have, $\frac{-3}{5}, \frac{-6}{10}, \frac{-9}{15}, \frac{-12}{20}$

Now, $\frac{-3}{5} = \frac{-3\times1}{5\times1}, \frac{-6}{10} = \frac{-3\times2}{5\times2}, \frac{-9}{15}$

$= \frac{-3\times3}{5\times3}, \frac{-12}{20} = \frac{-3\times4}{5\times4}$

Thus, this pattern follow as:

$$\frac{-3}{5} = \frac{-3\times5}{5\times5} = \frac{-15}{25}, \frac{-3}{5} = \frac{-3\times6}{5\times6} = \frac{-18}{30},$$

$$\frac{-3}{5} = \frac{-3\times7}{5\times7} = \frac{-21}{35}, \frac{-3}{5} = \frac{-3\times8}{5\times8} = \frac{-24}{40}$$

Therefore, the next four rational numbers of this pattern would be,

$$\frac{-15}{25}, \frac{-18}{30}, \frac{-21}{35}, \frac{-24}{40}.$$

(*ii*) We have, $\frac{-1}{4}, \frac{-2}{8}, \frac{-3}{12}$

Now, $\frac{-1}{4} = \frac{-1\times1}{4\times1}, \frac{-2}{8} = \frac{-1\times2}{4\times2}, \frac{-3}{12} = \frac{-1\times3}{4\times3}$

Thus, this pattern follows as:

$$\frac{-1}{4} = \frac{-1\times4}{4\times4} = \frac{-4}{16}, \frac{-1}{4} = \frac{-1\times5}{4\times5} = \frac{-5}{20},$$

$$\frac{-1}{4} = \frac{-1\times6}{4\times6} = \frac{-6}{24}, \frac{-1}{4} = \frac{-1\times7}{4\times7} = \frac{-7}{28}$$

Therefore, the next four rational numbers of this pattern would be,

$$\frac{-4}{16}, \frac{-5}{20}, \frac{-6}{24}, \frac{-7}{28}.$$

(*iii*) We have, $\frac{-1}{6}, \frac{2}{-12}, \frac{3}{-18}, \frac{4}{-24}$

Now, $\frac{-1}{6} = \frac{-1\times1}{6\times1}, \frac{2}{-12} = \frac{1\times2}{-6\times2},$

$$\frac{3}{-18} = \frac{1\times3}{-6\times3}, \frac{4}{-24} = \frac{1\times4}{-6\times4}$$

Thus, this pattern follows as:

$$\frac{1}{-6} = \frac{1\times5}{-6\times5} = \frac{5}{-30}, \frac{1}{-6} = \frac{1\times6}{-6\times6} = \frac{6}{-36}$$

$$\frac{1}{-6} = \frac{1\times7}{-6\times7} = \frac{7}{-42}, \frac{1}{-6} = \frac{1\times8}{-6\times8} = \frac{8}{-48}$$

Therefore, the next four rational numbers of this pattern would be,

$$\frac{5}{-30}, \frac{6}{-36}, \frac{7}{-42}, \frac{8}{-48}.$$

(*iv*) We have, $\frac{-2}{3}, \frac{2}{-3}, \frac{4}{-6}, \frac{6}{-9}$

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

$$\frac{4}{-6} = \frac{2\times2}{-3\times2}, \frac{6}{-9} = \frac{2\times3}{-3\times3}$$

Thus, this pattern follows as:

$$\frac{2}{-3} = \frac{2\times4}{-3\times4} = \frac{8}{-12}, \frac{2}{-3} = \frac{2\times5}{-3\times5} = \frac{10}{-15}$$

$$\frac{2}{-3} = \frac{2\times6}{-3\times6} = \frac{12}{-18}, \frac{2}{-3} = \frac{2\times7}{-3\times7} = \frac{14}{-21}$$

Therefore, the next four rational numbers of this pattern would be,

$$\frac{8}{-12}, \frac{10}{-15}, \frac{12}{-18}, \frac{14}{-21}.$$

Q3. Give four rational numbers equivalent to:

(*i*) $\frac{-2}{7}$ (*ii*) $\frac{5}{-3}$ (*iii*) $\frac{4}{9}$.

Sol. (*i*) $\frac{-2}{7}$

Now, $\frac{-2}{7} = \frac{-2\times2}{7\times2} = \frac{-4}{14}$, $\frac{-2}{7} = \frac{-2\times3}{7\times3} = \frac{-6}{21}$

$\frac{-2}{7} = \frac{-2\times4}{7\times4} = \frac{-8}{28}$, $\frac{-2}{7} = \frac{-2\times5}{7\times5} = \frac{-10}{35}$

Therefore, four equivalent rational numbers are

$$\frac{-4}{14}, \frac{-6}{21}, \frac{-8}{28}, \frac{-10}{35}.$$

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

Now, $\frac{5}{-3} = \frac{5\times2}{-3\times2} = \frac{10}{-6}$, $\frac{5}{-3} = \frac{5\times3}{-3\times3} = \frac{15}{-9}$

$\frac{5}{-3} = \frac{5\times4}{-3\times4} = \frac{20}{-12}$, $\frac{5}{-3} = \frac{5\times5}{-3\times5} = \frac{25}{-15}$

Therefore, four equivalent rational numbers are

$$\frac{10}{-6}, \frac{15}{-9}, \frac{20}{-12}, \frac{25}{-15}.$$

(*iii*) $\frac{4}{9}$

Now, $\frac{4}{9} = \frac{4\times2}{9\times2} = \frac{8}{18}$, $\frac{4}{9} = \frac{4\times3}{9\times3} = \frac{12}{27}$

$\frac{4}{9} = \frac{4\times4}{9\times4} = \frac{16}{36}$, $\frac{4}{9} = \frac{4\times5}{9\times5} = \frac{20}{45}$

Therefore, four equivalent rational numbers are

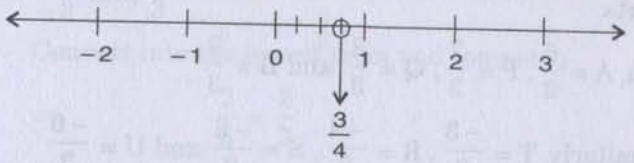
$$\frac{8}{18}, \frac{12}{27}, \frac{16}{36}, \frac{20}{45}.$$

Q4. Draw the number line and represent the following rational numbers on it:

(*i*) $\frac{3}{4}$ (*ii*) $\frac{-5}{8}$ (*iii*) $\frac{-7}{4}$ (*iv*) $\frac{7}{8}$

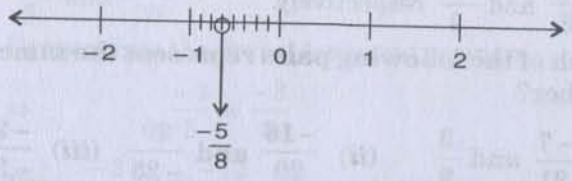
Sol. (*i*) $\frac{3}{4}$

Draw a number line and represent the positive rational number:



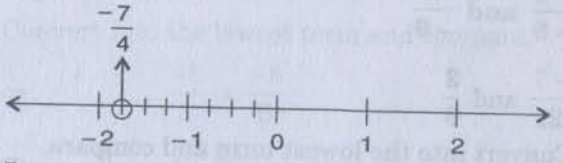
(*ii*) $\frac{-5}{8}$

Draw a number line and represent the negative rational number:



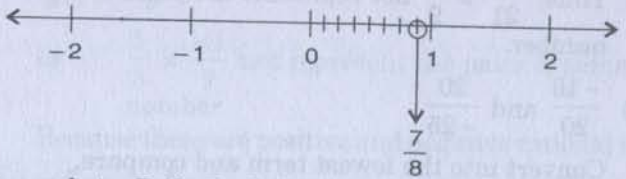
(*iii*) $\frac{-7}{4}$

Draw a number line and represent the negative rational number:

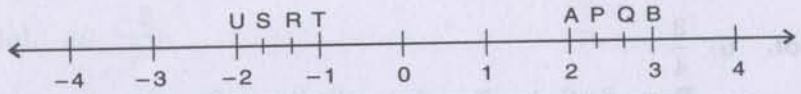


(*iv*) $\frac{7}{8}$

Draw a number line and represent the positive rational number:



Q5. The points, P, Q, R, S, T, U, A and B on the number line are such that, TR = RS = SU and AP = PQ = QB. Name the rational numbers represented by P, Q, R and S.



Sol. Each part which is between the two numbers is divided into 3 parts.

So, $A = \frac{6}{3}$, $P = \frac{7}{3}$, $Q = \frac{8}{3}$ and $B = \frac{9}{3}$

Similarly, $T = \frac{-3}{3}$, $R = \frac{-4}{3}$, $S = \frac{-5}{3}$ and $U = \frac{-6}{3}$

Thus, the rational numbers represented P, Q, R and S are $\frac{7}{3}$, $\frac{8}{3}$, $\frac{-4}{3}$ and $\frac{-5}{3}$ respectively.

Q6. Which of the following pairs represent the same rational number?

(*i*) $\frac{-7}{21}$ **and** $\frac{3}{9}$ **(*ii*)** $\frac{-16}{20}$ **and** $\frac{20}{-25}$ **(*iii*)** $\frac{-2}{-3}$ **and** $\frac{2}{3}$

(*iv*) $\frac{-3}{5}$ **and** $\frac{-12}{20}$ **(*v*)** $\frac{8}{-5}$ **and** $\frac{-24}{15}$ **(*vi*)** $\frac{1}{3}$ **and** $\frac{-1}{9}$

(*vii*) $\frac{-5}{-9}$ **and** $\frac{5}{-9}$

Sol. (*i*) $\frac{-7}{21}$ and $\frac{3}{9}$

Convert into the lowest term and compare,

$$\Rightarrow \quad \frac{-1}{3} \neq \frac{1}{3}$$

Thus, $\frac{-7}{21} \neq \frac{3}{9}$ not represent the pairs of same rational number.

(*ii*) $\frac{-16}{20}$ and $\frac{20}{-25}$

Convert into the lowest term and compare,

$$\Rightarrow \quad \frac{-4}{5} = \frac{-4}{5}$$

Thus, $\frac{-16}{20} = \frac{20}{-25}$ represent the pairs of same rational number.

(*iii*) $\frac{-2}{-3}$ and $\frac{2}{3}$

Convert into the lowest term and compare,

$$\Rightarrow \quad \frac{2}{3} = \frac{2}{3}$$

Thus, $\frac{-2}{-3}$ and $\frac{2}{3}$ represent the pairs of same rational number.

(*iv*) $\frac{-3}{5}$ and $\frac{-12}{20}$

Convert into the lowest term and compare,

$$\Rightarrow \quad \frac{-3}{5} = \frac{-3}{5}$$

Thus, $\frac{-3}{5}$ and $\frac{-12}{20}$ represent the pairs of same rational number.

(*v*) $\frac{8}{-5}$ and $\frac{-24}{15}$

Convert into the lowest term and compare,

$$\Rightarrow \quad \frac{-8}{5} = \frac{-8}{5}$$

Thus, $\frac{8}{-5}$ and $\frac{-24}{15}$ represent the pairs of same rational number.

(*vi*) $\frac{1}{3}$ and $\frac{-1}{9}$

$\Rightarrow \quad \frac{1}{3} \neq \frac{-1}{9}$ not represent the pairs of same rational number.

Because these are positive and negative rational numbers.

(*vii*) $\frac{-5}{-9}$ and $\frac{5}{-9}$

$\Rightarrow \quad \frac{5}{9} \neq \frac{-5}{9}$ not represent the pairs of same rational number.

Because these are positive and negative rational numbers.

Q7. Rewrite the following rational numbers in the simplest form:

(i) $\frac{-8}{6}$ **(ii)** $\frac{25}{45}$

(iii) $\frac{-44}{72}$ **(iv)** $\frac{-8}{10}$.

Sol. (i) $\frac{-8}{6} = \frac{-8 \div 2}{6 \div 2} = \frac{-4}{3}$ (H.C.F. of 8 and 6 is 2.)

(ii) $\frac{25}{45} = \frac{25 \div 5}{45 \div 5} = \frac{5}{9}$ (H.C.F. of 25 and 45 is 5.)

(iii) $\frac{-44}{72} = \frac{-44 \div 4}{72 \div 4} = \frac{-11}{18}$ (H.C.F. of 44 and 72 is 4.)

(iv) $\frac{-8}{10} = \frac{-8 \div 2}{10 \div 2} = \frac{-4}{5}$ (H.C.F. of 8 and 10 is 2.)

Q8. Fill in the boxes with the correct symbol out of >, < and =.

(i) $\frac{-5}{7} \square \frac{2}{3}$ **(ii)** $\frac{-4}{5} \square \frac{-5}{7}$ **(iii)** $\frac{-7}{8} \square \frac{14}{-16}$

(iv) $\frac{-8}{5} \square \frac{-7}{4}$ **(v)** $\frac{1}{-3} \square \frac{-1}{4}$ **(vi)** $\frac{5}{-11} \square \frac{-5}{11}$

(vii) $0 \square \frac{-7}{6}$

Sol. (i) $\frac{-5}{7} \boxed{<} \frac{2}{3}$ Since, positive number is greater than negative number.

(ii) $\frac{-4}{5} \square \frac{-5}{7}$

On converting both rational numbers into same denominator and comparing,

$\Rightarrow \quad \frac{-4 \times 7}{5 \times 7} \square \frac{-5 \times 5}{7 \times 5}$

$\Rightarrow \quad \frac{-28}{35} \boxed{<} \frac{-25}{35}$ (∴ Negative smaller number is greater than negative bigger number.)

Thus, $\frac{-4}{5} \boxed{<} \frac{-5}{7}$.

(iii) $\frac{-7}{8} \square \frac{14}{-16}$

On converting both rational numbers with same denominator and comparing,

$\Rightarrow \quad \frac{-7 \times 2}{8 \times 2} \square \frac{14 \times (-1)}{-16 \times (-1)}$

$\Rightarrow \quad \frac{-14}{16} \boxed{=} \frac{-14}{16}$

Thus, $\frac{-7}{8} \boxed{=} \frac{14}{-16}$.

(iv) $\frac{-8}{5} \square \frac{-7}{4}$

On converting both rational numbers with same denominator and comparing,

$\Rightarrow \quad \frac{-8 \times 4}{5 \times 4} \square \frac{-7 \times 5}{4 \times 5}$

$\Rightarrow \quad \frac{-32}{20} \boxed{>} \frac{-35}{20}$ (∵ Negative smaller number is greater than negative bigger number.)

Thus, $\frac{-8}{5} \boxed{>} \frac{-7}{4}$

(v) $\frac{1}{-3} \square \frac{-1}{4}$

Thus, $\frac{-1}{3} \boxed{<} \frac{-1}{4}$

(vi) $\frac{5}{-11} \square \frac{-5}{11}$

Thus, $\frac{-5}{11} \boxed{=} \frac{-5}{11}$

(vii) $0 \boxed{>} \frac{-7}{6}$ (∵ 0 is greater than every negative number.)

Q9. Which is greater in each of the following:

(i) $\frac{2}{3}, \frac{5}{2}$ **(ii)** $\frac{-5}{6}, \frac{-4}{3}$ **(iii)** $\frac{-3}{4}, \frac{2}{-3}$

(iv) $\frac{-1}{4}, \frac{1}{4}$ (v) $-3\frac{2}{7}, -3\frac{4}{5}$.

Sol. (i) $\frac{2}{3}, \frac{5}{2}$

Convert into same denominators,

$$\frac{2\times2}{3\times2} = \frac{4}{6} \text{ and } \frac{5\times3}{2\times3} = \frac{15}{6}$$

Now, $\frac{4}{6} \boxed{<} \frac{15}{6}$ or $\frac{2}{3} \boxed{<} \frac{5}{2}$

Thus, $\frac{5}{2}$ is greater than $\frac{2}{3}$.

(ii) $\frac{-5}{6}, \frac{-4}{3}$

Convert into same denominators,

$$\frac{-5}{6} \text{ and } \frac{-4\times2}{3\times2} = \frac{-8}{6}$$

Now, $\frac{-5}{6} \boxed{>} \frac{-8}{6}$ or $\frac{-5}{6} \boxed{>} \frac{-4}{3}$

Thus, $\frac{-5}{6}$ is greater than $\frac{-4}{3}$.

(iii) $\frac{-3}{4}, \frac{2}{-3}$

Convert into same denominators,

$$\frac{-3\times3}{4\times3} = \frac{-9}{12} \text{ and } \frac{2}{-3} = \frac{2\times(-4)}{-3\times(-4)} = \frac{-8}{12}$$

Now, $\frac{-9}{12} \boxed{<} \frac{-8}{12}$ or $\frac{-3}{4} \boxed{<} \frac{2}{-3}$.

Thus, $\frac{2}{-3}$ is greater than $\frac{-3}{4}$.

(iv) $\frac{-1}{4}, \frac{1}{4}$

Positive number is always greater than negative number.

So, $\frac{1}{4}$ is greater than $\frac{-1}{4}$.

(v) $-3\frac{2}{7}, -3\frac{4}{5}$

Convert into same denominators,

$$-3\frac{2}{7} = \frac{-23}{7} = \frac{-23\times5}{7\times5} \text{ and } -3\frac{4}{5} = \frac{-19}{5} = \frac{-19\times7}{5\times7}$$

$$\Rightarrow \quad \frac{-115}{35} \text{ and } \frac{-133}{35}$$

Now, $\frac{-115}{35} \boxed{>} \frac{-133}{35}$ or $-3\frac{2}{7} \boxed{>} -3\frac{4}{5}$

Thus, $-3\frac{2}{7}$ is greater than $-3\frac{4}{5}$.

Q10. Write the following rational numbers in ascending order:

(i) $\frac{-3}{5}, \frac{-2}{5}, \frac{-1}{5}$ **(ii)** $\frac{1}{3}, \frac{-2}{9}, \frac{-4}{3}$ **(iii)** $\frac{-3}{7}, \frac{-3}{2}, \frac{-3}{4}$.

Sol. (i) $\frac{-3}{5}, \frac{-2}{5}, \frac{-1}{5}$

Now, rational numbers are in ascending order

$$\frac{-3}{5} < \frac{-2}{5} < \frac{-1}{5}.$$

(ii) $\frac{1}{3}, \frac{-2}{9}, \frac{-4}{3}$

Converted into same denominators $\frac{3}{9}, \frac{-2}{9}, \frac{-12}{9}$.

Now, rational numbers are in ascending order

$$\frac{-12}{9} < \frac{-2}{9} < \frac{3}{9}.$$

Thus, $\frac{-4}{3} < \frac{-2}{9} < \frac{1}{3}$.

(iii) $\frac{-3}{7}, \frac{-3}{2}, \frac{-3}{4}$

Now, rational numbers are in ascending order

$$\frac{-3}{2} < \frac{-3}{4} < \frac{-3}{7}.$$

Exercise 9.2 *(Page No. 190)*

Q1. Find the sum:

(i) $\frac{5}{4} + \left(\frac{-11}{4}\right)$ **(ii)** $\frac{5}{3} + \frac{3}{5}$ **(iii)** $\frac{-9}{10} + \frac{22}{15}$

(iv) $\frac{-3}{-11} + \frac{5}{9}$ **(v)** $\frac{-8}{19} + \frac{(-2)}{57}$ **(vi)** $\frac{-2}{3} + 0$

(vii) $-2\frac{1}{3} + 4\frac{3}{5}$.

Sol. (i) $\frac{5}{4} + \left(\frac{-11}{4}\right) = \frac{5-11}{4} = \frac{-6}{4} = \frac{-3}{2}$.

(ii) $\frac{5}{3} + \frac{3}{5}$

L.C.M. of 3 and 5 is 15.

So, $\frac{5}{3} = \frac{25}{15}$ and $\frac{3}{5} = \frac{9}{15}$

Thus, $\frac{5}{3} + \frac{3}{5} = \frac{25}{15} + \frac{9}{15} = \frac{25+9}{15} = \frac{34}{15} = 2\frac{4}{15}$.

(iii) $\frac{-9}{10} + \frac{22}{15}$

L.C.M. of 10 and 15 is 30.

So, $\frac{-9}{10} = \frac{-27}{30}$ and $\frac{22}{15} = \frac{44}{30}$

Thus, $\frac{-9}{10} + \frac{22}{15} = \frac{-27}{30} + \frac{44}{30} = \frac{-27+44}{30} = \frac{17}{30}$.

(iv) $\frac{-3}{-11} + \frac{5}{9}$

L.C.M. of 11 and 9 is 99.

So, $\frac{-3}{-11} = \frac{27}{99}$ and $\frac{5}{9} = \frac{55}{99}$

Thus, $\frac{-3}{-11} + \frac{5}{9} = \frac{27}{99} + \frac{55}{99} = \frac{27+55}{99} = \frac{82}{99}$.

(v) $\frac{-8}{19} + \frac{(-2)}{57}$

L.C.M. of 19 and 57 is 57.

So, $\frac{-8}{19} = \frac{-24}{57}$ and $\frac{(-2)}{57} = \frac{-2}{57}$

Thus, $\frac{-8}{19} + \frac{(-2)}{57} = \frac{-24}{57} + \frac{-2}{57} = \frac{(-24)+(-2)}{57} = \frac{-26}{57}$.

(vi) $\frac{-2}{3} + 0 = \frac{-2}{3}$.

(vii) $-2\frac{1}{3} + 4\frac{3}{5} = \frac{-7}{3} + \frac{23}{5}$

L.C.M. of 3 and 5 is 15.

So, $\frac{-7}{3} = \frac{-35}{15}$ and $\frac{23}{5} = \frac{69}{15}$

Thus, $\frac{-7}{3} + \frac{23}{5} = \frac{-35}{15} + \frac{69}{15} = \frac{(-35)+69}{15}$

$= \frac{34}{15} = 2\frac{4}{15}$.

Q2. Find:

(i) $\frac{7}{24} - \frac{17}{36}$ **(ii)** $\frac{5}{63} - \left(\frac{-6}{21}\right)$ **(iii)** $\frac{-6}{13} - \left(\frac{-7}{15}\right)$

(iv) $\frac{-3}{8} - \frac{7}{11}$ **(v)** $-2\frac{1}{9} - 6$.

Sol. (i) $\frac{7}{24} - \frac{17}{36}$

L.C.M. of 24 and 36 is 72.

So, $\frac{7}{24} = \frac{21}{72}$ and $\frac{17}{36} = \frac{34}{72}$

Thus, $\frac{7}{24} - \frac{17}{36} = \frac{21}{72} - \frac{34}{72} = \frac{21-34}{72} = \frac{-13}{72}$.

(ii) $\frac{5}{63} - \left(\frac{-6}{21}\right)$

L.C.M. of 63 and 21 is 63.

So, $\frac{5}{63} = \frac{5}{63}$ and $\frac{-6}{21} = \frac{-18}{63}$

Thus, $\frac{5}{63} - \left(\frac{-6}{21}\right) = \frac{5}{63} - \left(\frac{-18}{63}\right) = \frac{5-(-18)}{63}$

$= \frac{5+18}{63} = \frac{23}{63}$.

(iii) $\frac{-6}{13} - \left(\frac{-7}{15}\right)$

L.C.M. of 13 and 15 is 195.

So, $\frac{-6}{13} = \frac{-90}{195}$ and $\frac{-7}{15} = \frac{-91}{195}$

Thus, $\frac{-6}{13} - \left(\frac{-7}{15}\right) = \frac{-90}{195} - \left(\frac{-91}{195}\right) = \frac{-90-(-91)}{195}$

$= \frac{-90+91}{195} = \frac{1}{195}$.

(iv) $\frac{-3}{8} - \frac{7}{11}$

L.C.M. of 8 and 11 is 88.

So, $\frac{-3}{8} = \frac{-33}{88}$ and $\frac{7}{11} = \frac{56}{88}$

Thus, $\frac{-3}{8} - \frac{7}{11} = \frac{-33}{88} - \frac{56}{88} = \frac{-33-56}{88}$

$= \frac{-89}{88} = -1\frac{1}{88}$.

(v) $-2\frac{1}{9} - 6$

L.C.M. of 9 and 1 is 9.

So, $\frac{-19}{9} = \frac{-19}{9}$ and $\frac{6}{1} = \frac{54}{9}$

Thus, $\frac{-19}{9} - 6 = \frac{-19}{9} - \frac{54}{9} = \frac{-19-54}{9}$

$= \frac{-73}{9} = -8\frac{1}{9}$.

Q3. Find the product:

(i) $\frac{9}{2} \times \left(\frac{-7}{4}\right)$ **(ii)** $\frac{3}{10} \times (-9)$ **(iii)** $\frac{-6}{5} \times \frac{9}{11}$

(iv) $\frac{3}{7} \times \left(\frac{-2}{5}\right)$ **(v)** $\frac{3}{11} \times \frac{2}{5}$ **(vi)** $\frac{3}{-5} \times \frac{-5}{3}$.

Sol. (i) $\frac{9}{2} \times \left(\frac{-7}{4}\right) = \frac{9\times(-7)}{2\times4} = \frac{-63}{8} = -7\frac{7}{8}$.

(ii) $\frac{3}{10} \times (-9) = \frac{3\times(-9)}{10} = \frac{-27}{10} = -2\frac{7}{10}$.

(iii) $\frac{-6}{5} \times \frac{9}{11} = \frac{(-6)\times9}{5\times11} = \frac{-54}{55}$.

(iv) $\frac{3}{7} \times \left(\frac{-2}{5}\right) = \frac{3\times(-2)}{7\times5} = \frac{-6}{35}$.

(v) $\frac{3}{11} \times \frac{2}{5} = \frac{3\times2}{11\times5} = \frac{6}{55}$.

(vi) $\frac{3}{-5} \times \left(\frac{-5}{3}\right) = \frac{3\times(-5)}{(-5)\times3} = 1$.

Q4. Find the value of:

(i) $(-4) \div \frac{2}{3}$ **(ii)** $\frac{-3}{5} \div 2$ **(iii)** $\frac{-4}{5} \div (-3)$

(iv) $\frac{-1}{8} \div \frac{3}{4}$ **(v)** $\frac{-2}{13} \div \frac{1}{7}$ **(vi)** $\frac{-7}{12} \div \left(\frac{-2}{13}\right)$

(vii) $\frac{3}{13} \div \left(\frac{-4}{65}\right)$.

Sol. (i) $(-4) \div \frac{2}{3} = (-4) \times \frac{3}{2} = (-2) \times 3 = -6$.

(ii) $\frac{-3}{5} \div 2 = \left(\frac{-3}{5}\right) \times \frac{1}{2} = \frac{(-3)\times1}{5\times2} = \frac{-3}{10}$.

(iii) $\frac{-4}{5} \div (-3) = \frac{(-4)}{5} \times \frac{1}{(-3)} = \frac{(-4)\times1}{5\times(-3)} = \frac{-4}{-15} = \frac{4}{15}$.

(iv) $\frac{-1}{8} \div \frac{3}{4} = \frac{(-1)}{8} \times \frac{4}{3} = \frac{(-1)\times1}{2\times3} = \frac{-1}{6}$.

(v) $\frac{-2}{13} \div \frac{1}{7} = \frac{(-2)}{13} \times \frac{7}{1} = \frac{(-2)\times7}{13\times1} = \frac{-14}{13} = -1\frac{1}{13}$.

(vi) $\frac{-7}{12} \div \left(\frac{-2}{13}\right) = \left(\frac{-7}{12}\right) \times \left(\frac{13}{-2}\right) = \frac{(-7)\times13}{12\times(-2)} = \frac{-91}{-24} = 3\frac{19}{24}$.

(vii) $\frac{3}{13} \div \left(\frac{-4}{65}\right) = \frac{3}{13} \times \left(\frac{-65}{4}\right) = \frac{3\times(-5)}{1\times4} = \frac{-15}{4} = -3\frac{3}{4}$.

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