

Date _____
Page _____

CHAPTER - 9 RATIONAL NUMBERS

EXERCISE 9.1

Q1. List five rational numbers between :

(i) -1 & 0 (ii) -2 & -1

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

→ (i) -1 and 0

Converting each of rational numbers as a denominator $5+1=6$ we have

$$-1 = \frac{-1 \times 6}{6} = \frac{-6}{6} \quad \text{and} \quad 0 = \frac{0 \times 6}{6} = \frac{0}{6}$$

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

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

(ii) -2 and -1

Converting each of rational numbers as a denominator 6 , we have

$$-2 = \frac{-2 \times 6}{6} = \frac{-12}{6} \quad -1 = \frac{-1 \times 6}{6} = \frac{-6}{6}$$

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

Required rational numbers are $\frac{-11}{6}, \frac{-10}{6}, \frac{-9}{6}, \frac{-8}{6}, \frac{-7}{6}$

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

Converting each rational numbers as 15 , we have

$$\frac{-4}{5} = \frac{-4 \times 3}{5 \times 3} = \frac{-12}{15}, \quad \frac{-2}{3} = \frac{-2 \times 5}{3 \times 5} = \frac{-10}{15}$$

Since there is only one rational number, will find the equivalent fractions.

$$\frac{-12}{15} = \frac{-12 \times 3}{15 \times 3} = \frac{-36}{45}, \quad \frac{-10}{15} = \frac{-10 \times 3}{15 \times 3} = \frac{-30}{45}$$

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

\(\therefore\) Required is between rational numbers are

$$\frac{-35}{45}, \frac{-34}{45}, \frac{-33}{45}, \frac{-32}{45}, \frac{-31}{45}$$

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

Converting each of rational numbers to their equivalent rational numbers we have,

$$\frac{-1}{2} = \frac{-1 \times 18}{2 \times 18} = \frac{-18}{36}; \quad \frac{2}{3} = \frac{2 \times 12}{3 \times 12} = \frac{24}{36}$$

$$\therefore \frac{-18}{36} & \frac{-18}{36} < \frac{-17}{36} < \frac{-16}{36} < \frac{-15}{36} < \frac{-14}{36} < \frac{-13}{36} \dots < \frac{24}{36}$$

Required is between rational numbers are

$$\frac{-17}{36}, \frac{-16}{36}, \frac{-15}{36}, \frac{-14}{36}, \frac{-13}{36}$$

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

(i) $\frac{-3}{5}, \frac{-6}{10}, \frac{-9}{15}, \frac{-12}{20}, \dots$

Given pattern is

$$\frac{-3}{5} = \frac{-3 \times 1}{5 \times 1} = \frac{-3}{5}$$

$$\frac{-6}{10} = \frac{-3 \times 2}{5 \times 2} = \frac{-6}{10}$$

$$\frac{-9}{15} = \frac{-3 \times 3}{5 \times 3} = \frac{-9}{15}$$

$$\frac{-12}{20} = \frac{-3 \times 4}{5 \times 4} = \frac{-12}{20}$$

Preceding with the pattern

$$\frac{-3 \times 5}{5 \times 5} = \frac{-15}{25}$$

$$\frac{-3 \times 6}{5 \times 6} = \frac{-18}{30}$$

$$\frac{-3 \times 7}{5 \times 7} = \frac{-21}{35}$$

$$\frac{-3 \times 8}{5 \times 8} = \frac{-24}{40}$$

Hence, required rational numbers are

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

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

Given pattern is

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

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

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

Preceding with the pattern

$$\frac{-1 \times 4}{4 \times 4} = \frac{-4}{16}$$

$$\frac{-1 \times 5}{4 \times 5} = \frac{-5}{20}$$

$$\frac{-1 \times 6}{4 \times 6} = \frac{-6}{24}$$

$$\frac{-1 \times 7}{4 \times 7} = \frac{-7}{28}$$

Hence, required rational numbers are

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

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

→ Given pattern is

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

Preceding with the same pattern

$$\frac{-1 \times 5}{6 \times 5} = \frac{-5}{30}$$

$$\frac{-2}{12} = \frac{-1 \times 2}{6 \times 2} = \frac{-2}{12}$$

$$\frac{-1 \times 6}{6 \times 6} = \frac{-6}{36}$$

$$\frac{-3}{18} = \frac{-1 \times 3}{6 \times 3} = \frac{-3}{18}$$

$$\frac{-1 \times 7}{6 \times 7} = \frac{-7}{42}$$

$$\frac{-4}{24} = \frac{-1 \times 4}{6 \times 4} = \frac{-4}{24}$$

$$\frac{-1 \times 8}{6 \times 8} = \frac{-8}{48}$$

Hence, required rational numbers are

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

(ix) $\frac{-2}{3}, \frac{2}{-3}, \frac{4}{-6}, \frac{6}{-9} \dots$

→ Given pattern is

Preceding with the pattern

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

$$\frac{-2 \times 4}{3 \times 4} = \frac{-8}{12}$$

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

$$\frac{-2 \times 5}{3 \times 5} = \frac{-10}{15}$$

$$\frac{4}{-6} = \frac{-4}{6} = \frac{-2 \times 2}{3 \times 2}$$

$$\frac{-2 \times 6}{3 \times 6} = \frac{-12}{18}$$

$$\frac{-6}{9} = \frac{-2 \times 3}{3 \times 3} = \frac{-6}{9}$$

$$\frac{-2 \times 7}{3 \times 7} = \frac{-14}{21}$$

Hence, required rational numbers are

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

Q3. Give four rational numbers equivalent to:

(i) $\frac{-2}{7}$

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

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

$$\rightarrow (i) \quad \frac{-2}{7} = \frac{-2 \times 2}{7 \times 2} = \frac{-4}{14}$$

$$(ii) \quad \frac{5}{-3} = \frac{-5 \times 2}{-3 \times 2} = \frac{10}{-6}$$

$$\frac{-2}{7} = \frac{-2 \times 3}{7 \times 3} = \frac{-6}{21}$$

$$\frac{5}{-3} = \frac{5 \times 3}{-3 \times 3} = \frac{15}{-9}$$

$$\frac{-2}{7} = \frac{-2 \times 4}{7 \times 4} = \frac{-8}{28}$$

$$\frac{5}{-3} = \frac{5 \times 4}{-3 \times 4} = \frac{20}{-12}$$

$$\frac{-2}{7} = \frac{-2 \times 5}{7 \times 5} = \frac{-10}{35}$$

$$\frac{5}{-3} = \frac{5 \times 5}{-3 \times 5} = \frac{25}{-15}$$

$$(iii) \quad \frac{4}{9} = \frac{4 \times 2}{9 \times 2} = \frac{8}{18}$$

$$\frac{4}{9} = \frac{4 \times 3}{9 \times 3} = \frac{12}{27}$$

$$\frac{4}{9} = \frac{4 \times 4}{9 \times 4} = \frac{16}{36}$$

$$\frac{4}{9} = \frac{4 \times 5}{9 \times 5} = \frac{20}{45}$$

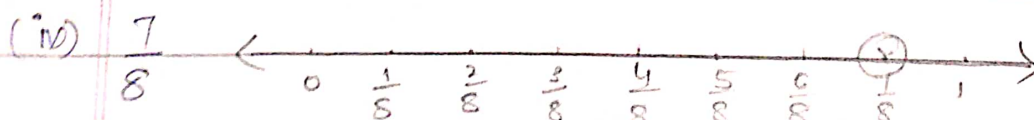
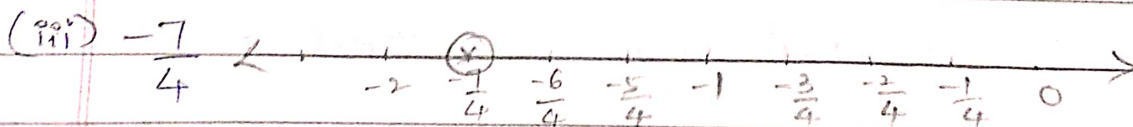
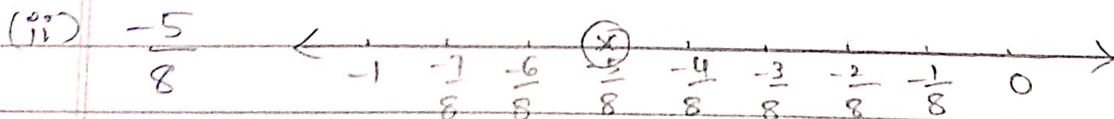
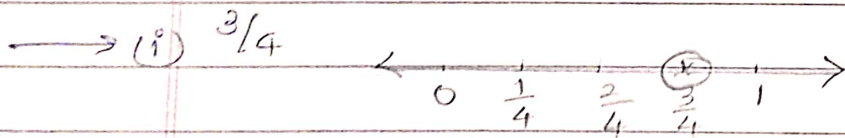
Q4. Draw the number line & represent the following rational numbers on it:

$$(i) \quad \frac{3}{4}$$

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

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

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



Q5. The points P, Q, R, S, T, U, A, B on the number line are such that, $TR = RS = SU$ & $AP = PQ = QB$.

Name the rational numbers represented by P, Q, R, S.



→ Rational numbers represented by P, Q, R, S are $\frac{7}{3}, \frac{8}{3}, -\frac{4}{3}, -\frac{5}{3}$ resp.

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

→ (i) $-\frac{7}{21}$ and $\frac{3}{9}$

Converting each of the rational numbers to its lowest form

$$-\frac{7}{21} = \frac{-7 \div 7}{21 \div 7} = -\frac{1}{3} \qquad \frac{3}{9} = \frac{3 \div 3}{9 \div 3} = \frac{1}{3}$$

Since $-\frac{1}{3} \neq \frac{1}{3}$; $-\frac{7}{21}$ and $\frac{3}{9}$ do not

represent the same rational numbers.

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

→ Converting each of the rational numbers to its lowest form

$$-\frac{16}{20} = \frac{-16 \div 4}{20 \div 4} = -\frac{4}{5} \qquad \frac{20}{-25} = \frac{20 \div 5}{-25 \div 5} = \frac{4}{-5} = -\frac{4}{5}$$

Since $-\frac{4}{5} = -\frac{4}{5}$; $-\frac{16}{20}$ & $\frac{20}{-25}$ represent the

same rational numbers.

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

→ Since the given rational numbers are in its lowest form, & numerator & denominator are same

∴ $\frac{-2}{-3}$ & $\frac{2}{3}$ represent the same rational numbers.

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

→ Converting $\frac{-12}{20}$ in its lowest form

$$\frac{-12}{20} = \frac{-12 \div 4}{20 \div 4} = \frac{-3}{5}$$

Since $\frac{-3}{5} = \frac{-3}{5}$; $\frac{-3}{5}$ & $\frac{-12}{20}$ represent the

same rational numbers.

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

→ Converting $\frac{-24}{15}$ in its lowest form

$$\frac{-24}{15} = \frac{-24 \div 3}{15 \div 3} = \frac{-8}{5} = \frac{8}{-5}$$

Since, $\frac{8}{-5} = \frac{8}{-5}$; $\frac{8}{-5}$ and $\frac{-24}{15}$ represent

the same rational numbers.

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

→ Here both are in their lowest form.

∴ $\frac{1}{3} \neq \frac{-1}{9}$, they do not represent the

same rational numbers.

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

$$(i) \frac{-8}{6} = \frac{-8 \div 2}{6 \div 2} = \frac{-4}{3}$$

$$(iv) \frac{-8}{10} = \frac{-8 \div 2}{10 \div 2} = \frac{-4}{5}$$

$$(ii) \frac{25}{45} = \frac{25 \div 5}{45 \div 5} = \frac{5}{9}$$

$$(iii) \frac{-44}{72} = \frac{-44 \div 4}{72 \div 4} = \frac{-11}{18}$$

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

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

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

$$\rightarrow \frac{-5 \times 3}{7 \times 3} = \frac{-15}{21}$$

$$\frac{-4 \times 7}{5 \times 7} = \frac{-28}{35}$$

$$\frac{2 \times 7}{3 \times 7} = \frac{14}{21}$$

$$\frac{-5 \times 5}{7 \times 5} = \frac{-25}{35}$$

$$\therefore \frac{-15}{21} \square \frac{14}{21}$$

$$\frac{-28}{35} \square \frac{-25}{35}$$

$$\therefore \frac{-5}{7} \square \frac{2}{3}$$

$$\therefore \frac{-4}{5} \square \frac{-5}{7}$$

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

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

$$\frac{-7 \times 2}{8 \times 2} = \frac{-14}{16}$$

$$\frac{-8 \times 4}{5 \times 4} = \frac{-32}{20}$$

$$\frac{14 \times (-1)}{-16 \times (-1)} = \frac{-14}{16}$$

$$\frac{-7 \times 5}{4 \times 5} = \frac{-35}{20}$$

$$\frac{-14}{16} \square \frac{-14}{16}$$

$$\frac{-32}{20} \square \frac{-35}{20}$$

$$\therefore \frac{-7}{8} \square \frac{14}{-16}$$

$$\therefore \frac{-8}{5} \square \frac{-7}{4}$$

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

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

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

$$\frac{4}{-12} \square \frac{3}{-12}$$

$$\therefore \frac{1}{-3} \square \frac{-1}{4}$$

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

$$\frac{5 \times 11}{-11 \times 11} = \frac{55}{-121}$$

$$\frac{-5 \times 11}{11 \times 11} = \frac{-55}{121}$$

$$\frac{55}{121} \square \frac{-55}{121}$$

$$\therefore \frac{5}{-11} \square \frac{-5}{11}$$

(vii) $0 \square \frac{-7}{6}$ Because 0 is greater than every negative number.

Q9. Which is greater in each of the following:

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

[LCM of 3, 2 = 6]

$$\rightarrow \frac{2 \times 2}{3 \times 2} = \frac{4}{6}; \quad \frac{5 \times 3}{2 \times 3} = \frac{15}{6}$$

$$\frac{4}{6} < \frac{15}{6} \Rightarrow \frac{2}{3} < \frac{5}{2}$$

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

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

[LCM of 6, 3 = 6]

$$\frac{-4}{3} = \frac{-4 \times 2}{3 \times 2} = \frac{-8}{6}$$

$$\frac{-5}{6} > \frac{-8}{6} \Rightarrow \frac{-5}{6} > \frac{-4}{3}$$

$$(33) \quad -\frac{2}{4}, \frac{2}{-3}$$

$$\rightarrow \frac{-2 \times 3}{4 \times 3} = \frac{-6}{12} \quad ; \quad \frac{2 \times 4}{-3 \times 4} = \frac{8}{-12} \quad \left[\text{LCM of } 4, -3 = 12 \right]$$

$$\frac{-6}{12} < \frac{8}{-12} \Rightarrow \frac{-2}{4} > \frac{2}{-3}$$

$$(34) \quad -\frac{1}{4}, \frac{1}{4}$$

$$\rightarrow -\frac{1}{4} < \frac{1}{4}$$

$$(35) \quad -\frac{22}{7}, -\frac{34}{5}$$

$$\rightarrow -\frac{22}{7}, -\frac{19}{5}$$

$$-\frac{22 \times 5}{7 \times 5} = \frac{-110}{35} \quad ; \quad \frac{-19 \times 7}{5 \times 7} = \frac{-133}{35}$$

$$\frac{-110}{35} > \frac{-133}{35} \Rightarrow -\frac{22}{7} > -\frac{34}{5}$$

Q10. Write the following rational numbers in ascending order:

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

\rightarrow Here denominators are same

$$-3 < -2 < -1$$

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

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

→ LCM of 3, 9, 3 = 9

$$\frac{-1 \times 3}{3 \times 3} = \frac{-3}{9}; \quad \frac{-2 \times 1}{9 \times 1} = \frac{-2}{9}; \quad \frac{-4 \times 3}{3 \times 3} = \frac{-12}{9}$$

$$\frac{-12}{9} < \frac{-3}{9} < \frac{-2}{9} \Rightarrow \frac{-4}{3} < \frac{-1}{3} < \frac{-2}{9}$$

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

→ LCM of 7, 2, 4 = 28

$$\frac{-3 \times 4}{7 \times 4} = \frac{-12}{28}; \quad \frac{-3 \times 14}{2 \times 14} = \frac{-42}{28}; \quad \frac{-3 \times 7}{4 \times 7} = \frac{-21}{28}$$

$$\frac{-42}{28} < \frac{-21}{28} < \frac{-12}{28} \Rightarrow \frac{-3}{2} < \frac{-3}{4} < \frac{-3}{7}$$

EXERCISE 9.2

Q1. Find the sum:

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

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

LCM of 3, 5 = 15

$$\frac{5}{3} + \frac{3}{5} = \frac{(5 \times 5) + (3 \times 3)}{15} = \frac{25 + 9}{15} = \frac{34}{15}$$

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

LCM of 10, 15 = 30

$$\frac{-9}{10} + \frac{22}{15} = \frac{(-9 \times 3) + (22 \times 2)}{30} = \frac{-27 + 44}{30} = \frac{17}{30}$$

$$(iv) \quad \frac{-3}{-811} + \frac{5}{9} = \frac{3}{11} + \frac{5}{9}$$

LCM of 11, 9 = 99

$$\frac{3}{11} + \frac{5}{9} = \frac{(3 \times 9) + (5 \times 11)}{99} = \frac{27 + 55}{99} = \frac{82}{99}$$

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

LCM of 19, 57 = 57

$$\frac{-8 \times 3}{19 \times 3} = \frac{-24}{57} \quad \frac{-2}{57} = \frac{-2 \times 1}{57 \times 1} = \frac{-2}{57}$$

$$\frac{-24 + (-2)}{57} = \frac{-26}{57}$$

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

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

$$-\frac{7}{3} + \frac{23}{5}$$

LCM of 3, 5 = 15

$$-\frac{7}{3} + \frac{23}{5} = \frac{(-7 \times 5) + (23 \times 3)}{15} = \frac{-35 + 69}{15} = \frac{34}{15}$$

Q2. Find

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

LCM of 24 and 36 is 72

$$\frac{7}{24} - \frac{17}{36} = \frac{(7 \times 3) - (17 \times 2)}{72} = \frac{21 - 34}{72} = \frac{-13}{72}$$

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

LCM of 63, 21 is 63.

$$\frac{5}{63} + \frac{6}{21} = \frac{(5 \times 1) + (6 \times 3)}{63} = \frac{5 + 18}{63} = \frac{23}{63}$$

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

LCM of 13, 15 is 195

$$\frac{-6}{13} + \frac{7}{15} = \frac{(-6 \times 15) + (7 \times 13)}{195} = \frac{(-90) + (91)}{195} = \frac{1}{195}$$

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

LCM of 8, 11 is 88.

$$\frac{-3}{8} - \frac{7}{11} = \frac{(-3 \times 11) - (7 \times 8)}{88} = \frac{-33 - 56}{88} = \frac{-89}{88}$$

$$(v) -2\frac{1}{9} - 6 = \frac{-19}{9} - \frac{6}{1}$$

LCM of 9, 1 is 9

$$\frac{-19}{9} - \frac{6}{1} = \frac{(-19 \times 1) - (6 \times 9)}{9} = \frac{-19 - 54}{9} = \frac{-73}{9}$$

Q3. Find the product:

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

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

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

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

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

$$(vi) \frac{3}{-5} \times \frac{-5}{3} = \frac{3 \times (-5)}{(-5) \times 3} = \frac{-15}{-15} = 1$$

Q4. Find the value of :

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

$$(ii) \frac{-3}{5} \div 2 = \frac{-3}{5} \times \frac{1}{2} = \frac{-3}{10}$$

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

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

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

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

$$(vii) \frac{3}{13} \div \left(\frac{-4}{11}\right) = \frac{3}{13} \times \frac{11}{-4} = \frac{-33}{52}$$