

Exercise 1.6

Q.1 Verify the property: $x \times y = y \times x$ by taking:

(i) $x = -\frac{1}{3}, y = \frac{2}{7}$ (ii) $x = -\frac{3}{5}, y = -\frac{11}{13}$

(iii) $x = 2, y = \frac{7}{-8}$ (iv) $x = 0, y = -\frac{15}{8}$

Solution (i) $x = -\frac{1}{3}, y = \frac{2}{7}$

$$\therefore x \times y = -\frac{1}{3} \times \frac{2}{7} = -\frac{2}{21}$$

$$\text{also } y \times x = \frac{2}{7} \times -\frac{1}{3} = -\frac{2}{21}$$

$$\therefore \text{LHS} = \text{RHS}$$

(ii) $x = -\frac{3}{5}, y = -\frac{11}{13}$

$$\text{here } x \times y = -\frac{3}{5} \times -\frac{11}{13} = \frac{33}{65}$$

$$\text{also } y \times x = -\frac{11}{13} \times -\frac{3}{5} = \frac{33}{65}$$

$$\therefore \text{LHS} = \text{RHS}$$

(iii) $x = 2, y = \frac{7}{-8}$

$$\text{here } x \times y = 2 \times \frac{7}{-8} = \frac{14}{-8} = \frac{7}{-4} = -\frac{7}{4}$$

$$\text{also } y \times x = \frac{7}{-8} \times 2 = \frac{7}{-4} = -\frac{7}{4}$$

$$(iv) \quad x=0, y=-\frac{15}{8}$$

$$\therefore x \times y = 0 \times -\frac{15}{8} = \frac{0}{8} = 0$$

$$\text{also } y \times x = -\frac{15}{8} \times 0 = \frac{0}{8} = 0$$

Q.2 Verify the property: $x \times (y \times z) = (x \times y) \times z$
by taking.

$$(i) \quad x = -\frac{7}{3}, y = \frac{12}{5}, z = \frac{4}{9} \quad (ii) \quad x=0, y=-\frac{3}{5}, z=-\frac{9}{4}$$

$$(iii) \quad x = \frac{1}{2}, y = \frac{5}{-4}, z = -\frac{7}{5} \quad (iv) \quad x = \frac{5}{7}, y = -\frac{12}{13}, z = -\frac{7}{18}$$

Solution: (i) $x = -\frac{7}{3}, y = \frac{12}{5}, z = \frac{4}{9}$

$$\therefore x \times (y \times z) = -\frac{7}{3} \times \left(\frac{12}{5} \times \frac{4}{9} \right) = -\frac{7}{3} \times \frac{16}{15} = -\frac{112}{45}$$

$$\text{Now } (x \times y) \times z = \left(-\frac{7}{3} \times \frac{12}{5} \right) \times \frac{4}{9} = -\frac{28}{5} \times \frac{4}{9} = -\frac{112}{45}$$

$$\therefore x \times (y \times z) = (x \times y) \times z.$$

$$(ii) \quad x=0, y=-\frac{3}{5}, z=-\frac{9}{4}$$

$$x \times (y \times z) = (x \times y) \times z$$

$$\Rightarrow 0 \times \left(-\frac{3}{5} \times -\frac{9}{4} \right) = \left(0 \times -\frac{3}{5} \right) \times \left(-\frac{9}{4} \right)$$

$$\Rightarrow 0 \times \frac{27}{20} = 0 \times -\frac{9}{4}$$

$$\Rightarrow 0 = 0$$

$$(iii) \quad x = \frac{1}{2}, y = \frac{5}{-4}, z = \frac{-7}{5}$$

$$x \times (y \times z) = (x \times y) \times z$$

$$\Rightarrow \frac{1}{2} \times \left(\frac{5}{-4} \times \frac{-7}{5} \right) = \left(\frac{1}{2} \times \frac{5}{-4} \right) \times \frac{-7}{5}$$

$$\Rightarrow \frac{1}{2} \times \frac{7}{4} = \frac{5}{-8} \times \frac{-7}{5}$$

$$\Rightarrow \frac{7}{8} = \frac{7}{8}$$

$$(iv) \quad x = \frac{5}{7}, y = \frac{-12}{13}, z = \frac{-7}{18}$$

$$x \times (y \times z) = (x \times y) \times z$$

$$\Rightarrow \frac{5}{7} \times \left(\frac{-12}{13} \times \frac{-7}{18} \right) = \left(\frac{5}{7} \times \frac{-12}{13} \right) \times \left(\frac{-7}{18} \right)$$

$$\Rightarrow \frac{5}{7} \times \frac{14}{39} = \frac{-60}{91} \times \frac{-7}{18}$$

$$\Rightarrow \frac{10}{39} = \frac{10}{39}$$

Q3 Verify the property $x \times (y + z) = (x \times y) + (x \times z)$
by taking

$$(i) \quad x = -\frac{3}{7}, y = \frac{12}{13}, z = \frac{-5}{6}$$

$$(ii) \quad x = -\frac{12}{5}, y = \frac{-15}{4}, z = \frac{1}{3}$$

$$(iii) \quad x = \frac{-8}{3}, y = \frac{5}{6}, z = \frac{-13}{12}$$

$$(iv) \quad x = -\frac{3}{4}, y = \frac{-5}{2}, z = \frac{7}{6}$$

Solution (i) $x = -\frac{3}{7}$, $y = \frac{12}{13}$, $z = -\frac{5}{6}$

$$\therefore x \times (y + z) = (x \times y) + (x \times z)$$

$$\Rightarrow -\frac{3}{7} \times \left(\frac{12}{13} + -\frac{5}{6} \right) = \left(-\frac{3}{7} \times \frac{12}{13} \right) + \left(-\frac{3}{7} \times -\frac{5}{6} \right)$$

$$\Rightarrow -\frac{3}{7} \times \left(\frac{72 - 65}{78} \right) = -\frac{36}{91} + \frac{15}{42}$$

$$\Rightarrow -\frac{3}{7} \times \frac{7}{78} = \frac{195 - 216}{546}$$

$$\Rightarrow -\frac{21}{546} = -\frac{21}{546}$$

(ii) $x = -\frac{12}{5}$, $y = -\frac{15}{4}$, $z = \frac{8}{3}$

$$x \times (y + z) = (x \times y) + (x \times z)$$

$$\Rightarrow -\frac{12}{5} \times \left(-\frac{15}{4} + \frac{8}{3} \right) = \left(-\frac{12}{5} \times -\frac{15}{4} \right) + \left(-\frac{12}{5} \times \frac{8}{3} \right)$$

$$\Rightarrow -\frac{12}{5} \times \left(\frac{-45 + 32}{12} \right) = 9 + \left(-\frac{32}{5} \right)$$

$$= -\frac{12}{5} \times -\frac{13}{12} = \frac{45 - 32}{5}$$

$$\Rightarrow \frac{13}{5} = \frac{13}{5}$$

$$(iii) \quad x = -\frac{8}{3}, \quad y = \frac{5}{6}, \quad z = -\frac{13}{12}$$

$$x \times (y+z) = (x \times y) + (x \times z)$$

$$\Rightarrow -\frac{8}{3} \times \left\{ \left(\frac{5}{6} \right) + \left(-\frac{13}{12} \right) \right\} = \left(-\frac{8}{3} \times \frac{5}{6} \right) + \left(-\frac{8}{3} \times -\frac{13}{12} \right)$$

$$\Rightarrow -\frac{8}{3} \times \left(\frac{10-13}{12} \right) = -\frac{40}{18} + \frac{104}{36}$$

$$\Rightarrow -\frac{8}{3} \times -\frac{3}{12} = \frac{-80 + 104}{36}$$

$$\Rightarrow \frac{24}{36} = \frac{24}{36}$$

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

$$(iv) \quad x = -\frac{3}{4}, \quad y = -\frac{5}{2}, \quad z = \frac{7}{6}$$

$$x \times (y+z) = (x \times y) + (x \times z)$$

$$\Rightarrow -\frac{3}{4} \times \left(-\frac{5}{2} + \frac{7}{6} \right) = \left(-\frac{3}{4} \times -\frac{5}{2} \right) + \left(-\frac{3}{4} \times \frac{7}{6} \right)$$

$$\Rightarrow -\frac{3}{4} \times \left(\frac{-15+7}{6} \right) = \frac{15}{8} + \left(-\frac{21}{24} \right)$$

$$\Rightarrow -\frac{3}{4} \times -\frac{8}{6} = \frac{15}{8} - \frac{21}{24}$$

$$\Rightarrow \frac{24}{24} = \frac{45-21}{24} \Rightarrow 1 = 1$$

Q4 use the distributivity of multiplication of rational numbers over their addition to simplify

$$\begin{aligned} \text{(i)} \quad \frac{3}{5} \times \left(\frac{35}{24} + \frac{10}{1} \right) &= \frac{3}{5} \times \frac{35}{24} + \frac{3}{5} \times \frac{10}{1} \\ &= \frac{7}{8} + 6 = \frac{7+48}{8} = \frac{55}{8} \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad -\frac{5}{4} \times \left(\frac{8}{5} + \frac{16}{5} \right) &= \left(-\frac{5}{4} \times \frac{8}{5} \right) + \left(-\frac{5}{4} \times \frac{16}{5} \right) \\ &= -\frac{40}{20} + -\frac{80}{20} \\ &= -2 + (-4) = -2-4 = -6 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad \frac{2}{7} \times \left(\frac{7}{16} - \frac{21}{4} \right) &= \left(\frac{2}{7} \times \frac{7}{16} \right) - \left(\frac{2}{7} \times \frac{21}{4} \right) \\ &= \frac{1}{8} - \frac{3}{2} = \frac{1-12}{8} = -\frac{11}{8} \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad \frac{3}{4} \times \left(\frac{8}{9} - 40 \right) &= \left(\frac{3}{4} \times \frac{8}{9} \right) - \left(\frac{3}{4} \times 40 \right) \\ &= \frac{2}{3} - 30 = \frac{2-90}{3} = -\frac{88}{3} \end{aligned}$$

Q5 Find the Multiplicative Inverse (reciprocal) of each of the following rational numbers.

(i) 9

(ii) -7

(iii) $\frac{12}{5}$

(iv) $-\frac{7}{9}$

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

(vi) $\frac{2}{3} \times \frac{9}{4}$

(vii) $-\frac{5}{8} \times \frac{16}{15}$

(viii) $-2 \times \frac{-3}{5}$

(ix) -1

(x) $\frac{0}{3}$

(xi) 1

Solution: (i) $\frac{1}{9}$

(ii) $-\frac{1}{7}$

(iii) $\frac{5}{12}$

(iv) $-\frac{9}{7}$

(v) $\frac{5}{3}$

~~(vi)~~

(vi) $\frac{2}{3} \times \frac{9}{4} = \frac{18}{12} = \frac{3}{2}$

$\therefore$ M.I of $\frac{3}{2}$ is $\frac{2}{3}$

(vii) $-\frac{5}{8} \times \frac{16}{15} = \frac{-80}{120} = -\frac{2}{3}$

$\therefore$ M.I of $-\frac{2}{3}$ is $-\frac{3}{2}$

(viii) $\therefore -2 \times \frac{-3}{5} = \frac{6}{5}$

$\therefore$ M.I of $\frac{6}{5}$ is $\frac{5}{6}$

(ix) M.I of -1 is -1

(x) M.I of $\frac{0}{3}$ is $\frac{3}{0}$ i.e not defined.

(xi) M.I of 1 is 1 .

Q.6 Name the property of multiplication of rational numbers illustrated by the following statements.

$$(i) -\frac{5}{16} \times \frac{8}{15} = \frac{8}{15} \times -\frac{5}{16}$$

$$(ii) -\frac{17}{5} \times 9 = 9 \times -\frac{17}{5}$$

$$(iii) \frac{7}{4} \times \left(-\frac{8}{3} + -\frac{13}{12}\right) = \frac{7}{4} \times -\frac{8}{3} + \frac{7}{4} \times -\frac{13}{12}$$

$$(iv) -\frac{5}{9} \times \left(\frac{4}{15} \times -\frac{9}{8}\right) = \left(-\frac{5}{9} \times \frac{4}{15}\right) \times -\frac{9}{8}$$

$$(v) \frac{13}{-17} \times 1 = \frac{13}{-17} = 1 \times \frac{13}{-17}$$

$$(vi) -\frac{11}{16} \times \frac{16}{-11} = 1$$

$$(vii) \frac{2}{13} \times 0 = 0 \neq 0 \times \frac{2}{13}$$

$$(viii) -\frac{3}{2} \times \frac{5}{4} + -\frac{3}{2} \times -\frac{7}{6} = -\frac{3}{2} \times \left(\frac{5}{4} + -\frac{7}{6}\right)$$

Solution (i) Commutativity (ii) Commutativity

(iii) Distributivity of multiplication over addition.

- (iv) Associativity (v) Multiplicative Identity
 (vi) Multiplicative Inverse
 (vii) Multiplication by zero
 (viii) Distributivity

Q.7 Fill in the blanks.

- (i) The product of two positive rational number is always - - - - -
 (ii) The product of a positive rational number and a negative rational number is always - - - - -
 (iii) The product of two negative rational number is always - - - - -
 (iv) The reciprocal of a positive rational number is ____
 (v) The reciprocal of a negative rational number is ____
 (vi) zero has ____ reciprocal.
 (vii) The product of a rational number and its reciprocal is ____
 (viii) The numbers ____ and ____ are their own reciprocals.
 (ix) If a is a reciprocal of b , then the reciprocal of b is - - - - -

(*) The number 0 is the reciprocal of any number.

(x) Reciprocal of $\frac{1}{a}$, $a \neq 0$ is

(xi) $(17 \times 12)^{-1} = 17^{-1} \times \dots$

Solution : (i) Positive (ii) Negative

(iii) Positive (iv) Positive (v) negative.

(vi) No (vii) 1 (viii) 1, -1 (ix) a

(x) not (xi) a (xii) 12^{-1}

Q.8 Fill in the blanks.

(i) $-4 \times \frac{7}{9} = \frac{7}{9} \times \dots$ (ii) $\frac{5}{11} \times \frac{-3}{8} = \frac{-3}{8} \times \dots$

(iii) $\frac{1}{2} \times \left(\frac{3}{4} + \frac{-5}{12} \right) = \frac{1}{2} \times \dots + \dots \times \frac{-5}{12}$

(iv) $\frac{-4}{5} \times \left(\frac{5}{7} + \frac{-8}{9} \right) = \left(\frac{-4}{5} \times \dots \right) \times \frac{-8}{9}$

Solution : (i) -4 (ii) $\frac{5}{11}$

(iii) $\frac{3}{4}, \frac{1}{2}$ (iv) $\frac{5}{7}$