Exercise 1.2

Q1 Verify commutativity of addition of rational numbers for each of the following pairs of rational numbers.

(i) $-\frac{11}{5}$ and $\frac{4}{7}$ (ii) $\frac{4}{9}$ and $\frac{-7}{12}$

(iii) $\frac{-3}{5}$ and $\frac{-2}{-15}$ (iv) $\frac{2}{-7}$ and $\frac{12}{-35}$ (v) 4 and $\frac{-3}{5}$

(vi) -4 and $\frac{4}{-7}$

Solution: As we know two rational number $\frac{a}{b}$ and $\frac{c}{d}$ are Commutative if

$$\frac{a}{b}+\frac{c}{d}=\frac{c}{d}+\frac{a}{b}$$

(i) $-\frac{11}{5}+\frac{4}{7}=\frac{(-11\times7)+(4\times5)}{35}=\frac{-77+20}{35}=\frac{-57}{35}$

also $\frac{4}{7}+\left(\frac{-11}{5}\right)=\frac{(4\times5)+(-11\times7)}{35}$

$=\frac{20-77}{35}=\frac{-57}{35}$

$\therefore -\frac{11}{5}+\frac{4}{7}=\frac{4}{7}+\left(\frac{-11}{5}\right)$

(ii) $\frac{4}{9}$ and $\frac{-7}{12}=$ _____

$\therefore \frac{4}{9}+\frac{-7}{12}=\frac{16+(-21)}{36}=\frac{16-21}{36}=\frac{-5}{36}$

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also, $\frac{-7}{12}+\frac{4}{9} = \frac{(-7\times3)+(4\times4)}{36} = \frac{-21+16}{36}$

$= \frac{-5}{36}$

$\therefore \quad \frac{4}{9}+\left(\frac{-7}{12}\right) = \left(\frac{-7}{12}\right)+\frac{4}{9}$

(iii) $\frac{-3}{5}+\left(\frac{-2}{-15}\right) = \frac{-3}{5}+\frac{2}{15} = \frac{(-3\times3)+(2\times1)}{15}$

$= \frac{-9+2}{15} = \frac{-7}{15}$

Also, $\left(\frac{-2}{-15}\right)+\left(\frac{-3}{5}\right) = \frac{2}{15}-\frac{3}{5} = \frac{2-3\times3}{15}$

$= \frac{2-9}{15} = \frac{-7}{15}$

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

(iv) $\frac{2}{-7}+\frac{12}{-35} = -\frac{2}{7}+\frac{-12}{35} = \frac{(-2\times5)+(-12\times1)}{35}$

$= \frac{-10-12}{35} = \frac{-22}{35}$

also $\frac{12}{-35}+\frac{2}{-7} = \frac{-12}{35}-\frac{2}{7} = \frac{-12-(2\times5)}{35} = \frac{-12-10}{35}$

$= \frac{-22}{35}$

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(vi) -4 and $\frac{4}{-7}$

$\therefore -4+\frac{4}{-7} = -4+\frac{(-4)}{7} = \frac{(-4\times7)+(-4\times1)}{7} = \frac{-28-4}{7} = \frac{-32}{7}$

also, $\frac{4}{-7}-4 = \frac{-4-28}{7} = \frac{-32}{7}$

$\therefore -4+\frac{4}{-7} = \frac{4}{-7}+(-4)$

Q.2 Verify associativity of addition of rational numbers i.e $(x+y)+z = x+(y+z)$, when.

(i) $x=\frac{1}{2}, y=\frac{2}{3}, z=\frac{-1}{5}$ (ii) $x=\frac{-2}{5}, y=\frac{4}{3}, z=\frac{-7}{10}$

(iii) $x=\frac{-7}{11}, y=\frac{2}{-5}, z=\frac{-3}{22}$ (iv) $x=-2, y=\frac{3}{5}, z=\frac{-4}{3}$

Solution: (i) $x=\frac{1}{2}, y=\frac{2}{3}, z=\frac{-1}{5}$

LHS $(x+y)+z = \left(\frac{1}{2}+\frac{2}{3}\right)+\left(\frac{-1}{5}\right)$

$= \left(\frac{3+4}{6}\right)+\left(\frac{-1}{5}\right) = \frac{7}{6}-\frac{1}{5}$

$= \frac{(7\times5)-(1\times6)}{30} = \frac{35-6}{30}$

$= \frac{29}{30}$

RHS: $x+(y+z)$

$= \frac{1}{2}+\left(\frac{2}{3}-\frac{1}{5}\right) = \frac{1}{2}+\left(\frac{10-3}{15}\right)$

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$$\frac{1}{2}+\frac{7}{15} = \frac{15+14}{30} = \frac{29}{30}$$

$\therefore$ LHS = RHS

(11) $x = -\frac{2}{5}$, $y = \frac{4}{3}$, $z = -\frac{7}{10}$

$$(x+y)+z = \left(-\frac{2}{5}+\frac{4}{3}\right)+\left(-\frac{7}{10}\right)$$

$$= \left(\frac{-2\times3+4\times5}{15}\right)+\left(-\frac{7}{10}\right)$$

$$= \frac{-6+20}{15}+\left(-\frac{7}{10}\right) = \frac{14}{15}-\frac{7}{10}$$

$$= \frac{56-42}{60} = \frac{14}{60} = \frac{7}{30}$$

$$x+(y+z) = -\frac{2}{5}+\left(\frac{4}{3}-\frac{7}{10}\right)$$

$$= -\frac{2}{5}+\left(\frac{4\times10-7\times3}{30}\right) = -\frac{2}{5}+\left(\frac{40-21}{30}\right)$$

$$= -\frac{2}{5}+\frac{19}{30} = \frac{-12+19}{30}$$

$$= \frac{7}{30}$$

$\therefore$ LHS = RHS

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(iii) $x = \frac{-7}{11}$, $y = \frac{2}{-5}$, $z = \frac{-3}{22}$

$$(x+y)+z = \left(\frac{-7}{11} + \frac{2}{-5}\right) + \left(\frac{-3}{22}\right)$$

$$= \left(\frac{-7}{11} - \frac{2}{5}\right) - \frac{3}{22}$$

$$= \left(\frac{-7\times5 - 2\times11}{55}\right) - \frac{3}{22}$$

$$= \left(\frac{-35-22}{55}\right) \times \frac{3}{22} = \frac{-57}{55} - \frac{3}{22}$$

$$= \frac{-114-15}{110} = \frac{-129}{110}$$

$$x+(y+z) = \frac{-7}{11} + \left(\frac{2}{-5} + \frac{-3}{22}\right) = \frac{-7}{11} + \left(\frac{-2}{5} - \frac{3}{22}\right)$$

$$= \frac{-7}{11} + \left(\frac{-44-15}{110}\right)$$

$$= \frac{-7}{11} + \frac{(-59)}{110}$$

$$= \frac{-7\times10 + (-59)}{110}$$

$$= \frac{-70-59}{110} = -\frac{129}{110}$$

$\therefore$ LHS = RHS

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

$\because \ (x+y)+z = \left(-2+\frac{3}{5}\right) + \left(-\frac{4}{3}\right)$

$= \left(\frac{-2\times5+3\times1}{5}\right) + \left(-\frac{4}{3}\right)$

$= -\frac{10+3}{5} - \frac{4}{3} = -\frac{7}{5} - \frac{4}{3}$

$= \frac{-7\times3-4\times5}{15} = -\frac{21-20}{15}$

$= \frac{-41}{15}$

$x+(y+z) = -2+\left(\frac{3}{5}-\frac{4}{3}\right)$

$= -2+\left(\frac{3\times3-4\times5}{15}\right) = -2+\left(\frac{9-20}{15}\right)$

$= -2-\frac{11}{15} = -\frac{30-11}{15}$

$= -\frac{41}{15}$

$\therefore$ LHS = RHS

Q3 Write the additive inverse of each of the following Rational numbers.

(i) $\frac{-2}{17}$ (ii) $\frac{3}{-11}$ (iii) $-\frac{17}{5}$ (iv) $\frac{-11}{-25}$

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Solution: (i) $\frac{2}{17}$ (ii) $\frac{3}{11}$ (iii) $\frac{17}{5}$

(iv) $\frac{-11}{25}$

Q4 Write the negative (additive inverse) of each of the following:

(i) $\frac{-2}{5}$ (ii) $\frac{7}{-9}$ (iii) $\frac{-16}{13}$ (iv) $\frac{-5}{1}$

(v) 0 (vi) 1

Solution (i) $\frac{2}{5}$ (ii) $\frac{7}{9}$ (iii) $\frac{16}{13}$

(iv) 5 (v) 0 (vi) -1

Q.5 Using commutativity and associativity of addition of rational numbers, express each of the following as a rational number.

(i) $\frac{2}{5}+\frac{7}{3}+\frac{-4}{5}+\frac{-1}{3}$ (ii) $\frac{3}{7}+\frac{-4}{9}+\frac{-11}{7}+\frac{7}{9}$

(iii) $\frac{2}{5}+\frac{8}{3}+\frac{-11}{15}+\frac{4}{5}+\frac{-2}{3}$ (iv) $\frac{4}{7}+0+\frac{-8}{9}+\frac{-13}{7}+\frac{17}{21}$

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Solution: (i) $\frac{2}{5}+\frac{7}{3}+\frac{-4}{5}+\frac{-1}{3}$

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

$= \left(\frac{2-4}{5}\right)+\left(\frac{7-1}{3}\right) = \frac{-2}{5}+\frac{6}{3} = \frac{-2}{5}+2$

$= \frac{-2+10}{5} = \frac{8}{5}$

(ii) $\frac{3}{7}+\frac{-4}{9}+\frac{-11}{7}+\frac{7}{9}$

$= \left(\frac{3}{7}+\frac{-11}{7}\right)+\left(\frac{-4}{9}+\frac{7}{9}\right)$

$= \left(\frac{3-11}{7}\right)+\left(\frac{-4+7}{9}\right) = \left(\frac{-8}{7}\right)+\left(\frac{3}{9}\right)$

$= \frac{-8}{7}+3 = \frac{-8+21}{7} = -\frac{8}{7}+\frac{1}{3} = \frac{-24+7}{21}$

$= \frac{-17}{21}$

(iii) $\frac{2}{5}+\frac{8}{3}+\frac{-11}{15}+\frac{4}{5}+\frac{-2}{3}$

$= \left(\frac{2}{5}+\frac{4}{5}\right)+\left(\frac{8}{3}+\frac{-2}{3}\right)+\left(\frac{-11}{15}\right)$

$= \left(\frac{2+4}{5}+\frac{8-2}{3}\right)-\frac{11}{15}$

$= \left(\frac{6}{5}+\frac{6}{3}\right)-\frac{11}{15} = \left(\frac{18+30}{15}\right)-\frac{11}{15} = \frac{48}{15}-\frac{11}{15}$

$= \frac{48-11}{15} = \frac{37}{15}$

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(iv) $\frac{4}{7}+0+\frac{-8}{9}+\frac{-13}{7}+\frac{17}{21}$

$= \left(\frac{4}{7}+\frac{-13}{7}\right)+\left(\frac{-8}{9}\right)+\frac{17}{21}$

$= \frac{4-13}{7}-\frac{8}{9}+\frac{17}{21}$

$= \left(\frac{-9}{7}+\frac{17}{21}\right)-\frac{8}{9}$

$= \left(\frac{-27+17}{21}\right)-\frac{8}{9} = \frac{-10}{21}-\frac{8}{9} = \frac{-30-56}{63} = \frac{-86}{63}$

Q.6 Re-arrange suitably and find the sum in each of the following:

(i) $\frac{11}{2}+\frac{-17}{3}+\frac{11}{2}+\frac{-25}{2}$

(ii) $\frac{-6}{7}+\frac{-5}{6}+\frac{-4}{9}+\frac{-15}{7}$

(iii) $\frac{3}{5}+\frac{7}{3}+\frac{9}{5}+\frac{-13}{15}+\frac{-7}{3}$

(iv) $\frac{4}{13}+\frac{-5}{8}+\frac{-8}{13}+\frac{9}{13}$

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

(vi) $\frac{1}{8}+\frac{5}{12}+\frac{2}{7}+\frac{7}{12}+\frac{9}{7}+\frac{-5}{16}$

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Solution (i) $\frac{11}{12} + \frac{-17}{3} + \frac{11}{2} + \frac{-25}{2}$

$\Rightarrow \frac{11}{12} + \frac{-17}{3} + \frac{11-25}{2}$

$= \frac{11}{12} - \frac{17}{3} + \left(\frac{-14}{2}\right)$

$= \frac{11-68-84}{12} = \frac{-141}{12}$

(ii) $-\frac{6}{7} + \frac{-5}{6} + \frac{-4}{9} + \frac{-15}{7}$

$= \left(\frac{-6}{7} + \frac{-15}{7}\right) + \left(\frac{-5}{6}\right) + \left(\frac{-4}{9}\right)$

$= \left(\frac{-6-15}{7}\right) + \left(\frac{-5}{6}\right) + \left(\frac{-4}{9}\right)$

$= -\frac{21}{7} - \frac{5}{6} - \frac{4}{9} = -3 - \frac{5}{6} - \frac{4}{9} = \frac{-54-15-8}{18}$

$= -\frac{77}{18}$

(iii) $\frac{3}{5} + \frac{7}{3} + \frac{9}{5} + \frac{-13}{15} + \frac{-7}{3}$

$= \left(\frac{3}{5} + \frac{9}{5}\right) + \left(\frac{7}{3} + \frac{-7}{3}\right) + \left(\frac{-13}{15}\right)$

$= \frac{12}{5} + 0 - \frac{13}{15} = \frac{36-13}{15} = \frac{23}{15}$

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(iv) $\frac{4}{13} + \frac{-5}{8} + \frac{-8}{13} + \frac{9}{13}$

$= \left(\frac{4}{13} + \frac{-8}{13} + \frac{9}{13}\right) + \left(\frac{-5}{8}\right)$

$= \left(\frac{4-8+9}{13}\right) + \left(\frac{-5}{8}\right) = \frac{5}{13} - \frac{5}{8} = \frac{40-65}{104}$

$= \frac{-25}{104}$

(v) $\frac{2}{3} + \frac{-4}{5} + \frac{1}{3} + \frac{2}{5} = \left(\frac{2}{3} + \frac{1}{3}\right) + \left(\frac{-4}{5} + \frac{2}{5}\right)$

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

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

(vi) $\frac{1}{8} + \frac{5}{12} + \frac{2}{7} + \frac{7}{12} + \frac{9}{7} + \frac{-5}{16}$

$= \left(\frac{1}{8} + \frac{-5}{16}\right) + \left(\frac{5}{12} + \frac{7}{12}\right) + \left(\frac{2}{7} + \frac{9}{7}\right)$

$= \left(\frac{2-5}{16}\right) + \left(\frac{5+7}{12}\right) + \left(\frac{2+9}{7}\right) = \frac{-3}{16} + \frac{12}{12} + \frac{11}{7}$

$= \frac{-3}{16} + 1 + \frac{11}{7} = \frac{-21+112+17}{112}$

$= \frac{267}{112}$

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