INDEX

Page	Title	Signature

Ch - 2

1/04/2019

Rational Numbers and Their Operations

Rational Numbers

~~Any~~ rational number is of the form of $\frac{a}{b}$, where a and b are integers and $b \neq 0$.

Basic Rules

1) When a positive integer is divided by positive integer, the quotient is positive and hence it is a positive rational number.

eg. $\frac{+7}{+9}$ is a +ve rational no.

2) When a negative integer is divided by a negative integer, the quotient is a positive integer.

eg. $\frac{-8}{-9} = \frac{8}{9}$

3) When the dividend and divisor are of the opp. sign, the quotient is negative.

eg. $\frac{+8}{-9} = -\frac{8}{9}$

NOTE :- Zero is a rational no.

Ex 2.1

(Q.1) i) a) $\frac{4}{7}$ - Yes

b) $\frac{10}{3}$ - Yes

c) $\frac{-8}{1}$ - Yes

d) $\frac{0}{1}$ - yes

e) 1.2 - Yes

ii) a) $\frac{+7}{+3}$ - Yes

b) $\frac{+9}{-5}$ - No

c) $\frac{-7}{+10}$ - No

d) $\frac{-11}{-14}$ - Yes

iii) a) $\frac{-7}{-8}$ - No

b) $\frac{+12}{+17}$ - No

c) $\frac{-4}{+9}$ - Yes

d) $\frac{+6}{-13}$ - Yes

(Q.2) $4 = \frac{4}{1}$

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

∴ Yes, integers can be represented as a quotient of 2 integers.

Q.3) a) $\frac{-7}{9}$ and $\frac{7}{-9}$ are the same negative rational numbers.

b) $-\frac{3}{4}$, $-\frac{3}{4}$ and $\frac{3}{-4}$ are 3 different forms of the same rational no.s.

Q.4) Yes, integers are rational no.s.

Q.5) a) $\frac{15}{1} = 15$

b) $\frac{-3}{1} = -3$

c) $\frac{45}{1} = 45$

Q.6) a) $5 = \frac{5}{1}$ b) $-13 = \frac{-13}{1}$ c) $12 = \frac{12}{1}$

Standard Form Of RATIONAL No.s

A rational no. is written in the standard form has :-

i) positive denominator.

ii) numerator and denominator are coprimes.

Ex 2.2

Q.1) $\frac{2}{-3}$

a) -6

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

b) 8

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

c) $\div 12$

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

d) 14

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

Q.2) $\frac{-3}{-4}$

a) $4 \rightarrow \frac{-3 \times -1}{-4 \times -1} = \frac{3}{4}$

$\frac{-3 \times 4}{-4 \times 4}$

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

c) $16 \rightarrow \frac{-3 \times -4}{-4 \times -4} = \frac{12}{16}$

d) $-12 \rightarrow \frac{-3 \times 3}{-4 \times 3} = \frac{-9}{-12}$

Q.3) a) $\frac{-5}{-6} = \frac{5}{6}$ b) $\frac{7}{-9} = \frac{-7}{9}$ c) $\frac{-9}{-13} = \frac{9}{13}$ d) $\frac{15}{-17} = \frac{-15}{17}$

Q.4 a) $\frac{-7}{9} = \frac{7}{-9}$ b) $\frac{-13}{-17} = \frac{13}{17}$ c) $\frac{-5}{13} = \frac{5}{-13}$ d) $\frac{-11}{-15} = \frac{11}{15}$

Q.5) a) $\frac{5}{6}$ → positive rn b) $\frac{-3}{5}$ → nrn c) $\frac{-7}{-9} = \frac{7}{9}$ → prn

d) $\frac{8}{-13}$ = nrn e) $\frac{-15}{17}$ → nrn f) $\frac{31}{35}$ → prn

g) $\frac{15}{-19}$ → nrn h) $\frac{-5}{-13} = \frac{5}{13}$ → prn

Q.6) a) $\frac{16}{20} \rightarrow \frac{4}{5}\left(\frac{16 \div 4}{20 \div 4}\right)$ b) $\frac{21}{-28} \rightarrow \frac{3}{-4}\left(\frac{21 \div 7}{-28 \div 7}\right) = \frac{-3}{4}$

c) $\frac{-25}{-30} \rightarrow \frac{25}{30} \rightarrow \frac{5}{6}\left(\frac{25 \div 5}{30 \div 5}\right)$ d) $\frac{28}{32} \rightarrow \frac{7}{8}\left(\frac{28 \div 4}{32 \div 4}\right)$

Q.7) a) $\frac{3}{4}$ and $\frac{-15}{-20}$

$3x - 20$	$4x - 15$
$\Rightarrow -60$	-60
$-60 = -60$	

2nd method

$\frac{3}{4}$	$+15$
	$+20$
	$= 15 \div 5$
	$20 \div 5$

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

3rd method

$\frac{3}{4}$ and $\frac{-15}{-20}$

$\frac{3}{4}$ and $\frac{15}{20}$.

L.C.M. of 4 and 20 = 20

$\frac{3 \times 5}{4 \times 5} = \frac{15}{20}$

$\frac{15 \times 1}{20 \times 1} = \frac{15}{20}$

Hence, $\frac{3}{4}$ and $\frac{-15}{-20}$ are equal.

(b) $\frac{8}{-9}$ and $\frac{-16}{18}$

$\Rightarrow \frac{8}{-9} \quad \frac{-16}{18}$

$= \frac{-8}{9} \quad \frac{-16 \div 2}{18 \div 2}$

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

Hence $\frac{8}{-9} = \frac{-16}{18}$

(c) $\frac{12}{18}$ and $\frac{15}{20}$

$\Rightarrow \frac{12 \div 6}{18 \div 6} \quad \frac{15 \div 5}{20 \div 5}$

$= \frac{2}{3} \quad = \frac{3}{4}$

$\frac{2}{3} \neq \frac{3}{4}$

Hence $\frac{2}{3}$ and $\frac{3}{4}$ are not equal.

(d) $\frac{-10}{-15}$ and $\frac{11}{14}$

$\Rightarrow \frac{10 \div 5}{15 \div 5} \quad \frac{11}{14}$

$\Rightarrow \frac{2}{3} \neq \frac{11}{14}$

No, they are not equal

(e) $\frac{-6}{18}$ and $\frac{9}{-27}$

$\Rightarrow \frac{-6 \div 6}{18 \div 6} \quad \Rightarrow \frac{9}{27}$

$\Rightarrow \frac{-1}{3} \quad \Rightarrow \frac{-9 \div 9}{27 \div 9}$

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

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

Hence, they are equal.

(f) $\frac{18}{21}$ and $\frac{-15}{-25}$

$\Rightarrow \frac{18 \div 3}{21 \div 3} \quad \frac{15 \div 5}{25 \div 5}$

$\Rightarrow \frac{6}{7} \quad \Rightarrow \frac{3}{5}$

$\frac{6}{7} \neq \frac{3}{5}$

No, they are not equal.

Absolute Value of Rational No.s

(1) The absolute value of a negative rational no. is a positive rational no.

eg. $\left|\frac{-2}{3}\right| = \frac{2}{3}$

(2) The absolute value of a positive rational no. is a positive rational no.

eg. $\left|\frac{2}{3}\right| = \frac{2}{3}$

(3) The absolute value of 0 is 0.

Rules Of Comparing

(1) If a, b, c, d are integers and $b > 0$, $d > 0$, then $\frac{a}{b} > \frac{c}{d}$, if $ad > bc$ and vice-versa.

(2) If a, b, c, d are integers and $b \neq 0$, $d \neq 0$, then $\frac{a}{b} = \frac{c}{d}$, if $ad = bc$ and vice-versa.

(3) If a, b, c, d are integers, and $b > 0$, $d > 0$; for $\frac{a}{b}$, $\frac{c}{d}$, if $ad < bc$ then $\frac{a}{b} < \frac{c}{d}$

(4) If a, b, c, d are integese and $b \neq 0$, $d \neq 0$, then $\frac{a}{b} = \frac{c}{d}$, if $ad = bc$ and vice versa.

Ex 2.3

(1) a) $\frac{-5}{8}, \frac{4}{-7}$

$\frac{-5}{8} \times \frac{4}{7}$

$-5 \times 7 \quad | \quad -4 \times 8$

$-35 \quad | \quad -32$

$-35 < -32$

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

b) $\frac{7}{12}, \frac{6}{10}$

$\frac{7}{12} \times \frac{6}{10}$

$7 \times 10 \quad | \quad 6 \times 12$

$70 \quad | \quad 72$

$70 < 72$

$\therefore \frac{7}{12} < \frac{6}{10}$

c) $\frac{6}{11}, \frac{-10}{7}$

$\frac{6}{11} \times \frac{-10}{7}$

$6 \times 7 \quad | \quad -10 \times 11$

$42 \quad | \quad -110$

$42 > -110$

$\therefore \frac{6}{11} > \frac{-10}{7}$

d) $\frac{8}{-13}, \frac{2}{7}$

$\frac{-8}{13} \times \frac{2}{7}$

$-8 \times 7 \quad | \quad 2 \times 13$

$-56 \quad | \quad 26$

$-56 < 26.$

$\therefore \frac{-8}{13} < \frac{2}{7}.$

(2) a) $\frac{5}{8} > \frac{6}{11}$

$\frac{5}{8} \times \frac{6}{11}$

$5 \times 11 \quad | \quad 6 \times 8$

$55 \quad | \quad 48$

$55 > 48.$

$\Rightarrow$ True $\left(\frac{5}{8} > \frac{6}{11}\right)$

b) $\frac{-6}{13} > \frac{5}{-8}$

$\frac{-6}{13} \times \frac{-8}{8}$

$-6 \times 8 \quad | \quad -5 \times 13$

$-48 \quad | \quad -65$

$-48 > -65$

$\frac{-6}{13} > \frac{-5}{8}$

$\Rightarrow$ True

c) $\frac{9}{11} < \frac{11}{13}$

$\frac{9}{11} \times \frac{11}{13}$

$9 \times 13 \quad | \quad 11 \times 11$

$117 \quad | \quad 121$

$117 < 121$

$\frac{9}{11} < \frac{11}{13}$

$\Rightarrow$ True

d) $\frac{4}{7} = \frac{7}{4}$

$\frac{4}{7} \times \frac{7}{4}$

$4 \times 4 \quad | \quad 7 \times 7$

$16 \quad | \quad 49$

$16 < 49$

$\frac{4}{7} < \frac{7}{4}$

$\Rightarrow$

But the statement given is $\frac{4}{7} = \frac{7}{4}$.

Hence false.

(3) a) $\left|\frac{-6}{7}\right| = \frac{5}{7}$

b) $\left|\frac{8}{-15}\right| = \left|\frac{-8}{15}\right| = \frac{8}{15}$

c) $\left|\frac{13}{16}\right| = \frac{13}{16}$

d) $|-10/7| = 10/7$

e) $|+4/10| = 4/10$

f) $|0| = 0$

Ex 2.4

Q.1 a) $\frac{2}{5} + \frac{3}{10}$

1st Method

2nd Method

Ex 2.4

Q.1 (a) $\frac{2}{5} + \frac{3}{10}$

1st Method

$\frac{2}{5} + \frac{3}{10}$

LCM of 5 and 10 is 10

2 | 5,10	$\frac{2 \times 2}{5 \times 2} = \frac{4}{10}$
5 | 5,5	
1, 1	
$2 \times 5 = 10$	$\frac{3 \times 1}{10 \times 1} = \frac{3}{10}$

$\Rightarrow \frac{4}{10} + \frac{3}{10}$

$\Rightarrow \frac{4+3}{10}$

$\Rightarrow \frac{7}{10}$ Ans.

2nd Method

$\frac{2}{5} + \frac{3}{10}$

LCM of 5 and 10 is 10

$\frac{4+3}{10}$

$= \frac{7}{10}$ Ans

2. (b) $\frac{4}{6} + \frac{7}{8}$

LCM of 6 and 8 is 24.

2 | 6, 8	
2 | 3, 4	
2 | 3, 2	
3 | 3, 1	
1, 1	

$2 \times 2 \times 2 \times 3 = 24$.

$= \frac{16+21}{24}$

$= \frac{37}{24}$.

3. $\frac{3}{4} + \left(\frac{-2}{5}\right)$.

$\frac{3}{4} - \frac{2}{5}$

LCM of 4 and 5 = 20

2 | 4, 5	
2 | 2, 5	
5 | 1, 5	
1, 1	

$2 \times 2 \times 5 = 20$.

$\frac{15 + (-8)}{20}$

$\frac{7}{20}$

(4) $\frac{8}{14} + \left(\frac{-10}{21}\right)$

$= \frac{8}{14} \quad \frac{-10}{21}$

LCM of 14 and 21.

2	14, 21
3	7, 21
7	7, 7
	1, 1

$2 \times 3 \times 7 = 42.$

$= \frac{24 + (-20)}{42}$

$= \frac{4}{42}\left(\frac{2}{21}\right)$ Ans

(5) $\frac{8}{-15} + \frac{-7}{20}$

$= \frac{-8}{15} \quad \frac{-7}{20}$

LCM of 15 and 20

2	15, 20
2	15, 10
3	15, 5
5	5, 5
	1, 1

$2 \times 2 \times 3 \times 5 = 60.$

$= \frac{-32 - 21}{60}$

$= \frac{-53}{60}$ Ans.

(6) (7) $\frac{9}{16} + \left(\frac{-13}{24}\right)$

$= \frac{9}{16} \quad \frac{-13}{24}.$

LCM of 16 and 24.

2	16, 24
2	8, 12
2	4, 6
2	2, 3
3	1, 3
	1, 1

$2 \times 2 \times 2 \times 2 \times 3 = 48.$

$= \frac{27 - 26}{48}$

$= \frac{1}{48}$ Ans.

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

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

$= \frac{-4+5}{5}$

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

$= \frac{1}{5}$ Ans.

(8) $\frac{4}{15} + \frac{-7}{20}$

LCM of 15 and 20.

2	15, 20
2	15, 10
3	15, 5
5	5, 5
	1, 1

$2 \times 2 \times 3 \times 5 = 60$

$= \frac{16 + (-21)}{60}$

$= \frac{16-21}{60}$

$= \frac{-5}{60}\left(\frac{-1}{12}\right).$

(9) $\frac{-7}{8} + \frac{5}{16} + \frac{-4}{24}$

$= \frac{-7}{8} + \frac{5}{16} - \frac{4}{24}$

LCM of 8, 16, 24

2	8, 16, 24
2	4, 8, 12
2	2, 4, 6
2	1, 2, 3
3	1, 1, 3
	1, 1, 1

$2 \times 2 \times 2 \times 2 \times 3 = 48$

$= \frac{-42 + 15 - 8}{24}$

$= \frac{-42 + 7}{24}$

$= \frac{-35}{24}$

(10) $3 + \frac{-4}{5}$

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

LCM of 1, 5

5	1, 5
	1, 1

LCM = 5

$= \frac{15 - 4}{5}$

$= \frac{11}{5}$

(11) $\frac{-11}{27} + \frac{5}{9}$

LCM of 27 and 9

3	27, 9
3	9, 3
3	3, 1
	1, 1

$3 \times 3 \times 3 = 27$

$= \frac{-11 + 15}{27}$

$= \frac{4}{15}$

PROPERTIES OF ADDITION

① **Closure Property** ⇒ The sum of any 2 rational numbers is also a rational no. We say the set of rational no.s is 'closed under addition'.

eg Consider 2 rational no.s $-\frac{4}{5}$ and $\frac{5}{6}$

Their sum $= \frac{-4}{5} + \frac{5}{6}$

LCM of 5 and 6 = 30.

$= \frac{-4 \times 6}{5 \times 6} + \frac{5 \times 5}{6 \times 5}$

$= \frac{-24}{30} + \frac{25}{30}$

$= \frac{-24 + 25}{30} = \frac{1}{30}$.

1/30 is also a rational no.

(2) **Commutative Property** - The sum of 2 rational no.s is the same even if the order of the no.s is changed. If a, b, c, d are integers and $b>0$, $d>0$ then $\frac{a}{b} + \frac{c}{d} = \frac{c}{d} + \frac{a}{b}$. We say addition is commutative for rational no.

eg Consider 2 rational no.s → $\frac{6}{7}, \frac{-8}{11}$

$\frac{6}{7} + \frac{-8}{11}$

$= \frac{6 \times 11}{7 \times 11} + \frac{-8 \times 7}{11 \times 7}$

$= \frac{66}{77} + \frac{-56}{77}$

$= \frac{66 - 56}{77}$

$= \frac{10}{77}$

$\frac{-8}{11} + \frac{6}{7}$

$= \frac{-8 \times 7}{11 \times 7} + \frac{6 \times 11}{7 \times 11}$

$= \frac{-56}{77} + \frac{66}{77}$

$= \frac{-56 + 66}{77}$

$= \frac{10}{77}$.

(3) **Associative Property**

Consider 3 rational no.s → $\frac{2}{3}, \frac{5}{6}, \frac{-3}{4}$

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

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

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

$= \frac{9}{6} + \frac{-3}{4} = \frac{18}{12} + \frac{-9}{12}$

$= \frac{18 + (-9)}{12} = \frac{9}{12} = \frac{3}{4}$

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

$= \frac{2}{3} + \left(\frac{10}{12} + \frac{-9}{12}\right)$

$= \frac{2}{3} + \left(\frac{10 + (-9)}{12}\right)$

$= \frac{2}{3} + \frac{1}{12} = \frac{8}{12} + \frac{1}{12}$

$= \frac{8+1}{12} = \frac{9}{12} = \frac{3}{4}$.

④ Additive Identity

When we add zero to any rational no., the sum is that rational no.

If a and b are integers and $b \neq 0$, then $\frac{a}{b} + 0 = 0 + \frac{a}{b} = \frac{a}{b}$

0 is called the Additive identity for rational. 0 is also called the identity, or element for addition of rational numbers.

eg Examine the following addition.

$\frac{7}{12} + 0 = \frac{7}{12} + \frac{0}{12}$

$= \frac{7+0}{12} = \frac{7}{12}$

$\therefore \frac{7}{12} + 0 = \frac{7}{12}$

$0 + \frac{-9}{16} = \frac{0}{16} + \frac{-9}{16} = \frac{0+(-9)}{16} = \frac{-9}{16}$

$\therefore 0 + \frac{-9}{16} = \frac{-9}{16}$.

⑤ Additive Inverse

$\frac{-a}{b}$ is called the additive inverse or opposite of $\frac{a}{b}$. Similarly

$\frac{a}{b}$ is called the additive inverse or opposite of $\frac{-a}{b}$.

eg: Examine the following addition of rational nos.:-

$\frac{9}{11} + \frac{-9}{11} = \frac{9+(-9)}{11} = \frac{0}{11} = 0$

$\therefore \frac{9}{11} + \frac{-9}{11} = 0$

$\frac{-7}{12} + \frac{7}{12} = \frac{-7+7}{12} = \frac{0}{12} = 0$

$\therefore \frac{-7}{12} + \frac{7}{12} = 0$.

If a, b are integers and $b \neq 0$, then $\frac{a}{b} + \left(\frac{-a}{b}\right) = 0$.

Ex. 2.5

Q.1 book

Q.2 book

Q.3 a) $\frac{2}{3} + \frac{3}{4} + \frac{1}{2}$

1st Way

$\left(\frac{2}{3} + \frac{3}{4}\right) + \frac{1}{2}$

$\left(\frac{8+9}{12}\right) + \frac{1}{2}$

$= \frac{17}{12} + \frac{1}{2}$

$= \frac{17+6}{12}$

$= \frac{23}{12}$

2nd Way

$\frac{2}{3} + \left(\frac{3}{4} + \frac{1}{2}\right)$

$= \frac{2}{3} + \left(\frac{3+2}{4}\right)$

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

$= \frac{8+15}{12}$

$= \frac{23}{12}$

2	12, 2
2	6, 1
3	3, 1
	1, 1

$2 \times 3 \times 2 = 12$

2	4, 2
2	2, 1
	1, 1

$2 \times 2 = 4$

b) $\frac{-4}{5} + \frac{7}{10} + \frac{-9}{15}$

$= \frac{-4}{5} + \frac{7}{10} - \frac{9}{15}$

1st way

$\frac{-4}{5} + \left(\frac{7}{10} - \frac{9}{15}\right)$

$\frac{-4}{5} + \left(\frac{21-18}{30}\right)$

$= \frac{-4}{5} + \frac{3}{30}$

$= \frac{-24+3}{30}$

$= \frac{-21}{30} - \frac{7}{10}$

$= \frac{-7}{10}$

2nd way

$\left(\frac{-4}{5} + \frac{7}{10}\right) - \frac{9}{15}$

$= \left(\frac{-8+7}{10}\right) - \frac{9}{15}$

$= \frac{-1}{10} - \frac{9}{15}$

$= \frac{-3-18}{30}$

$= \frac{-21}{30} - \frac{7}{10}$

$= \frac{-7}{10}$

2	10, 15
3	5, 15
5	5, 5
	1, 1

$2 \times 3 \times 5 = 30$

2	5, 10
5	5, 5
	1, 1

$2 \times 5 = 10$

2	5, 30
3	5, 15
5	5, 5
	1, 1

$2 \times 3 \times 5 = 30$

(c) $2.75 + 3.08 + 4.67$

1st way	2nd way
$(2.75 + 3.08) + 4.67$	$2.75 + (3.08 + 4.67)$
$= 5.83 + 4.67$	$= 2.75 + 7.75$
$= 10.5$	$= 10.5$

Q.4 book.

Q.5 a) $\frac{23}{25} + x = \frac{31}{35} + \frac{23}{25}$

$x = \frac{31}{35}$

b) $\frac{-7}{5} + \frac{5}{-7} = x + \frac{-7}{5}$

$x = \frac{5}{-7}$

c) $4\frac{3}{4} + 0 = x$

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

d) $\frac{-17}{20} + x = 0$

$x = \frac{17}{20}$

(e) $\left(\frac{-4}{15} + \frac{6}{12}\right) + \frac{-8}{10} = \frac{-4}{15} + \left(x + \frac{-8}{10}\right)$

$x = \frac{6}{12}$

Q.6 Is addition of rational no.s closed?

a) closed? Yes

b) associative? Yes.

c) commutative? Yes

Q.7 a) Yes

b) Yes.

c) 0.

Ex 2.6

(1) $\frac{4}{7} \times \frac{3}{5} = \frac{12}{35}$

(2) $\frac{-5}{8} \times \frac{7}{4} = \frac{-35}{32}$

(3) $\frac{8}{15} \times \frac{21}{-7} = \frac{8}{-35} = \frac{-8}{35}$

(4) $\frac{-4}{5} \times \frac{7}{-16} = \frac{14}{15}$

(5) $\left(\frac{-9}{10}\right) \times \left(\frac{-5}{16}\right)$

$= \frac{9}{-32} = \frac{9}{32}$

(6) $\frac{-63}{77} \times \frac{-8}{10} = \frac{-24}{55}$

(7) $\frac{12}{7} \times \frac{0}{10} = 0$

(8) $\frac{25}{27} \times \frac{5}{9} = \frac{5}{9}$

(9) $\frac{5}{8} \times \frac{11}{3} = \frac{-5}{6}$

(10) $\frac{-6}{25} \times \frac{15}{12} = \frac{-3}{10}$

(11) $\frac{-3}{5} \times \frac{-9}{11} = \frac{27}{55}$

(12) $\frac{-11}{12} \times \frac{4}{9} = \frac{4}{27}$

PROPERTIES OF MULTIPLICATION

(1) Closure Property.

The product of two rational no.s is also a rational number.

eg. Take 2 rational no.s $\frac{1}{2}, \frac{1}{3}$

$\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$.

(2) Commutative property

The product of 2 rational no.s is the same even if the order of the factors is changed.

If a, b, c, d are integers and $b \neq 0$ and $d \neq 0$, then $\frac{a}{b} \times \frac{c}{d} = \frac{c}{d} \times \frac{a}{b}$

Eg. $\frac{4}{9} \times \frac{-3}{8} = \frac{4 \times (-3)}{9 \times 8}$ | $\frac{-3}{8} \times \frac{4}{9} = \frac{-3 \times 4}{8 \times 9}$

$= \frac{-12}{72} = \frac{-1}{6}$ | $= \frac{-12}{72} = \frac{-1}{6}$

(3) Associative Property

The product of 3 rational no.s is the same even if the grouping of the factors is changed.

If a, b, c, d, e, f are integers and $b \neq 0$ and $d \neq 0$, $f \neq 0$

$$\left(\frac{a}{b} \times \frac{c}{d}\right) \times \frac{e}{f} = \frac{a}{b} \times \left(\frac{c}{d} \times \frac{e}{f}\right)$$

$\left(\frac{1}{2} \times \frac{1}{3}\right) \times \frac{1}{5}$ | $\frac{1}{2} \times \left(\frac{1}{3} \times \frac{1}{5}\right)$

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

$= \frac{1}{30}$ | $= \frac{1}{2} \times \frac{1}{15}$

$= \frac{1}{30}$.

(4) Multiplicative Identity.

If we multiply a rational no. by 1, the product is that rational no.

If a, b are integers and $b \neq 0$ then $\frac{a}{b} \times 1 = 1 \times \frac{a}{b} = \frac{a}{b}$.

eg $\frac{11}{15} \times 1 = \frac{11}{15}$.

(5) Multiplicative Inverse.

If a, b are integers and $a \neq 0$ $b \neq 0$, then $\frac{a}{b} \times \frac{b}{a} = 1$

$\frac{b}{a}$ is called the reciprocal of $\frac{a}{b}$ or multiplicative inverse of $\frac{a}{b}$.

$\frac{a}{b}$ is called reciprocal of $\frac{b}{a}$.

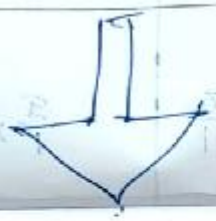
Remember 0 has no reciprocal.

eg $\frac{x}{y} \times \frac{y}{x} = 1$.

⑥ Distributive Property

If a, b, c, d, e, f are integers and $b \neq 0$, $d \neq 0$, $f \neq 0$ then

$$\frac{a}{b} \times \left(\frac{c}{d} + \frac{e}{f}\right) = \frac{a}{b} \times \frac{c}{d} + \frac{a}{b} \times \frac{e}{f}.$$



eg. $\frac{3}{5} \times \left(\frac{-7}{8} + \frac{2}{5}\right)$

$= \frac{3}{5} \times \left(\frac{-21+16}{24}\right)$

$= \frac{3}{5} \times \frac{-5}{24} = \frac{-1}{8}$.

$\frac{3}{5} \times \frac{-7}{8} + \frac{3}{5} \times \frac{2}{5}$

$= \frac{-21}{40} + \frac{2}{5} = \frac{-21+16}{40}$

$= \frac{-5}{40} = \frac{-1}{8}$.

⑦ Multiplication of a rational no. by zero.

The product of a rational no. and zero is always zero.

eg $\frac{-7}{19} \times 0 = \frac{-7}{19} \times \frac{0}{1} = \frac{-7 \times 0}{19 \times 1} = \frac{0}{19} = 0$.

Ex 2.7

(3) a) $\frac{2}{\cancel{8}} \times \frac{\cancel{4}^{1}}{5} \times \frac{\cancel{3}}{\cancel{8}_{\cancel{2}}} = \frac{1}{5}$

b) $\frac{\cancel{3}^{1}}{5} \times \frac{7}{\cancel{8}_{2}} \times \frac{\cancel{14}^{1}}{\cancel{21}_{3}} = \frac{7}{30}$

c) $2\frac{1}{3} \times \frac{2}{7} \times \frac{-5}{8}$

$= \frac{7}{3} \times \frac{\cancel{2}}{\cancel{7}} \times \frac{-5}{\cancel{8}4}$

$= \frac{-35}{84}$

(5) a) $3\frac{2}{3} \times \frac{5}{8} + 3\frac{2}{8} \times \frac{7}{12}$

$= 3\frac{2}{3}\left(\frac{5}{8} + \frac{7}{12}\right)$

$= \cancel{3}\frac{11}{3}\left(\frac{15+14}{24}\right)$

$= \frac{11}{3}\left(\frac{29}{24}\right)$

$= \frac{11}{3} \times \frac{29}{24}$

$= \frac{319}{72}$

$= 4\frac{31}{72}$

b) $\frac{-7}{12}\left(\frac{6}{13}+\frac{9}{26}\right)$

b) $\frac{-7}{12}\times\frac{6}{13}+\frac{-7}{12}\times\frac{9}{26}$

$=\frac{-7}{12}\left(\frac{6}{13}+\frac{9}{26}\right)$

$=\frac{-7}{12}\left(\frac{12+9}{26}\right)$

$=\frac{-7}{12}\times\frac{21}{26}\ 7$

$=\frac{-49}{104}$

③ a) $\frac{2}{3}\times\frac{4}{5}\times\frac{3}{8}$

1st way

$\frac{2}{3}\times\left(\frac{4}{5}\times\frac{3}{8}\right)=\frac{2}{3}\times\left(\frac{3}{10}\right)=\frac{1}{5}$

2nd way

$\left(\frac{2}{3}\times\frac{4}{5}\right)\times\frac{3}{8}=\frac{8}{15}\times\frac{3}{8}=\frac{1}{5}$

b) $\frac{-3}{5}\times\frac{7}{8}\times\frac{4}{-9}$

I st way

$\left(\frac{-3}{5}\times\frac{7}{8}\right)\times\frac{4}{-9}$

$\frac{-21}{40}\times\frac{1}{-3}$

$\frac{7}{30}$

II nd way

$\frac{-3}{5}\times\left(\frac{7}{8}\times\frac{1}{-9}\right)$

$\frac{-3}{5}\times\frac{7}{-18}$

$\frac{7}{30}$

c) $2\frac{1}{3}\times\frac{2}{7}\times\frac{-5}{8}$

I st way

$2\frac{1}{3}\left(\frac{2}{7}\times\frac{-5}{8}\right)$

$\frac{7}{3}\left(\frac{-10}{56}\right)$

$\frac{1}{3}\times\frac{-5}{28}$

$\frac{-5}{12}$

II nd way

$\left(2\frac{1}{3}\times\frac{2}{7}\right)\times\frac{-5}{8}$

$\left(\frac{7}{3}\times\frac{2}{7}\right)\times\frac{-5}{8}$

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

$\frac{-5}{12}$.

Q.8 $x \times y = y \times x$

a) $x = \frac{5}{6}, y = \frac{-3}{4}$

$x \times y$	$y \times x$
$\frac{5}{6_2} \times \frac{-3_1}{4}$	$\frac{-3_1}{4} \times \frac{5}{6_2}$
$\frac{-5}{8}$	$\frac{-5}{8}$

Hence verified

b) $x = \frac{-3}{7}, y = \frac{11}{13}$

$x \times y$	$y \times x$
$\frac{-3}{7} \times \frac{11}{13}$	$\frac{11}{13} \times \frac{-3}{7}$
$\frac{-33}{91}$	$\frac{-33}{91}$

Hence verified.

c) $x = 0, y = \frac{9}{13}$

$x \times y$	$y \times x$
$0 \times \frac{9}{13}$	$\frac{9}{13} \times 0$
$\Rightarrow 0$	$\Rightarrow 0$

Hence verified

d) $x = \frac{-3}{-5}, y = \frac{-5}{-3}$

$x \times y$	$y \times x$
$\frac{3}{-5} \times \frac{-5}{-3}$	$\frac{-5}{-3} \times \frac{-3}{-5}$
$\Rightarrow 1$	$\Rightarrow 1$

Q.9 • $x \times (y \times z) = (x \times y) \times z$

a) $x = \frac{3}{4}, y = \frac{-5}{6}, z = \frac{1}{3}$

$x \times (y \times z)$	$(x \times y) \times z$
$\frac{3}{4} \times \left(\frac{-5}{6} \times \frac{1}{3}\right)$	$\left(\frac{3_1}{4} \times \frac{-5}{2_6}\right) \times \frac{1}{3}$
$\frac{3_1}{4} \times \frac{-5}{18_6}$	$\frac{-5}{8} \times \frac{1}{3}$
$\frac{-5}{24}$	$\frac{-5}{24}$

Hence verified

b) $x = \frac{-7}{9}, y = 0, z = \frac{3}{4}$

$x \times (y \times z)$	$(x \times y) \times z$
$\frac{-7}{9} \times \left(0 \times \frac{3}{4}\right)$	$\left(\frac{-7}{9} \times 0\right) \times \frac{3}{4}$
$\frac{-7}{9} \times 0$	$0 \times \frac{3}{4}$
0	0

Hence verified

c) $x = \frac{6}{-11}, y = \frac{2}{3}, z = \frac{1}{4}$

$x \times (y \times z)$

$= \frac{6}{-11} \times \left(\frac{1}{3} \times \frac{1}{4}\right)$

$= \frac{6}{-11} \times \frac{1}{6}$

$= \frac{1}{-11} \rightarrow \frac{-1}{11}$

$(x \times y) \times z$

$\left(\frac{6}{-11} \times \frac{2}{3}\right) \times \frac{1}{4}$

$\frac{1}{-11} = \frac{-1}{11}$

Hence verified.

d) $x = \frac{7}{13}, y = \frac{1}{7}, z = \frac{-13}{15}$

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

$x \times (y \times z)$

$\frac{7}{13} \times \left(\frac{1}{7} \times \frac{-13}{15}\right)$

$\rightarrow \frac{7}{13} \times \frac{-13}{105}$ 15

$\frac{-1}{15}$

$(x \times y) \times z$

$\left(\frac{7}{13} \times \frac{1}{7}\right) \times \frac{-13}{15}$

$\rightarrow \frac{1}{13} \times \frac{-13}{15}$ -1

$\rightarrow \frac{-1}{15}$

Q.10 $x \times (y+z) = (x \times y) + (x \times z)$

a) $x = \frac{-5}{6}, y = \frac{3}{4}, z = \frac{1}{2}$

$x \times (y+z)$

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

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

$\frac{-5}{6} \times \frac{5}{4}$

$\frac{-25}{24}$

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

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

$\frac{-5}{8} + \frac{-5}{12}$

$\frac{-15 + -10}{24}$

$\frac{-25}{24}$

b) $x = \frac{7}{-8}, y = \frac{4}{-5}, z = \frac{3}{10}$

$x \times (y+z)$

$\frac{7}{-8} \times \left(\frac{4}{-5} + \frac{3}{10}\right)$

$\frac{7}{-8} \times \left(\frac{-8+3}{10}\right)$

$\frac{7}{-8} \times \left(\frac{-5}{10}\right)$

$\frac{7}{8} \times \frac{1}{2}$

$\frac{7}{16}$

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

$\left(\frac{7}{-8} \times \frac{-4}{-5}\right) + \left(\frac{7}{-8} \times \frac{3}{10}\right)$

$= \frac{7}{10} + \frac{-21}{80}$

$= \frac{56 - 21}{80}$

$= \frac{35}{80}$

$\frac{7}{16}$

(c) $x = \frac{1}{2}, y = \frac{3}{7}, z = \frac{5}{14}$

$x \times (y+z)$

$\frac{1}{2} \times \left(\frac{3}{7} + \frac{5}{14}\right)$

$\frac{1}{2} \times \left(\frac{6+5}{14}\right)$

$\frac{1}{2} \times \frac{11}{14}$

$\frac{11}{28}$

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

$\left(\frac{1}{2} \times \frac{3}{7}\right) + \left(\frac{1}{2} \times \frac{5}{14}\right)$

$\frac{3}{14} + \frac{5}{28}$

$\frac{6+5}{28}$

$\frac{11}{28}$

d) $x = \frac{6}{-7}, y = \frac{2}{3}, z = \frac{-1}{6}$

$x \times (y+z)$

$\frac{6}{-7} \times \left(\frac{2}{3} - \frac{1}{6}\right)$

$\frac{6}{-7} \times \left(\frac{4-1}{6}\right)$

$\frac{6}{-7} \times \frac{3}{6}$

$\frac{3}{-7} \rightarrow \frac{-3}{7}$

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

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

$\frac{-4}{7} + \frac{1}{7}$

$= \frac{-3}{7}$

Ex 2.8

Q.1 a) $\frac{4}{5} - \frac{2}{3}$

$= \frac{12-10}{15}$

$= \frac{2}{15}$

b) $\frac{5}{6} - \frac{-4}{8}$

$= \frac{5}{6} + \frac{4}{8}$

$= \frac{5}{6} + \frac{1}{2}$

$= \frac{5+3}{6}$

$= \frac{8}{6}$

$= \frac{4}{3}$

$= 1\frac{1}{3}$

c) $\frac{-5}{8} - \frac{7}{12}$

$= \frac{-15-14}{24}$

$= \frac{-29}{24}$

$= -1\frac{5}{24}$

d) $\frac{-7}{21} - \frac{-5}{14}$

$= \frac{-1}{3} + \frac{5}{14}$

$= \frac{-14+15}{42}$

$= \frac{1}{42}$

e) $9.87 - 6.56$

$= 9.87$
$- 6.56$
3.31

$= 3.31$ or $3\frac{31}{100}$

f) $6.54 - (-3.21)$

6.54
$+3.21$
9.75

$= 9.75$ or $9\frac{75}{100}$

or $9\frac{3}{4}$

Q.2 a) $\frac{3}{4} - \frac{5}{8}$

$= \frac{6-5}{8}$

$= \frac{1}{8}$

b) $\frac{2}{3} - \frac{-7}{6}$

$= \frac{2}{3} + \frac{7}{6}$

$= \frac{4+7}{6}$

$= \frac{11}{6}$

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

c) $\frac{-1}{2} - \frac{-5}{9}$

$= \frac{-1}{2} + \frac{5}{9}$

$= \frac{-9+10}{18}$

$= \frac{1}{18}$

d) $\frac{-5}{3} - (-7)$

$= \frac{-5}{3} + \frac{7}{1}$

$= \frac{-5+21}{3}$

$= \frac{16}{3}$

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

e) $\frac{7}{6} - \frac{-2}{3}$

$= \frac{7}{6} + \frac{2}{3}$

$= \frac{7+4}{6}$

$= \frac{11}{6} = 1\frac{5}{6}$

PROPERTIES OF SUBTRACTION

1.) The difference of 2 rational no.s is always a rational no.

eg. $\frac{5}{6} - \frac{-4}{8} = \frac{4}{3}$

2) Subtraction is not commutative for rational nos.

eg. $\frac{-8}{21} - \frac{5}{14} = \frac{-8}{21} + \left(\frac{-5}{14}\right)$

$= \frac{-16}{42} + \frac{-15}{42}$

$= \frac{-31}{42}$

$\frac{5}{14} - \frac{-8}{21} = \frac{5}{14} + \frac{8}{21}$

$= \frac{15}{42} + \frac{16}{42}$

$= \frac{31}{42}$

So $\frac{-8}{21} - \frac{5}{14} \neq \frac{5}{14} - \frac{-8}{21}$

③ Subtraction is not associative for rational nos.

$\left(\frac{2}{3} - \frac{4}{5}\right) - \frac{3}{4}$ | $\frac{2}{3} - \left(\frac{4}{5} - \frac{3}{4}\right)$

$= \frac{-2}{15} - \frac{3}{4} = \frac{-2}{15} + \frac{-3}{4}$ | $= \frac{2}{3} - \frac{1}{20} = \frac{2}{3} + \frac{-1}{20}$

$= \frac{-8}{60} + \frac{-45}{60} = \frac{-53}{60}$. | $= \frac{40}{60} + \frac{-3}{60} = \frac{37}{60}$.

④ Multiplication is distributive with respect to subtraction for rational nos.

eg $\frac{-3}{4} \times \left(\frac{7}{9} - \frac{5}{12}\right)$ | $\frac{-3}{4} \times \frac{7}{9} - \frac{-3}{4} \times \frac{5}{12}$

$= \frac{-3}{4} \times \frac{13}{36}$ | $= \frac{-7}{12} + \frac{5}{16}$

$= -\frac{13}{48}$ | $= \frac{-13}{48}$.

PROPERTIES OF DIVISION

① When we divide a rational no. by another non zero rational no., we always get a rational no. Rational nos excluding 0 are closed under division.

eg $\frac{4}{9} \div \frac{3}{5} = \frac{20}{27}$

② Division is not commutative for rational nos.

$\frac{-9}{16} \div \frac{7}{12} = \frac{-27}{28}$ | $\frac{7}{12} \div \frac{-9}{16} = \frac{-28}{27}$.

③ Division is not associative for rational nos.

P.T.O.

$\left(\frac{3}{4} \div \frac{2}{5}\right) \div \frac{-3}{2}$

$= \left(\frac{3}{4} \times \frac{5}{2}\right) \div \frac{-3}{2}$

$= \frac{15}{48} \times \frac{2}{-3} = 1$

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

$\frac{3}{4} \div \left(\frac{2}{5} \div \frac{-3}{2}\right)$

$= \frac{3}{4} \div \left(\frac{2}{5} \times \frac{2}{-3}\right)$

$= \frac{3}{4} \div \frac{4}{-15}$

$= \frac{3}{4} \times \frac{-15}{4} = -\frac{45}{16}$

Ex 2.9

Q.1 a) $\frac{-5}{8} + \frac{3}{2} = \frac{7}{8}$

$\frac{-5}{8} = \frac{7}{8} - \frac{3}{2}$

b) $\frac{-2}{5} + \frac{3}{4} = \frac{7}{20}$

$\frac{-2}{5} = \frac{7}{20} - \frac{3}{4}$

b) $\frac{5}{4} - \frac{2}{3} = \frac{7}{12}$

$\frac{5}{4} = \frac{7}{12} + \frac{2}{3}$

Q.2 a) $\frac{-2}{3} - \frac{+4}{5} = \frac{-22}{15}$

$\frac{-2}{3} = \frac{-22}{15} + \frac{4}{5}$

b) 

Q.3

Ex 2.10

(1) $\frac{4}{9} \div \frac{3}{5} = \frac{4}{9} \times \frac{5}{3} = \frac{20}{27}$

(2) $\frac{-9}{10} \div \frac{4}{5} = \frac{-9}{10_2} \times \frac{5_1}{4} = \frac{-9}{8}$

(3) $\frac{-12}{20} \div \frac{7}{15} = \frac{-12^{-3}}{20_4} \times \frac{15^3}{7} = \frac{-9}{7}$

(4) $\frac{-7}{9} \div \frac{7}{-9} = \frac{-7_1}{9_1} \times \frac{-9_1}{7_1} = 1$

(5) $\frac{20}{32} \div \frac{-8}{-15} = \frac{20^5}{32_8} \times \frac{-15}{-8} = \frac{75}{64}$

(6) $\frac{-11}{15} \div \frac{-5}{3} = \frac{-11}{\frac{15}{5}} \times \frac{3_1}{-5} = \frac{11}{25}$

Ex 2.11

(1) a) $\frac{-8}{13} \div \frac{9}{13} = \frac{-8}{9}$

$\frac{-8}{13} = \frac{-8}{9} \times \frac{9}{13}$

b) $\frac{21}{25} \div \frac{14}{10} = \frac{3}{5}$

$\frac{21}{25} = \frac{3}{15} \times \frac{14}{10}$

(2) a) $\frac{-4}{5} \times \frac{3}{7} = \frac{-12}{35}$

$\frac{-4}{5} = \frac{-12}{35} \div \frac{3}{7}$

b) $\frac{-8}{15} \times \frac{5}{12} = \frac{-2}{9}$

$\frac{-8}{15} = \frac{-2}{9} \div \frac{5}{12}$

RATIONAL AS DECIMAL AND DECIMAL AS RATIONAL.

- Decimals can be classified under 3 heads :-

i) Terminating decimals
ii) Non Terminating and recurring decimals
iii) Non Terminating and non recurring decimals.

- Terminating decimals and non-terminating and recurring decimals can be converted into rational numbers. But the non terminating and non-recurring decimals cannot be converted into rational no.s. Infact they are called irrational no.s.

- All rational no.s can be written as decimals. Rationals whose denominators are products of 2 or 5 or powers of 2 or 5, give rise to terminating decimals. The rationals whose denominators contain prime factors other than 2 and 5 give rise to recurring decimals.

Ex 2.12

Q.1 a) $\frac{1}{4}$

$4 = 2 \times 2$

Hence it will be terminating decimal.

b) $\frac{8}{25}$

$25 = 5 \times 5$

Hence, terminating

c) $\frac{3}{7}$

$7 = 7 \times 1$

Hence it is non terminating recurring decimal

d) $\frac{10}{9}$

$9 = 3 \times 3$

Here it is non terminating recurring decimal

e) $\frac{25}{108}$

2	108
2	54
3	27
3	9
3	3
	1

$108 = 2 \times 2 \times 3 \times 3 \times 3$

Hence it is non terminating recurring decimal

f) $\frac{123}{400}$

2	400
2	200
2	100
2	50
5	25
	5

$400 = 2 \times 2 \times 2 \times 2 \times 5 \times 5$

Hence it is terminating decimal.

g) $\frac{100}{15}$

$15 = 3 \times 5$

Hence it will be a non terminating recurring decimal

h) $\frac{1}{16}$

$16 = 2 \times 2 \times 2 \times 2$

Here it is terminating decimal.

i) $\frac{381}{32}$

$32 = 2 \times 2 \times 2 \times 2 \times 2$

Hence it will be a terminating decimal

j) $\frac{1}{6}$

$6 = 2 \times 3$

Hence it is non terminating recurring decimal.

k) $\frac{5}{12}$

$12 = 3 \times 2 \times 2$

Hence it is non terminating recurring

l) $\frac{15}{7}$

$7 = 7 \times 1$

Hence it is non terminating recurring

Q.2 a) $\frac{1}{4} = 0.25$

$4 \overline{)10} \; 0.25$

-8

20

-20

xx

b) $\frac{8}{25} = 0.32$

$25 \overline{)80} \; 0.32$

-75

50

-50

xx

c) $\frac{3}{7} = 0.\overline{428571}$

$7 \overline{)30} \; 0.428571$

-28

20

-14

60

-56

40

-35

50

-49

10

-7

3

d) $\frac{10}{9} = 1.\overline{1}$

$9 \overline{)10} \; 1.1$

-9

10

-9

1

e) $\frac{25}{108} = 0.2\overline{314}8$

$0.23\overline{148}$
$108\overline{)250}$
-216
340
-324
160
-108
520
-432
880
-864
16

f) $\frac{123}{400} = 0.3075$

$.307$
$400\overline{)1230}$
$+200$
300
-0
3000
-2800
2000
-2000
xxx

g) $\frac{100}{15} = 6.\overline{6}$

$6.\overline{6}$
$15\overline{)100}$
-90
100
-90
10

h) $\frac{1}{16} = 0.0625$

0.0625
$16\overline{)100}$
-96
40
-32
80
-80
xx

i) $\frac{381}{32} = 11.9025$

11.9025
$32\overline{)381}$
-32
61
-32
290
-288
200
192
80
-64
160
-160
xx

j) $\frac{1}{6} = 0.1\overline{6}$

$.1\overline{6}$
$6\overline{)10}$
-6
40
-36
4

k) $\frac{5}{12} = 0.41\overline{6}$

$.41\overline{6}$
$12\overline{)60}$
-48
20
-12
80
-72
8

l) $\frac{15}{7} = 2.\overline{142857}$

2.142857
$7\overline{)15}$
-14
10
-7
30
-28
20
-14
60
-56
40
-35
50
-49
1

Q.3

a) -7.35

$= \frac{-735}{100}$

$= \frac{147}{20}$

$= 7\frac{7}{20}$ (QR/D)

7
20) 147
−140
7

b) 18.2

$= \frac{182}{10}$

$= \frac{91}{5}$

$= 18\frac{1}{5}$

18
5) 91
−5
41
−40
1

c) $0.\overline{9}$

Let $x = 0.999\ldots$ ①

Multiply both side by 10.

$10x = 9.999\ldots$ ②

② − ① $x = 0.999\ldots$

$9x = 9$

$x = 9 \div 9$

$x = 1$

d) $-12.\overline{7}$

Let $x = -12.777\ldots$ ①

Multiply both side by 10

$10x = -127.777\ldots$ ②

② − ① $x = -12.777\ldots$

$9x = -115$

$x = \frac{-115}{9}$

$x = -12\frac{7}{9}$

12
9) 115
−9
25
−18
7

e) $.\overline{13}$

Let $x = .131313\ldots$ ①

Multiply both side by 100

$100x = 13.131313\ldots$ ②

② − ① $-x = .131313\ldots$

$99x = 13$

$x = \frac{13}{99}$

f) $1.0\overline{3}$

Let $x = 1.033333\ldots$

Multiply both side by 100

$100x = 103.333\ldots$

$x = 1.0$

f) $1.0\overline{3}$

Let $x = 1.033\ldots$

Multiply by 10

$10x = 10.333\ldots$

$x = 1.033\ldots$

$9x = 9.3$

$x = \frac{9.3}{90}$

$= \frac{93}{90}$

$= 1\frac{3}{30} = 1\frac{1}{10}$

f) $1.0\overline{3}$

Let $x = 1.0333\ldots$

$10x = 10.333\ldots$

$100x = 103.333\ldots$

$-10x = -10.333\ldots$

$90x = 93$

$x = \frac{93}{90} = \frac{31}{30} = 1\frac{1}{30}$

g) $10.2\overline{315}$

Let $x = 10.2315315\ldots$

$10x = 102.315315\ldots$

$1000x = 10315.315315\ldots$

$-\ 10x = 102.315315\ldots$

$10x = 102.315315\ldots$

$x = 10.23\overline{15}$

g) $10.2\overline{315}$

Let $x = 10.2315315$

$10000x = 102315.315315$

$10x = 102.315315$

$9990x = 102213$

$x = \frac{102213}{9990}$

Ex 2.13

Q.1 a) $\frac{2}{3}, \frac{7}{10}$

$\frac{2}{3} = 0.\overline{66}\ldots$

$\frac{7}{10} = 0.70$

$\therefore$ 0.66 or $\frac{17}{25}$ and 0.69 or $\frac{69}{100}$

b) $\frac{1}{2}, \frac{3}{4}$

$\frac{1}{2} = 0.50$

$\frac{3}{4} = 0.75$

0.6 or $\frac{3}{5}$ and 0.7 or $\frac{7}{10}$ are required rational nos.

c) $\frac{1}{6}, \frac{1}{5}$

$\frac{1}{6} = 0.1\overline{66}\ldots$

$\frac{1}{5} = 0.20$

i) $0.17 = \frac{17}{100}$

ii) $0.19 = \frac{19}{100}$

d) $\frac{11}{8}, \frac{15}{9}$

$\frac{11}{8} = 1.375$

$\frac{15}{9} = 1.666\ldots$

i) $1.40 = \frac{14}{10} = \frac{7}{5}$

ii) $1.5 = \frac{15}{10} = \frac{3}{2}$

e) $-1, -\frac{1}{2}$

$-1 = -1$

$-\frac{1}{2} = -0.50$

i) $-0.60 = -\frac{3}{5}$

ii) $-0.80 = -\frac{4}{5}$

Q.2

a) $\frac{-2}{3} = -0.\overline{6}$

$\frac{-1}{3} = -0.\overline{3}$

$-0.50 = \frac{-50}{100}$

$\frac{-1}{2}$ is the rational no.

b) $\frac{-3}{5}, \frac{-4}{5}$

$\frac{-3}{5} = -0.6$

$\frac{-4}{5} = -0.8$

0.7 / $\frac{7}{10}$ is the rational no.

c) $\frac{-5}{8}, \frac{-6}{11}$

$\frac{-5}{8} = -0.625$

$\frac{-6}{11} = -0.\overline{54}$

-0.6 / $\frac{-6}{10}$ / $\frac{-3}{5}$ Ans

d) $-3, -3\frac{1}{2}$

$-3\frac{1}{2} = \frac{-7}{2} = -3.50$

-3.000

-3.1 / $\frac{-31}{10}$ / $-3\frac{1}{10}$ Ans

e) $4, 5\frac{1}{3}$

$5\frac{1}{3} = \frac{16}{3} = 5.\overline{3}$

5 or $\frac{5}{1}$ Ans

f) $-4, -5\frac{1}{3}$

$-5\frac{1}{3} = \frac{-16}{3} = -5.\overline{3}$

-4 and $-5.\overline{3}$

-5 or $\frac{-5}{1}$ Ans

g) $-7\frac{1}{2}, -8\frac{1}{2}$

$-7\frac{1}{2} = \frac{-15}{2} = -7.5$

$-8\frac{1}{2} = \frac{-17}{2} = -8.5$

-8 Ans

Applications → Scientific Notation

We apply the knowledge of Exponents in writing Scientific Notation.

What is Scientific Notation?

The numbers are written in the form of the product of a number

i) between 1 and 10 (K)

ii) And a power of 10 (10^n)

That is $K \times 10^n$.

(where K lies between 1 to 10)

Standard Representation of Numbers.

Example: Is 149.6×10^6 in Standard form.

Because Value of 1st part : 149.6 is not between 1 & 10. **NO**

So it has to be changed. as below

$$149.6 = 1.496 \times 100$$

Now $149.6 \times 10^6 = 1.496 \times 10^2 \times 10^6$

$$= 1.496 \times 10^{2+6}.$$

$$= 1.496 \times 10^8$$

$(K \times 10^m)$

↓

K should be Between → 1 to 10.

Example : Is 149.6×10^6 in Standard form.

Because value of 1st part : 149.6 is not between 1 & 10. **NO**

So it has to be Changed. as below

$149.6 = 1.496 \times 100$

Now $149.6 \times 10^6 = 1.496 \times 10^2 \times 10^6$

$= 1.496 \times 10^{2+6}$.

$= 1.496 \times 10^8$

$(K \times 10^m)$

↓

K should be Between → 1 to 10.

Example : 2

Diameter of Earth is 12756 km

$= 1.2756 \times 10000$

$= 1.2756 \times 10^4$ km.

$= 1.2756 \times 10^4 \times 1000$ m.

$= 1.2756 \times 10^4 \times 10^3$ m.

$= 1.2756 \times 10^{4+3}$ m

$= 1.2756 \times 10^7$ m

$(K \times 10^n)$

K ↓ 1 to 10.

Example 3 :

Weight of a box is 200 tonnes.

$= 200 \times 1000$ kg.

$= 2 \times 100 \times 1000$ kg

$= 2 \times 10^2 \times 10^3$ kg

$= 2 \times 10^5$ kg.

$= 2 \times 10^5 \times 1000$ g

$= 2 \times 10^5 \times 10^3$ g

$= 2 \times 10^8$ g.

$(K \times 10^n)$

K ↓ 1 to 10.

Exercise 3.9 (Pg-47)

1. Refer table (Pg-47) and write in Scientific Notation.

d) The distance between Venus & the Earth

Earth → 149.6 million km
Venus → 108.2 million km
Difference = 41.4 million km

$= 41.4 \times 1000\,000$ km
$= 41.4 \times 10^6$ km.
$= 4.14 \times 10^1 \times 10^6$ km
$= 4.14 \times 10^7$ km.

2. Write in Common Notation

d) 1.785×10^5

$= 1.785 \times 100000$

$= 178500$.

c) 4.56×10^3

$= 4.56 \times 1000$

$= 4560$.

3. Write in Scientific Notation

d) 1632.7×10^2

$= 1.6327 \times 10^3 \times 10^2 = 1.6327 \times 10^5$.

4. Compare each pair using > or <.

d) 7.2×10^6 ; 17.3×10^5

$\Rightarrow 7.2 \times 1000000$ $\Rightarrow 17.3 \times 100000$

$\Rightarrow 72,00,000$ $\Rightarrow 17,30,000$

72 Lakhs $\boxed{>}$ 17 Lakh 30 Thousand.

5) Express the product in Scientific Notation.

e) $723 \times 3\,000\,000$

$= 723 \times 3 \times 1\,000\,000$

$= 2169 \times 1\,000\,000$

$= \underline{2169} \times 10^{6}$

$= 2.169 \times 10^{3} \times 10^{6}$

$= 2.169 \times 10^{3+6}$

$= 2.169 \times 10^{9}$

$(k \times 10^{n})$

↓

1 to 10.

Infinitesimals in Scientific Notation (Pg 48)

The word 'infinitesimals' means very small numbers

Example: The mass of an Electron (the smallest particle in an atom) is 9.108×10^{-28} gm.

Example: Express 0.000 005 in Scientific notation.

$$= \frac{5}{1\,000\,000} = \frac{5}{10^6} = 5 \times 10^{-6}.$$

Exercise 3.10 (Pg - 49)

1. Write in Scientific Notation.

c. 0.0001563

$= \frac{1563}{10000000} = \frac{1563}{10^7} = 1563 \times 10^{-7}$.

Is 1563×10^{-7} in Scientific Notation

NO.

So $1563 \times 10^{-7} = 1.563 \times 10^3 \times 10^{-7}$

$= 1.563 \times 10^{+3-7}$

$= 1.563 \times 10^{-4}$.

$(K \times 10^n)$

$\downarrow$

1 to 10.

b) 0.00527×10^{-3}

$= \frac{527}{100000} \times 10^{-3}$

$= \frac{527}{10^5} \times 10^{-3}$

$= 527 \times 10^{-5} \times 10^{-3}$

$= 527 \times 10^{-8}$

$= 5.27 \times 10^{+2} \times 10^{-8}$

$= 5.27 \times 10^{+2-8}$

$= 5.27 \times 10^{-6}$

$(K \times 10^n)$

K ↓ 1 to 10.

i) 0.32×0.0005

$= \frac{32}{100} \times \frac{5}{10000}$

$= \frac{32 \times 5}{1000000}$

$= \frac{160}{10^6} = \underline{160} \times 10^{-6}$

$= 1.6 \times 10^2 \times 10^{-6}$

$= 1.6 \times 10^{+2-6}$

$= 1.6 \times 10^{-4}$

$(K \times 10^n)$

↓

1 to 10.

2. Compare each pair, using > or <

d. 5.67×10^{-9} , 1.3×10^{-8}

$\Rightarrow \frac{5.67}{10^9}$ $\quad$ $\frac{1.3}{10^8}$

$\Rightarrow \frac{567}{10^2 \times 10^9}$ $\quad$ $\Rightarrow \frac{13}{10 \times 10^8}$

$\Rightarrow \frac{567}{10^{11}}$ $\quad$ $\Rightarrow \frac{13}{10^9}$

$\Rightarrow 567 \times 10^{-11}$ $\quad <$ $\quad \Rightarrow 13 \times 10^{-9}$

3 Simplify and write the answer in Scientific Notation

c) $(3.123 \div 90) \times 10^5$

$= \frac{3.123}{90} \times \frac{10^5}{1}$

$= \frac{3.123 \times 100000}{90}$

$= \frac{31230}{9} = 3470$

$= 3.47 \times 10^3$

$(K \times 10^n)$

↓

1 to 10.

3. f) $(1.43 \times 10^{-7}) \div (1.3 \times 10^{-9})$

$= \frac{1.43}{10^{7}} \div \frac{1.3}{10^{9}}$

$= \frac{1.43}{10^{7}} \times \frac{10^{9}}{1.3}$ $= \frac{1.43}{1.3} \times 10^{+9} \times 10^{-7}$

$= \frac{1.43}{1.3} \times 10^{+2}$

$= \frac{1.43 \times 100}{1.3}$

$= \frac{143}{1.3}$ $= \frac{143 \times 10}{1.3 \times 10}$

$= \frac{1430}{13} = 110$

$= 1.1 \times 10^{2}$

$(k \times 10^{n})$

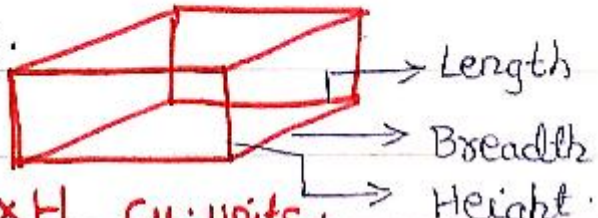
Ch-11 · Volume and Surface Area

As length measures Segments,
Area measures surfaces,
Volume is the measure of capacity.
It is the Amount of Space available inside any closed container.
Example: Amount of water a bottle can hold
Water stored in a tank etc.
Standard units for measuring capacity or finding Volume is Cubic units.
Volume of a cube of side 1 cm is $1\ cm^3$.
Volume of a cube of side 1 m is $1\ m^3$.

1 Litre = 1000 cu·cm.
1 Kilolitre = 1000 l.

Cuboid : It has 6 faces.

It has Length, Breadth & Height.



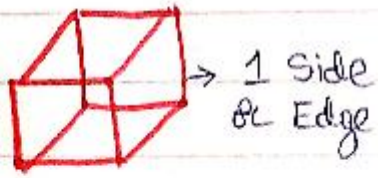
Volume of a Cuboid = $L \times B \times H$ cu. units.

OR = Area $\times$ H ($A = L \times B$).

Surface Area of a Cuboid = $2(LB + BH + HL)$ Sq. Units

Cube : It has 6 faces.

All 6 faces are Squares.



Its L, B and H are equal in length.

Volume of a cube = $l \times l \times l$ cubic units

$= l^3$ cubic units (l = 1 Side)

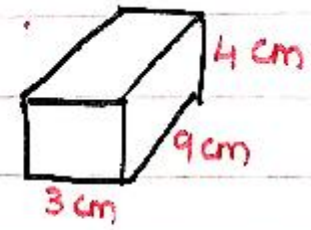
Surface Area of a Cube = $6l^2$ Sq. units.

Exercise 11.1 Pg - 139

Figures of cubes and cuboids are given. We have to find the volume counting cubic - blocks.

Exercise 11.2 Pg - 142

1. Figures are given find volume.



Volume = L x B x H

= 9 cm x 3 cm x 4 cm

= 108 cu. cm.

2. How many cubic centimetres in 1 metre cube?

We know $1\ m = 100\ cm$.

$(1\ m)^3 = (100\ cm)^3$ (cube both sides)

$1m \times 1m \times 1m = 100\ cm \times 100\ cm \times 100\ cm$

$1\ m^3 = 10,00,000\ cm^3$.

3. Find the volume of a cuboid, whose Length = 2m, Breadth = 75 cm & Height = $1\frac{1}{2}$ m.

Sol:- We know Volume = L × B × H.

$= 2m \times 75\ cm \times 1\frac{1}{2}\ m$

$= 2m \times 0.75\ m \times 1.5\ m$

$= 1.5 \times 1.5\ m^3 = 2.25\ m^3$.

4. The volume of cuboid is 70 c.c. and the area of the base is 10 sq. cm. Find the height.

Sol:- Given V of cuboid = 70 c.cm.

Area of Base = 10 sq. cm

We know Height $= \frac{\text{Volume}}{\text{Area}} = \frac{70\ c.c}{10\ cm^2} = 7\ cm$.

5. Find the Volume of the cube whose Edge is

d) 4·5 cm

We Know Volume of Cube $= l^3$

$= 4{\cdot}5\text{cm} \times 4{\cdot}5\text{ cm} \times 4{\cdot}5\text{ cm} = 91{\cdot}125\ \text{cm}^3$.

6. A water tank is 6m long, 4m broad & 2m deep. How much of water can it store? Give answer in litres

Sol: Dimensions of water tank are

$l = 6\text{m}$, $b = 4\text{m}$ & h i.e depth $= 2\text{m}$.

Volume of tank is the Volume of water it can store.

$= l \times b \times d(h)$

$= 6\text{m} \times 4\text{m} \times 2\text{m} = 48\ \text{m}^3$.

$= 48 \times 10,00,000\ \text{cm}^3 = 4,80,00,000\ \text{cm}^3$

We Know $1\ l = 1000$ cu·cm.

$4,80,00,000\ \text{cm}^3 = \frac{4,80,00,000}{1000}$ litres $= 48,000\ l$.

7. The floor of a classroom is 10m by 12 m. Its height is 8 m. Find the area of the floor and its Volume.

Sol:- Given Floor of class = 10m by 12m., h = 8m

Area of floor = $l \times b$ = 10m x 12m = $120\ m^2$.

Volume of room = Area x height = $120\ m^2 \times 8\ m$

= $960\ m^3$.

8. How many boxes of size 5 cm by 10cm by 10cm can be packed into a big wood box of size 1m by $\frac{1}{2}$m by $\frac{3}{4}$m.

Sol: No. of boxes that can be packed in the big box = $\frac{\text{Volume of big box}}{\text{Volume of small box}}$

= $\frac{1\ m \times \frac{1}{2}\ m \times \frac{3}{4}\ m}{5\ cm \times 10\ cm \times 10\ cm}$ = $\frac{100\ cm \times 50\ cm \times 75\ cm}{5\ cm \times 10\ cm \times 10\ cm}$

= 750 boxes.

9. How many bricks of size 6cm by 20cm by 7cm will be required to build a wall 15m by $\frac{1}{2}$m by 7m?

Sol:-

$$\text{No. of bricks needed} = \frac{\text{Volume of Wall}}{\text{Volume of 1 brick}}$$

$$= \frac{15\text{m} \times \frac{1}{2}\text{m} \times 7\text{m}}{6\text{cm} \times 20\text{cm} \times 7\text{cm}} = \frac{1500\text{cm} \times 50\text{cm} \times 700\text{cm}}{6\text{cm} \times 20\text{cm} \times 7\text{cm}}$$

$$= 62,500 \text{ bricks}.$$

10. Ramesh has 64 one-cm cubes. Give the measures of 3 types of cuboids he can build, using them all for each.

Sol:- $64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$

Measures L of B 3 H types are

1. $16 \times 2 \times 2$
2. $8 \times 4 \times 2$
3. $16 \times 4 \times 1$

11. Find the area of 4 walls of a room measuring 10m × 5m × 6m (height).

Sol: Area of 4 walls = Perimeter × H

$= 2(l+b) \times H$

$= 2(10+5)\,m \times 6\,m$

$= 2 \times 15\,m \times 6\,m = 180\,m^2$.

12. Find the volume and surface Area of a cube whose edge is 5 cm.

Sol: Edge is 5 cm.

Volume of cube $= l^3 = 5 \times 5 \times 5\,cm^3 = 125\,cm^3$.

Surface Area of cube $= 6l^2$

$= 6 \times (5\,cm)^2$

$= 6 \times 25\,cm^2$.

$= 150\,m^2$.

13. A swimming pool is 200 m long and 120 m wide. 36,000 m^3 of water is pumped into it. Find the rise in the level of water.

Sol: Length of pool = 200 m

Width of pool = 120 m

Volume of water pumped = 36,000 m^3.

Rise in level of water is the height of water.

$$h = \frac{V}{l \times b} = \frac{36,000\ m^3}{200\ m \times 120\ m}$$

$$= \frac{36,000\ m^3}{24,000\ m^2}$$

$$= \frac{3}{2}\ m = 1\frac{1}{2}\ m \text{ or } 1.5\ m.$$

14. An oil tin is 20 cm x 20 cm x 50 cm.
Find the area of the tin sheet required to make 30 such tins.

Sol: Dimensions of oil tin = 20 cm x 20 cm x 50 cm.

Surface Area of 1 oil tin = $2(lb + bh + hl)$

$= 2(20\text{cm} \times 20\text{cm} + 20\text{cm} \times 50\text{cm} + 50\text{cm} \times 20\text{cm})$
$= 2(400\ \text{cm}^2 + 1000\ \text{cm}^2 + 1000\ \text{cm}^2)$
$= 2(2400\ \text{cm}^2)$
$= 4800\ \text{cm}^2$.

Surface Area of 30 oil tins $= 30 \times 4800\ \text{cm}^2$
$= 1,44,000\ \text{cm}^2$.

Thank You, Stay Safe. ☺