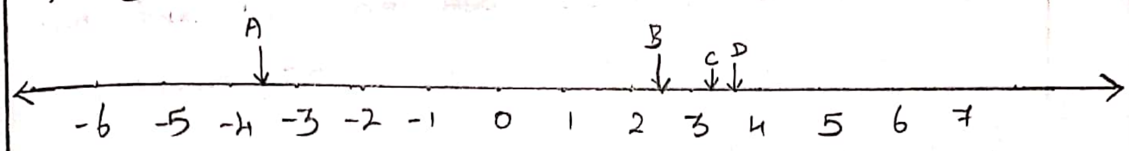
2. REAL NUMBERS

Exercise 2.1

1. Which arrow best shows the position of $\frac{11}{3}$ on the number line?



$\frac{11}{3} = 3\frac{2}{3}$

$\therefore$ D arrow shows the best position of $\frac{11}{3}$ on the number line.

2. Find any three rational numbers between $\frac{-7}{11}$ and $\frac{2}{11}$.

Three rational numbers between $-\frac{7}{11}$ and $\frac{2}{11}$ are $\frac{-6}{11}, \frac{-5}{11}, \frac{-4}{11}, \ldots, \frac{0}{11}, \frac{1}{11}$

3. Find any five rational numbers between (i) $\frac{1}{4}$ and $\frac{1}{5}$ (ii) 0.1 and 0.11 (iii) -1 and -2

(i) $\frac{1}{4}$ and $\frac{1}{5}$

$\frac{1}{4} < \frac{1+1}{4+5} < \frac{1}{5} \Rightarrow \frac{1}{4} < \frac{2}{9} < \frac{1}{5}$

$\frac{1}{4} < \frac{1+2}{4+9} < \frac{2}{9} < \frac{2+1}{9+5} < \frac{1}{5} \Rightarrow \frac{1}{4} < \frac{3}{13} < \frac{2}{9} < \frac{3}{14} <$

$\frac{1}{4} < \frac{1+3}{4+13} < \frac{3}{13} < \frac{2}{9} < \frac{3}{14} < \frac{3+1}{14+5} < \frac{1}{5}$

$\Rightarrow \frac{1}{4} < \frac{4}{17} < \frac{3}{13} < \frac{2}{9} < \frac{3}{14} < \frac{4}{19} < \frac{1}{5}$.

Hence five rational numbers between $\frac{1}{4}$ and $\frac{1}{5}$

are $\frac{4}{17}, \frac{3}{13}, \frac{2}{9}, \frac{3}{14}$ & $\frac{4}{19}$.

(ii) 0.1 and 0.11

$0.1 = 0.10 = \frac{10}{100}$ and $0.11 = \frac{11}{100}$

The rational numbers between 0.1 and 0.11 are 0.101, 102, 103, ……, 0.109, ~~0.100~~

(iii) −1 and −2.

Let q_1, q_2, q_3, q_4 and q_5 be five rational numbers.

$$q_1 = \frac{a+b}{2} = \frac{(-1)+(-2)}{2} = \frac{-1-2}{2} = \frac{-3}{2}$$

$$q_2 = \frac{a+q_1}{2} = \frac{(-1)+(\frac{-3}{2})}{2} = \frac{\frac{-2-3}{2}}{2} = \frac{\frac{-5}{2}}{\frac{2}{1}} = \frac{-5}{2} \times \frac{1}{2} = \frac{-5}{4}$$

$$q_3 = \frac{a+q_2}{2} = \frac{-1-\frac{5}{4}}{2} = \frac{-9/4}{2} = -\frac{9}{8}$$

$$q_4 = \frac{a+q_3}{2} = \frac{-1-9/8}{2} = \frac{-17/8}{2} = -\frac{17}{16}$$

$$q_5 = \frac{a+q_4}{2} = \frac{-1-\frac{17}{16}}{2} = \frac{-33/16}{2} = \frac{-33}{32}$$

The five rational numbers between −1 and −2 are $\frac{-3}{2}, \frac{-5}{4}, \frac{-9}{8}, \frac{-17}{16}$ and $\frac{-33}{32}$.

Exercise 2.2

1. Express the following rational numbers into decimal and state the kind of decimal expansion.

(i) $\frac{2}{7}$ (ii) $-5\frac{3}{11}$ (iii) $\frac{22}{3}$ (iv) $\frac{327}{200}$

Sol :

(i) $\frac{2}{7}$ (ii) $-5\frac{3}{11} = \frac{-58}{11}$ (iii) $\frac{22}{3}$ (iv) $\frac{327}{200}$

$7 \overline{)\,20\,}$ 0.285714

(-)14

60

(-)56

40

(-)35

50

(-)49

10

(-)7

30

(-)28

20

⋮

$\frac{2}{7} =$

$11 \overline{)\,58\,}$ 5.27

(-)55

30

(-)22

80

(-)77

3

⋮

$3 \overline{)\,22\,}$ 7.3

(-)21

10

(-)9

1

⋮

$200 \overline{)\,327\,}$ 1.635

(-)200

1270

(-)1200

700

(-)600

1000

(-)1000

0

(i) $\frac{2}{7} = 0.\overline{285714}$ Non-terminating and recurring

(ii) $-5\frac{3}{11} = -5.\overline{27}$ Non-terminating and recurring

(iii) $\frac{22}{3} = 7.\overline{3}$ Non-terminating and recurring

(iv) $\frac{327}{200} = 1.635$ Terminating.

2. Express $\frac{1}{13}$ in decimal form. Find the length of the period of decimals.

Sol

$\frac{1}{13}$

$$13\overline{)\,100}\;0.076923$$

(-) 91

90

(-) 78

120

(-) 117

30

(-) 26

40

- 39

1

$\frac{1}{13} = 0.\overline{076923}$

The length of the Period of decimals = 6.

3. Express the rational number $\frac{1}{33}$ in recurring decimal form by using the recurring decimal expansion of $\frac{1}{11}$. Hence write $\frac{71}{33}$ in recurring decimal form.

Sol

The recurring decimal expansion of

$\frac{1}{11} = 0.090909\ldots = 0.\overline{09}$

$$11\overline{)\,1.00}\;0.09$$

(-) 99

1

$\frac{1}{33} = \frac{1}{11\times 3} = \frac{1}{11}\times\frac{1}{3} = 0.090909\ldots \times \frac{1}{3}$

$\frac{1}{33} = 0.030303\ldots = 0.\overline{03}$

Also, $\frac{71}{33} = 2\frac{5}{33} = 2 + \frac{5}{33}$

$= 2 + 5\times\frac{1}{33}$

$= 2 + 5\times 0.030303\ldots$

$= 2 + 0.151515\ldots$

$= 2.151515\ldots$

$\frac{71}{33} = 2.\overline{15}$

4. Express the following decimal expression into rational numbers.

(i) $0.\overline{24}$ (ii) $2.\overline{327}$ (iii) -5.132

(iv) $3.1\overline{7}$ (v) $17.2\overline{15}$ vi) $-21.213\overline{7}$

Sol:

(i) $0.\overline{24}$

Let $x = 0.\overline{24} = 0.242424\ldots \longrightarrow ①$

Here Period of decimal is 2, multiply ① by100

$100x = 24.242424\ldots \longrightarrow ②$

② − ① ⇒ $99x = 24$

$$x = \frac{\cancel{24}^{8}}{\cancel{99}_{33}}$$

$$x = \frac{8}{33}$$

(ii) $2.\overline{327}$

Let $x = 2.\overline{327} = 2.327327327\ldots \longrightarrow ①$

Here the period of decimal is 3, multiply ① by 1000.

$1000x = 2327.327327327\ldots \longrightarrow ②$

② − ① ⇒ $999x = 2325$.

$$x = \frac{\cancel{2325}^{775}}{\cancel{999}_{333}}$$

$$x = \frac{775}{333}$$

(iii) -5.132

$$-5.132 = -\frac{\cancel{5132}^{1283}}{\cancel{1000}_{250}} = \frac{-1283}{250}$$

(iv) $3.1\overline{7}$

Let $x = 3.1\overline{7} = 3.1777\ldots\ldots \longrightarrow$ ①

Here the repeating decimal digit is 7, which is the second digit after the decimal point, so multiply ① by 10.

$10x = 31.777\ldots\ldots \longrightarrow$ ②

Now period of decimal is 1, multiply equation ② by 10

$100x = 317.777\ldots\ldots \longrightarrow$ ③

③ − ② $\Rightarrow$ $90x = 286$

$$x = \frac{\cancelto{143}{286}}{\cancelto{45}{90}}$$

$$x = \frac{143}{45}$$

(v) $17.2\overline{15}$

Let $x = 17.215151515\ldots\ldots \longrightarrow$ ①

Here the repeating decimal digit is 15, which is the second digit after the decimal point, so multiply ① by 10.

$10x = 172.151515\ldots\ldots \longrightarrow$ ②

Now period of decimal is 2, multiply equation ② by 100.

$1000x = 17215.151515\ldots\ldots \longrightarrow$ ③

③ − ② $\Rightarrow$ $990x = 17043$

$$\begin{array}{r} 17215 \\ 172 \\ \hline 17043 \end{array}$$

$$x = \frac{\cancelto{5681}{17043}}{\cancelto{330}{990}}$$

$$x = \frac{5681}{330}$$

(vi) $-21.213\overline{7}$

Let $x = -21.213\overline{7} = -21.213777\ldots \longrightarrow$ ①

Here the repeating decimal digit is 7, which is the fourth digit after the decimal point, so multiply ① by 10000

$$10000x = -212137.777\ldots\ldots \longrightarrow ②$$

Now period of decimal is 1, multiply ② by 10.

$$100000x = -2121377.777\ldots\ldots \longrightarrow ③$$

③ - ② $\Rightarrow$ $100000x - 10000x = (-2121377.777\ldots) - (-212137.777\ldots)$

$$90000x = -1909240$$

$$x = -\frac{\cancel{1909240}^{47731}}{\cancel{90000}_{2250}}$$

$$\begin{array}{r} 2121377 \\ 212137 \\ \hline 1909240 \end{array}$$

$$x = -\frac{190924}{90000} \quad (\text{or}) \quad -\frac{47731}{2250}$$

5). Without actual division, find which of the following rational numbers have terminating decimal expansion.

(i) $\frac{7}{128}$ (ii) $\frac{21}{15}$ (iii) $4\frac{9}{35}$ (v) $\frac{219}{2200}$

Sol :

If a rational number $\frac{p}{q}$, $q \neq 0$ can be expressed in the form $\frac{p}{2^m \times 5^n}$, where $p \in \mathbb{Z}$ and $m, n \in \mathbb{W}$, then rational number will have a terminating decimal expansion

(i) $\frac{7}{128} = \frac{7}{2^7 \times 5^0}$

$$\begin{array}{r|l} 2 & 128 \\ 2 & 64 \\ 2 & 32 \\ 2 & 16 \\ 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ & 1 \end{array}$$

So $\frac{7}{128}$ has a terminating decimal expansion.

(ii) $\frac{\cancelto{7}{21}}{\underset{5}{\cancel{15}}} = \frac{7}{5} = \frac{7}{2^0 \times 5^1}$

So $\cancel{\frac{7}{15}}$ $\frac{21}{15}$ has a terminating decimal expansion.

(iii) $4\frac{9}{35} = \frac{149}{35} = \frac{149}{5^1 \times 7^1}$

$$\begin{array}{r|l} 5 & 35 \\ 7 & 7 \\ & 1 \end{array}$$

So $4\frac{9}{35}$ has a non-terminating recurring decimal expansion.

(iv). $\frac{219}{2200} = \frac{219}{2^3 \times 5^2 \times 11^1}$

$$\begin{array}{r|l} 5 & 2200 \\ 5 & 440 \\ 11 & 88 \\ 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ & 1 \end{array}$$

So $\frac{219}{2200}$ has a non-terminating recurring decimal expansion.

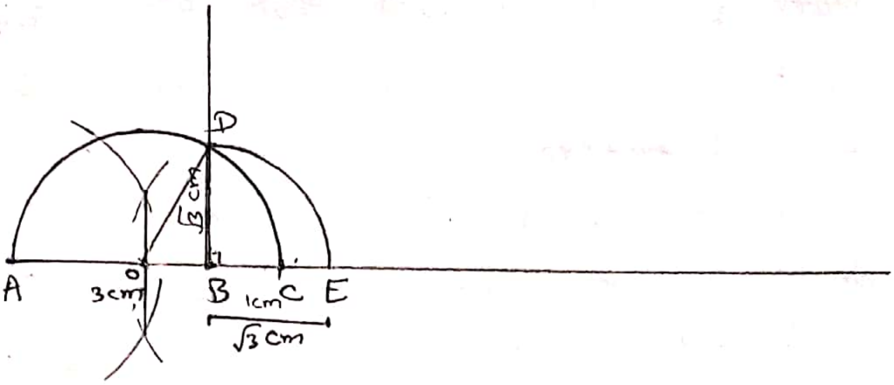
Exercise 2.3

1). Represent the following irrational numbers on the number line.

(i) $\sqrt{3}$ (ii) $\sqrt{4.7}$ (iii) $\sqrt{6.5}$

Sol

(i) $\sqrt{3}$



(i) Draw a line and mark a point A on it.

(ii) Mark a point B such that AB = 3 cm

(iii) Mark a point C on this line such that BC = 1 ~~unit~~. cm.

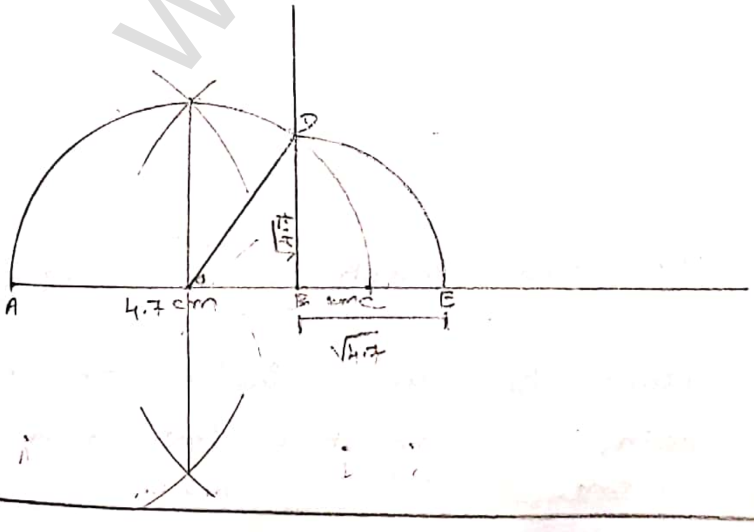
(iv) Find the midpoint of AC by drawing perpendicular bisector of AC and let it be O.

(v) With O as center and OC = OA as radius, draw a semi circle.

(vi) Draw a line BD, which is perpendicular to AB at B.

(vii) Now BD = $\sqrt{3}$, which can be marked in the ~~manner~~ number line as the value of BE = BD = $\sqrt{3}$

(ii) $\sqrt{4.7}$



(i) Draw a line and mark a point A on it

(ii) Mark a point B such that AB = 4.7 cm.

(iii) Mark a point C on this line such that BC = 1 ~~unit~~ cm.

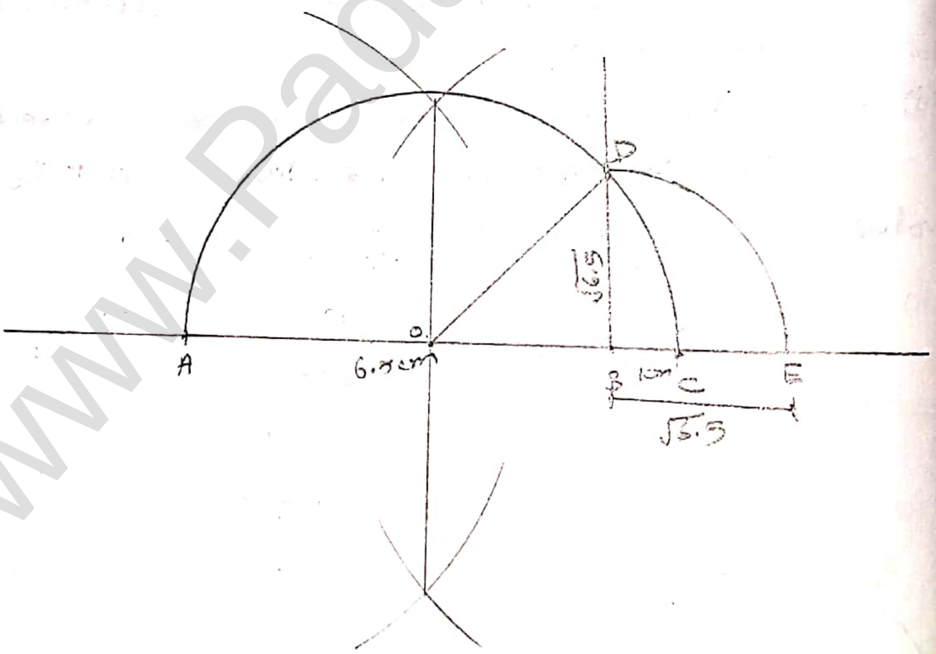
(iv) Find the midpoint of AC by drawing perpendicular bisector of AC and let it be O.

(v) With O as center and OC = OA as radius, draw a semi circle.

(vi) Draw a line BD, which is perpendicular to AB at B.

(vii) Now BD = $\sqrt{4.7}$, which can be marked in the number line as the value of BE = BD = $\sqrt{4.7}$

(iii) $\sqrt{6.5}$



(i) Draw a line and mark a point A on it.

(ii) Mark a point B such that AB = 6.5 cm

(iii) Mark a point C on this line such that BC = 1 cm.

(iv) Find the midpoint of AC by drawing perpendicular bisector of AC and let it be O.

(v) With O as center and OC = OA as radius, draw a semicircle

(vi) Draw a line BD, which is perpendicular to AB at B.

(vii) Now BD = $\sqrt{6.5}$, which can be marked in the number line as the value of BE = BD = $\sqrt{6.5}$

2). Find any two irrational numbers between

(i) 0.30100110001111...... and 0.3020020002......

(ii) $\frac{6}{7}$ and $\frac{12}{13}$ (iii) $\sqrt{2}$ and $\sqrt{3}$.

Sol

(i) Two irrational numbers between 0.30100110001111...... and 0.30200 20002..... are 0.301202200222..... and 0.301303300333.....

(ii) $\frac{6}{7}$ and $\frac{12}{13}$

$\frac{6}{7} = 0.857142....$

$\frac{12}{13} = 0.923076 15....$

$$7\overline{)60}\ 0.857142$$
(−) 56
40
(−) 35
50
(−) 49
10
(−) 7
30
(−) 28
20
(−) 14
6.

$$13\overline{)120}\ 0.92307615$$
(−) 117.
30
(−) 26
40
(−) 39
100
(−) 91
90
(−) 78
20
(−) 13
70.
(−) 65
50

Two irrational numbers between $\frac{6}{7}$ and $\frac{12}{13}$ are 0.8616611666111...... and 0.871771177711 1....

(iii) $\sqrt{2}$ and $\sqrt{3}$

$\sqrt{2} \simeq 1.414$ and $\sqrt{3} \simeq 1.732$

Two irrational numbers between $\sqrt{2}$ and $\sqrt{3}$ are 1.515511555...... and 1.61661166......

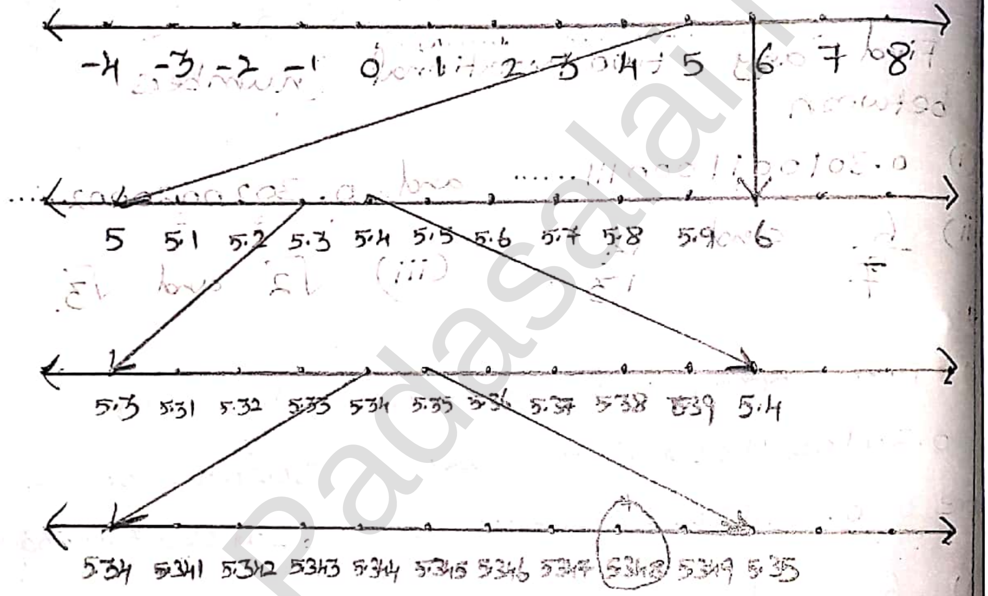
Exercise 2.4

1). Represent the following numbers on the number line.

(i) 5.348 (ii) $6.\overline{4}$ upto 3 decimal places.
(iii) $4.\overline{73}$ upto 4 decimal places.

Sol

(i) 5.348



Step 1: First we note that 5.348 lies between 5 and 6.

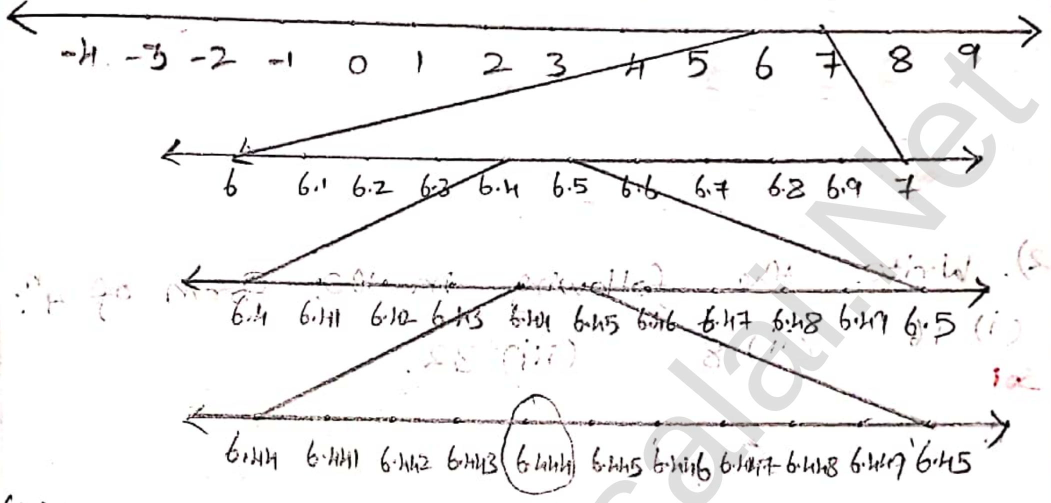
Step 2: Divide the portion between 5 and 6 into 10 equal parts and use a magnifying glass to visualise that 5.348 lies between 5.3 and 5.4.

Step 3: Divide the portion between 5.3 and 5.4 into 10 equal parts and use a magnifying glass to visualise that 5.348 lies between 5.34 and 5.35.

Step 4: Divide the portion between 5.34 and 5.35 into 10 equal parts and use a magnifying glass to visualise that 5.348 lies between 5.348 and 5.349

(ii) $6.\bar{4}$ upto 3 decimal places.

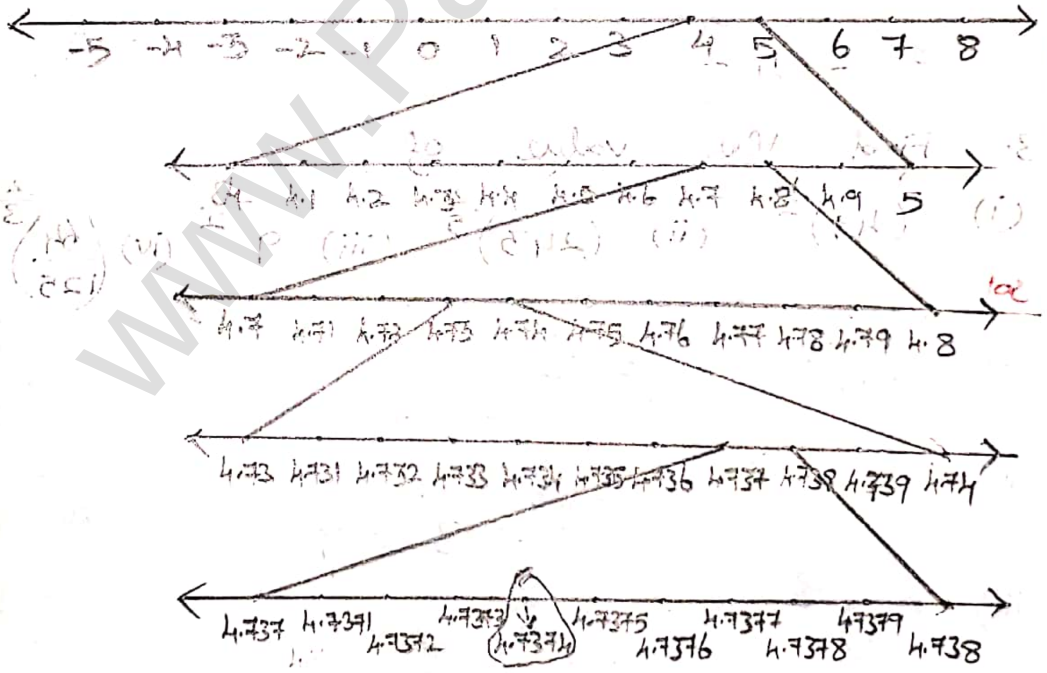
$6.\bar{4} = 6.4444.....$ = 6.444 (up to 3 decimal places)



(iii) $4.\overline{73}$ upto 4 decimal places

$4.\overline{73} = 4.737373......$

$= 4.7373$ (correct to 4 decimal places)



Exercise 2.5

1) Write the following in the form of 5^n.

(i) 625 (ii) $\frac{1}{5}$ (iii) $\sqrt{5}$ (iv) $\sqrt{125}$

Sol

(i) $625 = 5^4$

(ii) $\frac{1}{5} = 5^{-1}$

(iii) $\sqrt{5} = 5^{\frac{1}{2}}$

(iv) $\sqrt{125} = \sqrt{5^3} = 5^{\frac{3}{2}}$

$$\begin{array}{r|l} 5 & 625 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

---

2). Write the following in the form of 4^n.

(i) 16 (ii) 8 (iii) 32.

Sol

(i) $16 =$ ~~2^4~~ 4^2

(ii) $8 = 4\times2 = 4\times\sqrt{4} = 4\times4^{\frac{1}{2}} = 4^{1+\frac{1}{2}} = 4^{\frac{3}{2}}$

(iii) $32 = 4\times8 = 4\times4\times2 = 4^2\times\sqrt{4} = 4^2\times4^{\frac{1}{2}}$

$= 4^{2+\frac{1}{2}} = 4^{\frac{5}{2}}$

$32 = 4^{\frac{5}{2}}$

---

3. Find the value of

(i) $(49)^{\frac{1}{2}}$ (ii) $(243)^{\frac{2}{5}}$ (iii) $9^{-\frac{3}{2}}$ (iv) $\left(\frac{64}{125}\right)^{-\frac{2}{3}}$

Sol

(i) $(49)^{\frac{1}{2}} = (7^{\cancel{2}})^{\frac{1}{\cancel{2}}} = 7$

(ii) $(243)^{\frac{2}{5}} = (3^{\cancel{5}})^{\frac{2}{\cancel{5}}} = 3^2 = 9$

$$\begin{array}{r|l} 3 & 243 \\ \hline 3 & 81 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

(iii) $(9)^{-\frac{3}{2}} = (3^{\cancel{2}})^{-\frac{3}{\cancel{2}}} = 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$

(iv) $\left(\frac{64}{125}\right)^{-\frac{2}{3}} = \left(\frac{4^3}{5^3}\right)^{-\frac{2}{3}} = \left[\left(\frac{4}{5}\right)^3\right]^{-\frac{2}{3}}$

$\left(\frac{64}{125}\right)^{-\frac{2}{3}} = \left(\frac{4}{5}\right)^{-2} = \left(\frac{5}{4}\right)^{2} = \frac{5^2}{4^2} = \frac{25}{16}$

4). Use a fractional index to write:

(i) $\sqrt{5}$ (ii) $\sqrt[2]{7}$ (iii) $\left(\sqrt[3]{49}\right)^5$ (iv) $\left(\frac{1}{\sqrt[3]{100}}\right)^7$

sol

(i) $\sqrt{5} = 5^{\frac{1}{2}}$ (ii) $\sqrt[2]{7} = 7^{\frac{1}{2}}$

(iii) $\left(\sqrt[3]{49}\right)^5 = 49^{\frac{5}{3}}$

(iv) $\left(\frac{1}{\sqrt[3]{100}}\right)^7 = \left[\frac{1}{(100)^{\frac{1}{3}}}\right]^7 = \left[(100)^{-\frac{1}{3}}\right]^7$

$= (100)^{-\frac{7}{3}} = (10^2)^{-\frac{7}{3}} = (10)^{-\frac{14}{3}}$

5). Find the 5th root of

(i) 32 (ii) 243 (iii) 100000 (iv) $\frac{1024}{3125}$

sol:

(i) $\sqrt[5]{32} = \sqrt[5]{2^5} = (2^5)^{\frac{1}{5}} = 2$

(ii) $\sqrt[5]{243} = (243)^{\frac{1}{5}} = (3^5)^{\frac{1}{5}} = 3$

(iii) $\sqrt[5]{100000} = (100000)^{\frac{1}{5}} = (10^5)^{\frac{1}{5}} = 10$

(iv) $\sqrt[5]{\frac{1024}{3125}} = \left(\frac{1024}{3125}\right)^{\frac{1}{5}} = \left(\frac{4^5}{5^5}\right)^{\frac{1}{5}} = \left[\left(\frac{4}{5}\right)^5\right]^{\frac{1}{5}}$

$\sqrt[5]{\frac{1024}{3125}} = \frac{4}{5}$

Exercise 2.6

1). Simplify the following using addition and subtraction properties of surds:

(i) $5\sqrt{3}+18\sqrt{3}-2\sqrt{3}$ (ii) $4\sqrt[3]{5}+2\sqrt[3]{5}-3\sqrt[3]{5}$

(iii) $3\sqrt{75}+5\sqrt{48}-\sqrt{243}$ (iv) $5\sqrt[3]{40}+2\sqrt[3]{625}-3\sqrt[3]{320}$

Sol

(i) $5\sqrt{3}+18\sqrt{3}-2\sqrt{3}=(5+18-2)\sqrt{3}=21\sqrt{3}$

(ii) $4\sqrt[3]{5}+2\sqrt[3]{5}-3\sqrt[3]{5}=(4+2-3)\sqrt[3]{5}=3\sqrt[3]{5}$

(iii) $3\sqrt{75}+5\sqrt{48}-\sqrt{243}$

$=3\sqrt{5^2\times3}+5\sqrt{2^2\times2^2\times3}-\sqrt{3^2\times3^2\times3}$

$=3\times5\sqrt{3}+5\times2\times2\sqrt{3}-3\times3\sqrt{3}$

$=15\sqrt{3}+20\sqrt{3}-9\sqrt{3}$

$=(15+20-9)\sqrt{3}$

$=(35-9)\sqrt{3}$

$=26\sqrt{3}$

5 | 75
5 | 15
3 | 3
1

2 | 48
2 | 24
2 | 12
2 | 6
3 | 3
1.

3 | 243
3 | 81
3 | 27
3 | 9
3 | 3
1

(iv) $5\sqrt[3]{40}+2\sqrt[3]{625}-3\sqrt[3]{320}$

$=5\sqrt[3]{2^3\times5}+2\sqrt[3]{5^3\times5}-3\sqrt[3]{2^3\times2^3\times5}$

$=5\times2\times\sqrt[3]{5}+2\times5\times\sqrt[3]{5}-3\times2\times2\times\sqrt[3]{5}$

$=10\sqrt[3]{5}+10\sqrt[3]{5}-12\sqrt[3]{5}$

$=(10+10-12)\sqrt[3]{5}$

$=(20-12)\sqrt[3]{5}$

$=8\sqrt[3]{5}$.

5 | 40
2 | 8
2 | 4
2 | 2
1

5 | 625
5 | 125
5 | 25
5 | 5
1

5 | 320
2 | 64
2 | 32
2 | 16
2 | 8
2 | 4
2 | 2
1

2. Simplify the following using multiplication and division properties of surds:

(i) $\sqrt{3}\times\sqrt{5}\times\sqrt{2}$ (ii) $\sqrt{35}\div\sqrt{7}$

(iii) $\sqrt[3]{27} \times \sqrt[3]{8} \times \sqrt[3]{125}$ (iv) $(7\sqrt{a} - 5\sqrt{b})(7\sqrt{a} + 5\sqrt{b})$

(v) $\left[\sqrt{\frac{225}{729}} - \sqrt{\frac{25}{144}}\right] \div \sqrt{\frac{16}{81}}$

Sol:

(i) $\sqrt{3} \times \sqrt{5} \times \sqrt{2} = \sqrt{3 \times 5 \times 2} = \sqrt{30}$

(ii) $\sqrt{35} \div \sqrt{7} = \sqrt{\frac{35}{7}} = \sqrt{5}$

(iii) $\sqrt[3]{27} \times \sqrt[3]{8} \times \sqrt[3]{125}$

$= \sqrt[3]{27 \times 8 \times 125}$

$= \sqrt[3]{3^3 \times 2^3 \times 5^3}$

$= 3 \times 2 \times 5$

$= 30$

(iv) $(7\sqrt{a} - 5\sqrt{b})(7\sqrt{a} + 5\sqrt{b})$

$= (7\sqrt{a})^2 - (5\sqrt{b})^2$

$= 49(a) - 25(b)$

$= 49a - 25b.$

(v) $\left[\sqrt{\frac{225}{729}} - \sqrt{\frac{25}{144}}\right] \div \sqrt{\frac{16}{81}}$

$= \left[\sqrt{\frac{15^2}{27^2}} - \sqrt{\frac{5^2}{12^2}}\right] \div \sqrt{\frac{4^2}{9^2}}$

$= \left(\frac{15}{27} - \frac{5}{12}\right) \div \frac{4}{9}$

$= \left(\frac{\cancel{15}^{5}}{\cancel{27}_{9}} - \frac{5}{12}\right) \times \frac{9}{4}$

$= \left(\frac{20 - 15}{36}\right) \times \frac{9}{4}$

$= \frac{5}{\cancel{36}_{4}} \times \frac{\cancel{9}^{1}}{4} = \frac{5}{16}$

$$\begin{array}{r|l} 3 & 729 \\ 3 & 243 \\ 3 & 81 \\ 3 & 27 \\ 3 & 9 \\ 3 & 3 \\ & 1 \end{array}$$

$729 = 3^2 \times 3^2 \times 3^2$

$= (3 \times 3 \times 3)^2$

$729 = 27^2$

$$\begin{array}{r|l} 3 & 9, 12 \\ & 3, 4 \end{array}$$

L.C.M $= 3 \times 3 \times 4$

$= 36.$

3. If $\sqrt{2}=1.414$, $\sqrt{3}=1.732$, $\sqrt{5}=2.236$, $\sqrt{10}=3.162$, then find the values of the following (correct to 3 places of decimals)

(i) $\sqrt{40}-\sqrt{20}$ (ii) $\sqrt{300}+\sqrt{90}-\sqrt{8}$

Sol

(i) $\sqrt{40}-\sqrt{20}$

$= \sqrt{2^2\times 10}-\sqrt{2^2\times 5}$

$= 2\times\sqrt{10}-2\times\sqrt{5}$

$= 2\times 3.162-2\times 2.236$

$= 6.324-4.472$

$= 1.852$

~~$= \sqrt{4\times 10}-\sqrt{2\times 10}$~~

~~$= \sqrt{4}\sqrt{10}-\sqrt{2}\sqrt{10}$~~

~~$= (\sqrt{4}-\sqrt{2})\sqrt{10}$~~

~~$= (2-\sqrt{2})\sqrt{10}$~~

~~$= (2-1.414)\,3.162$~~

~~$= 0$~~

(ii) $\sqrt{300}+\sqrt{90}-\sqrt{8}$

$= \sqrt{3\times 10^2}+\sqrt{3^2\times 10}-\sqrt{2^2\times 2}$

$= 10\sqrt{3}+3\sqrt{10}-2\sqrt{2}$

$= 10(1.732)+3(3.162)-2(1.414)$

$= 17.32+9.486-2.828$

$= 26.806-2.828$

$= 23.978.$

4. Arrange surds in descending order:

(i) $\sqrt[3]{5}, \sqrt[9]{4}, \sqrt[6]{3}$ (ii) $\sqrt[2]{\sqrt[3]{5}}, \sqrt[3]{\sqrt[4]{7}}, \sqrt{\sqrt{3}}$.

Sol

(i) $\sqrt[3]{5}, \sqrt[9]{4}, \sqrt[6]{3}$

The order of $\sqrt[3]{5}$, $\sqrt[9]{4}$, $\sqrt[6]{3}$ are 3, 9, 6.

The L.C.M of 3, 9, 6 is 18.

$3 \,|\, 3, 9, 6$
$1, 3, 2$
L.C.M $= 3\times3\times2$
$= 18.$

$\sqrt[3]{5} = \sqrt[3\times6]{5^6} = \sqrt[18]{15625}$

$\sqrt[9]{4} = \sqrt[9\times2]{4^2} = \sqrt[18]{16}$

$\sqrt[6]{3} = \sqrt[6\times3]{3^3} = \sqrt[18]{27}$.

$5^4 = 625$
$5^6 = 625\times25$
3125
1250
15625

$\sqrt[18]{15625} > \sqrt[18]{27} > \sqrt[18]{16}$

i.e., $\sqrt[3]{5} > \sqrt[6]{3} > \sqrt[9]{4}$.

(ii) $\sqrt[2]{\sqrt[3]{5}}, \quad \sqrt[3]{\sqrt[4]{7}}, \quad \sqrt{\sqrt{3}}$.

The order of the surds $\sqrt[2]{\sqrt[3]{5}}, \sqrt[3]{\sqrt[4]{7}}, \sqrt{\sqrt{3}}$ are 6, 12, 4.

The L.C.M of 6, 12, 4 is 12.

$2 \,|\, 6, 12, 4$
$3 \,|\, 3, 6, 2$
$2 \,|\, 1, 2, 2$
$1, 1, 1$
L.C.M $= 2\times3\times2$
$= 12$

$\sqrt[2]{\sqrt[3]{5}} = \sqrt[6]{5} = \sqrt[6\times2]{5^2} = \sqrt[12]{25}$

$\sqrt[3]{\sqrt[4]{7}} = \sqrt[12]{7} = \quad = \sqrt[12]{7}$

$\sqrt{\sqrt{3}} = \sqrt[4]{3} = \sqrt[4\times3]{3^3} = \sqrt[12]{27}$

$\sqrt[12]{27} > \sqrt[12]{25} > \sqrt[12]{7}$

i.e., $\sqrt{\sqrt{3}} > \sqrt[2]{\sqrt[3]{5}} > \sqrt[3]{\sqrt[4]{7}}$

5. Can you get a pure surd when you find

(i) the sum of two surds

(ii) the difference of two surds

(iii) the product of two surds

(iv). the quotient of two surds.

Justify each answer with an example.

Sol

i) Consider two surds as $7\sqrt{3}$ and $-6\sqrt{3}$.

Their sum is $7\sqrt{3}+(-6\sqrt{3}) = 7\sqrt{3}-6\sqrt{3}$

$= (7-6)\sqrt{3}$

$= 1\sqrt{3}$

$= \sqrt{3}$.

$\therefore \sqrt{3}$ is a pure surds.

Yes, it is possible.

ii) Consider two surds as $5\sqrt{7}$ and $4\sqrt{7}$

Their difference is $5\sqrt{7}-4\sqrt{7} = (5-4)\sqrt{7} = 1\sqrt{7} = \sqrt{7}$.

$\therefore \sqrt{7}$ is a pure surd.

Yes, it is possible.

iii) consider two surds as $\sqrt{2}$ and $\sqrt{3}$

Their Product is $\sqrt{2}\times\sqrt{3} = \sqrt{2\times3} = \sqrt{6}$

$\therefore \sqrt{6}$ is a pure surd, Yes it is possible.

iv). consider two surds as $\sqrt{10}$ and $\sqrt{5}$.

Their quotient is $\sqrt{10}\div\sqrt{5} = \sqrt{\frac{10}{5}} = \sqrt{2}$

$\therefore \sqrt{2}$ is a pure surd, yes it is possible.

---

6). Can you get a rational number when you compute

(i) the sum of two surds (ii) the difference of two surds

(iii) the Product of two surds (iv) the quotient of two surds

Justify each answer with an example.

Sol

(i) Consider two surds as $5+\sqrt{3}$ and $5-\sqrt{3}$

Their sum is $(5+\sqrt{3})+(5-\sqrt{3}) = 5+\cancel{\sqrt{3}}+5-\cancel{\sqrt{3}} = 10$

$\therefore$ 10 is a rational number.

Yes, it is possible.

(ii) consider two surds as $5+\sqrt{3}$ and $2+\sqrt{3}$

Their difference is $(5+\sqrt{3})-(2+\sqrt{3}) = 5+\cancel{\sqrt{3}}-2-\cancel{\sqrt{3}} = 3$

∴ 3 is a rational number.

yes, it is possible.

(iii) consider two surds as $5+\sqrt{3}$ and $5-\sqrt{3}$

Their product is $(5+\sqrt{3})(5-\sqrt{3}) = (5)^2 - (\sqrt{3})^2 = 25-3=22$

∴ 22 is a rational number.

yes, it is possible.

(iv). consider two surds as $5\sqrt{3}$ and $\sqrt{3}$.

Their quotient is $\frac{5\cancel{\sqrt{3}}}{\cancel{\sqrt{3}}} = 5$.

∴ 5 is a rational number.

yes, it is possible.

Exercise 2.7

1). Rationalise the denominator

(i) $\frac{1}{\sqrt{50}}$ (ii) $\frac{5}{3\sqrt{5}}$ (iii) $\frac{\sqrt{75}}{\sqrt{18}}$ (iv) $\frac{3\sqrt{5}}{\sqrt{6}}$

Sol

i) $\frac{1}{\sqrt{50}} = \frac{1}{\sqrt{50}} \times \frac{\sqrt{50}}{\sqrt{50}} = \frac{\sqrt{50}}{50} = \frac{\sqrt{5^2 \times 2}}{50} = \frac{\overset{1}{\cancel{5}}\sqrt{2}}{\underset{10}{\cancel{50}}} = \frac{\sqrt{2}}{10}$

ii) $\frac{5}{3\sqrt{5}} = \frac{5}{3\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{\cancel{5}\sqrt{5}}{3(\cancel{5})} = \frac{\sqrt{5}}{3}$

iii) $\frac{\sqrt{75}}{\sqrt{18}} = \sqrt{\frac{\overset{25}{\cancel{75}}}{\underset{6}{\cancel{18}}}} = \sqrt{\frac{25}{6}} = \frac{\sqrt{25}}{\sqrt{6}} = \frac{5}{\sqrt{6}} = \frac{5}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} = \frac{5\sqrt{6}}{6}$

iv) $\frac{3\sqrt{5}}{\sqrt{6}} = \frac{3\sqrt{5}}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} = \frac{\overset{1}{\cancel{3}}\sqrt{30}}{\underset{2}{\cancel{6}}} = \frac{\sqrt{30}}{2}$

2). Rationalise the denominator and simplify

(i) $\frac{\sqrt{48}+\sqrt{32}}{\sqrt{27}-\sqrt{18}}$ (ii) $\frac{5\sqrt{3}+\sqrt{2}}{\sqrt{3}+\sqrt{2}}$ (iii) $\frac{2\sqrt{6}-\sqrt{5}}{3\sqrt{5}-2\sqrt{6}}$

(iv) $\frac{\sqrt{5}}{\sqrt{6}+2} - \frac{\sqrt{5}}{\sqrt{6}-2}$

Sol

(i) $$\frac{\sqrt{48}+\sqrt{32}}{\sqrt{27}-\sqrt{18}}$$

$$\begin{array}{r|l} 2 & 48 \\ 2 & 24 \\ 2 & 12 \\ 2 & 6 \\ 3 & 3 \\ & 1 \end{array} \qquad \begin{array}{r|l} 3 & 27 \\ 3 & 9 \\ 3 & 3 \\ & 1 \end{array} \qquad \begin{array}{r|l} 2 & 18 \\ 3 & 9 \\ 3 & 3 \\ & 1 \end{array} \qquad \begin{array}{r|l} 2 & 32 \\ 2 & 16 \\ 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ & 1 \end{array}$$

$$= \frac{\sqrt{48}+\sqrt{32}}{\sqrt{27}-\sqrt{18}} \times \frac{\sqrt{27}+\sqrt{18}}{\sqrt{27}+\sqrt{18}}$$

$$= \frac{\sqrt{48\times27}+\sqrt{48\times18}+\sqrt{32\times27}+\sqrt{32\times18}}{(\sqrt{27})^2-(\sqrt{18})^2}$$

$$= \frac{\sqrt{(2^2\times2^2\times\cancel{2\times}3)\times(3^2\times3)}+\sqrt{(2^2\times2^2\times3)\times(3^2\times2)} + \sqrt{(2^2\times2^2\times2)\times(3^2\times3)}+\sqrt{(2^2\times2^2\times2)\times(3^2\times2)}}{27-18}$$

$$= \frac{\sqrt{2^2\times2^2\times3^2\times3^2}+\sqrt{2^2\times2^2\times3^2\times6}+\sqrt{2^2\times2^2\times3^2\times6}+\sqrt{2^2\times2^2\times2^2\times3^2}}{9}$$

$$= \frac{2\times2\times3\times3+2\times2\times3\sqrt{6}+2\times2\times3\sqrt{6}+2\times2\times2\times3}{9}$$

$$= \frac{36+12\sqrt{6}+12\sqrt{6}+24}{9}$$

$$= \frac{60+24\sqrt{6}}{9}$$

$$= \frac{\overset{1}{\cancel{3}}(20+8\sqrt{6})}{\underset{3}{\cancel{9}}} = \frac{20+8\sqrt{6}}{3} = \frac{4}{3}(5+2\sqrt{6})$$

Scanned with CamScanner

(ii) $\frac{5\sqrt{3}+\sqrt{2}}{\sqrt{3}+\sqrt{2}}$

$= \frac{5\sqrt{3}+\sqrt{2}}{\sqrt{3}+\sqrt{2}} \times \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}-\sqrt{2}}$

$= \frac{5(\sqrt{3})^2 - 5\sqrt{6} + \sqrt{6} - (\sqrt{2})^2}{(\sqrt{3})^2 - (\sqrt{2})^2}$

$= \frac{5(3) - 4\sqrt{6} - 2}{3-2}$

$= \frac{15 - 4\sqrt{6} - 2}{1}$

$= 13 - 4\sqrt{6}$

(iii) $\frac{2\sqrt{6}-\sqrt{5}}{3\sqrt{5}-2\sqrt{6}}$

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

$= \frac{6\sqrt{30} + 4(6) - 3(5) - 2\sqrt{30}}{9(5) - 4(6)}$

$= \frac{6\sqrt{30} - 2\sqrt{30} + 24 - 15}{45-24}$

$= \frac{4\sqrt{30}+9}{21}$

$= \frac{9+4\sqrt{30}}{21}$

(iv). $\frac{\sqrt{5}}{\sqrt{6}+2} - \frac{\sqrt{5}}{\sqrt{6}-2}$

$$= \frac{\sqrt{5}(\sqrt{6}-2) - \sqrt{5}(\sqrt{6}+2)}{(\sqrt{6})^2 - (2)^2}$$

$$= \frac{\cancel{\sqrt{30}} - 2\sqrt{5} - \cancel{\sqrt{30}} - 2\sqrt{5}}{6-4}$$

$$= -\frac{\overset{2}{\cancel{4}}\sqrt{5}}{\cancel{2}_1}$$

$$= -2\sqrt{5}$$

3. Find the value of a and b if $\frac{\sqrt{7}-2}{\sqrt{7}+2} = a\sqrt{7}+b$.

Sol

$$\frac{\sqrt{7}-2}{\sqrt{7}+2} = a\sqrt{7}+b$$

$$\frac{\sqrt{7}-2}{\sqrt{7}+2} \times \frac{\sqrt{7}-2}{\sqrt{7}-2} = a\sqrt{7}+b$$

$$\frac{(\sqrt{7}-2)^2}{(\sqrt{7})^2-(2)^2} = a\sqrt{7}+b$$

$$\frac{(\sqrt{7})^2 - 2(\sqrt{7})(2) + (2)^2}{7-4} = a\sqrt{7}+b$$

$$\frac{7 - 4\sqrt{7} + 4}{3} = a\sqrt{7}+b$$

$$\frac{11 - 4\sqrt{7}}{3} = a\sqrt{7}+b$$

$$\frac{11}{3} - \frac{4}{3}\sqrt{7} = a\sqrt{7}+b.$$

$$-\frac{4}{3}\sqrt{7} + \frac{11}{3} = a\sqrt{7}+b.$$

Here $a = -\frac{4}{3}$ and $b = \frac{11}{3}$.

4). If $x = \sqrt{5}+2$, then find the value of $x^2 + \frac{1}{x^2}$

Sol

Given $x = \sqrt{5}+2$.

$$x^2 = (\sqrt{5}+2)^2 = (\sqrt{5})^2 + 2(\sqrt{5})(2) + (2)^2 = 5+4\sqrt{5}+4.$$

$$x^2 = 9+4\sqrt{5}$$

$$\frac{1}{x^2} = \frac{1}{9+4\sqrt{5}} = \frac{1}{9+4\sqrt{5}} \times \frac{9-4\sqrt{5}}{9-4\sqrt{5}}$$

$$= \frac{9-4\sqrt{5}}{81-16(5)} = \frac{9-4\sqrt{5}}{81-80} = \frac{9-4\sqrt{5}}{1}$$

$$\therefore \frac{1}{x^2} = 9-4\sqrt{5}.$$

$$\therefore x^2 + \frac{1}{x^2} = (9+4\sqrt{5}) + (9-4\sqrt{5}) = 9+\cancel{4\sqrt{5}}+9-\cancel{4\sqrt{5}} = 18$$

5). Given $\sqrt{2} = 1.414$, find the value of $\frac{8-5\sqrt{2}}{3-2\sqrt{2}}$ (to 3 places of decimals).

Sol

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

$$= \frac{24+16\sqrt{2}-15\sqrt{2}-10(2)}{9-4(2)}$$

$$\frac{8-5\sqrt{2}}{3-2\sqrt{2}} = \frac{24+16\sqrt{2}-15\sqrt{2}-20}{9-8}$$

$$= \frac{4+1\sqrt{2}}{1}$$

$$\therefore \frac{8-5\sqrt{2}}{3-2\sqrt{2}} = 4+\sqrt{2}$$

$$= 4+1.414$$

$$= 5.414$$

Exercise 2.8

1. Represent the following numbers in the scientific notation:

(i) 569430000000 (ii) 2000.57

(iii) 0.0000006000 (iv) 0.0009000002

Sol

(i) 569430000000 $= 5.6943 \times 10^{11}$

(ii) 2000.57 $= 2.00057 \times 10^{3}$

(iii) 0.0000006000 $= 6.0 \times 10^{-7}$

(iv) 0.0009000002 $= 9.000002 \times 10^{-4}$

2. Write the following numbers in decimal form:

(i) 3.459×10^{6} (ii) 5.678×10^{4}

(iii) 1.0005×10^{-5} (iv) 2.530009×10^{-7}

Sol

(i) $3.459 \times 10^{6} = 3459000$

(ii) $5.678 \times 10^{4} = 56780$

(iii) $1.0005 \times 10^{-5} = 0.000010005$

(iv) $2.530009 \times 10^{-7} = 0.000000253009$

3. Represent the following numbers in scientific notation:

(i) $(300000)^2 \times (20000)^4$ (ii) $(0.000001)^{11} \div (0.005)^3$

(iii) $\{(0.00003)^6 \times (0.00005)^4\} \div \{(0.009)^3 \times (0.05)^2\}$

Sol

(i) $(300000)^2 \times (20000)^4$

$= (3.0 \times 10^5)^2 \times (2.0 \times 10^4)^4$

$= 9.0 \times 10^{10} \times 16.0 \times 10^{16}$

$= 144.0 \times 10^{10} \times 10^{16}$

$= 1.44 \times 10^2 \times 10^{10} \times 10^{16}$

$= 1.44 \times 10^{2+10+16}$

$= 1.44 \times 10^{28}$

(ii) $(0.000001)^{11} \div (0.005)^3$

$= \dfrac{(0.000001)^{11}}{(0.005)^3}$

$= \dfrac{(1.0 \times 10^{-6})^{11}}{(5.0 \times 10^{-3})^3}$

$= \dfrac{1.0 \times 10^{-66}}{125.0 \times 10^{-9}}$

$= \dfrac{1.0 \times 10^{-66}}{1.25 \times 10^2 \times 10^{-9}}$

$= \dfrac{1.00}{1.25} \times 10^{-66-2+9}$

$= \frac{4}{5} \times 10^{-59}$

$= 0.8 \times 10^{-59}$

$= 8.0 \times 10^{-1} \times 10^{-59}$

$= 8.0 \times 10^{-60}$

iii) $\{(0.00003)^6 \times (0.00005)^4\} \div \{(0.009)^3 \times (0.05)^2\}$

$= \dfrac{(0.00003)^6 \times (0.00005)^4}{(0.009)^3 \times (0.05)^2}$

$= \dfrac{(3.0 \times 10^{-5})^6 \times (5.0 \times 10^{-5})^4}{(9.0 \times 10^{-3})^3 \times (5.0 \times 10^{-2})^2}$

$= \dfrac{3^6 \times 10^{-30} \times 5^4 \times 10^{-20}}{9^3 \times 10^{-9} \times 5^2 \times 10^{-4}}$

$= \dfrac{3^6 \times 5^4 \times 10^{-30-20}}{(3^2)^3 \times 5^2 \times 10^{-9-4}} = \dfrac{\cancel{3^6} \times 5^4 \times 10^{-50}}{\cancel{3^6} \times 5^2 \times 10^{-13}} = 5^{4-2} \times 10^{-50+13}$

$= 5^2 \times 10^{-37} = 25 \times 10^{-37} = 2.5 \times 10^1 \times 10^{-37} = 2.5 \times 10^{-36}$

4. Represent the following information in scientific notation:

(i). The world population is nearly 7000,000,000

(ii) One light year means the distance 9460528400000000 ~~kg~~. km

(iii) Mass of an electron is 0.000 000 000 000 000 000 000 000 000 0009109382 kg

Sol

(i) The world population is nearly 7,000,000,000.

$= 7.0 \times 10^9$

(ii) One light year means the distance 9460528400000000 k~~g~~m $= 9.4605284 \times 10^{15}$ km

(iii) Mass of an electron is

0.000 000 000 000 000 000 000 000 000 000 9109382 kg

$= 9.1093822 \times 10^{-31}$ kg.

5. Simplify:

(i) $(2.75 \times 10^7) + (1.23 \times 10^8)$ (ii) $(1.598 \times 10^{17}) - (4.58 \times 10^{15})$

(iii) $(1.02 \times 10^{10}) \times (1.20 \times 10^{-3})$ (iv) $(8.41 \times 10^4) \div (4.3 \times 10^5)$

Sol

(i) $(2.75 \times 10^7) + (1.23 \times 10^8)$

$= 27500000 + 123000000$

$= 150500000$

$= 1.505 \times 10^8$

$$\begin{array}{r} \overset{1}{2}7500000 \\ 123000000 \\ \hline 150500000 \\ \hline \end{array}$$

(ii) $1.598 \times 10^{17} - 4.58 \times 10^{15}$

$= 1.598 \times 10^2 \times 10^{15} - 4.58 \times 10^{15}$

$= 159.8 \times 10^{15} - 4.58 \times 10^{15}$

$= (159.8 - 4.58) \times 10^{15}$

$= 155.22 \times 10^{15} = 1.5522 \times 10^2 \times 10^{15} = 1.5522 \times 10^{17}$

$$\begin{array}{r} 159.\overset{7}{8}\overset{10}{0} \\ 4.58 \\ \hline 155.22 \\ \hline \end{array}$$

(iii) $(1.02 \times 10^{10}) \times (1.20 \times 10^{-3})$

$= 1.02 \times 1.20 \times 10^{10} \times 10^{-3}$

$= 1.224 \times 10^{7}$

102×120
204
102
1,2240

(iv) $(8.41 \times 10^{4}) \div (4.3 \times 10^{5})$

$= \dfrac{8.41 \times 10^{4}}{4.3 \times 10^{5}}$

$= \dfrac{841 \times 10^{-2} \times 10^{4}}{43 \times 10^{-1} \times 10^{5}}$

$= \dfrac{841}{43} \times 10^{-2+4+1-5}$

$= 19.558 \times 10^{-2}$

$= 1.9558 \times 10^{1} \times 10^{-2}$

$= 1.9558 \times 10^{-1}$

19.558
43) 841
(-) 43
411
(-) 387
240
(-) 215
250
(-) 215
350
(-) 344
60

4	3	43
8	6	86
12	9	129
16	12	172
20	15	215
24	18	258
28	21	301
32	24	344
36	27	387
40	30	430

Exercise 2.9

Multiple Choice Questions:

1). If n is a natural number then $\sqrt{n}$ is

(a) always a natural number (b) always an irrational number
(c) always a rational number (d) may be rational or irrational

Ans: (d). may be rational or irrational.

2). Which of the following is not true?

(a). Every rational number is a real number.
(b). Every integer is a rational number.
(c) Every real number is an irrational number.
(d) Every natural number is a whole number.

Real number contain rationals and irrationals.

Ans: (c). Every real number is an irrational number.

3). which one of the following, regarding Sum of two irrational numbers, is true?

(a) always an irrational number
(b) may be a rational or irrational number.
(c) always a rational number.
(d) always an integer.

Ans : (b). may be a rational or irrational number.

4). Which one of the following has a terminating decimal expansion? (a) $\frac{5}{64}$ (b) $\frac{8}{9}$ (c) $\frac{14}{15}$ (d) $\frac{1}{12}$.

Terminating decimal expansion form $\frac{P}{2^m \times 5^n}$.

(a) $\frac{5}{2^6 \times 5^0}$ (b) $\frac{8}{3^2}$ (c) $\frac{14}{3^1 \times 5^1}$ (d) $\frac{1}{3^1 \times 2^2}$

Ans : (a). $\frac{5}{64}$

5). Which one of the following is an irrational Number? (a) $\sqrt{25}$ (b) $\sqrt{\frac{9}{4}}$ (c) $\frac{7}{11}$ (d) π

(a). $\sqrt{25} = 5$ (b) $\sqrt{\frac{9}{4}} = \frac{3}{2}$ (c) $\frac{7}{11} = 0.63\overline{54}$ (d) π

π represents a irrational number.

Ans : (d) π

6). An irrational number between 2 and 2.5 is
(a) $\sqrt{11}$ (b) $\sqrt{5}$ (c) $\sqrt{2.5}$ (d) $\sqrt{8}$

$2^2 = 4$ and $2.5^2 = 6.25$ **Ans :** (b) $\sqrt{5}$

7). The smallest rational number by which $\frac{1}{3}$ should be multiplied so that its decimal expansion terminates after one place of decimal is ____ (a) $\frac{1}{10}$ (b) $\frac{3}{10}$ (c) 3 (d) 30.

(a) $\frac{1}{3} \times \frac{1}{10} = \frac{1}{30} = 0.0\overline{3}$ (b) $\frac{1}{3} \times \frac{3}{10} = \frac{1}{10} = 0.1$

(c) $\frac{1}{3} \times 3 = 1$ (d) $\frac{1}{3} \times 30 = 10$

Ans : (b). $\frac{3}{10}$

(8). If $\frac{1}{7} = 0.\overline{142857}$ then the value of $\frac{5}{7}$ is ___

(a) $0.\overline{142857}$ (b) $0.\overline{714285}$ (c) $0.\overline{571428}$ (d) 0.714285

$5 \times \frac{1}{7} = 5 \times 0.\overline{142857} = 0.\overline{714285}$ Ans: (b). $0.\overline{714285}$

9). Find the odd one out of the following

(a) $\sqrt{32} \times \sqrt{2}$ (b). $\frac{\sqrt{27}}{\sqrt{3}}$ (c) $\sqrt{72} \times \sqrt{8}$ (d) $\frac{\sqrt{54}}{\sqrt{8}}$

(a) $\sqrt{32} \times \sqrt{2} = \sqrt{64} = 8$ (b) $\frac{\sqrt{27}}{\sqrt{3}} = \sqrt{\frac{27}{3}} = \sqrt{9} = 3$

(c) $\sqrt{72} \times \sqrt{8} = \sqrt{9 \times 8 \times 8} = \sqrt{3^2 \times 8^2} = \sqrt{24^2} = 24$

(d). $\frac{\sqrt{54}}{\sqrt{18}} = \sqrt{\frac{54}{18}} = \sqrt{\frac{6}{2}} = \sqrt{3}$ Ans: (d) $\frac{\sqrt{54}}{\sqrt{84}}$

10. $0.\overline{34} + 0.3\overline{4} =$ ___ (a) $0.6\overline{87}$ (b) $0.\overline{68}$ (c) $0.6\overline{8}$ (d) $0.68\overline{7}$

$0.\overline{34} + 0.3\overline{4} = 0.343434 + 0.34444 \ldots$

$= 0.6878787 \ldots$

$= 0.6\overline{87}$

$0.343434 \ldots$

$(+)\ 0.344444 \ldots$

0.687878

Ans: (a) $0.6\overline{87}$

11. Which of the following statement is false?

(a) The square root of 25 is 5 or −5

(b) $\sqrt{25} = 5$ (c) $-\sqrt{25} = -5$ (d) $\sqrt{25} = \pm 5$.

Ans: (d) $\sqrt{25} = \pm 5$.

12. Which one of the following is not a rational number? (a) $\sqrt{\frac{8}{18}}$ (b) $\frac{7}{3}$ (c) $\sqrt{0.01}$ (d) $\sqrt{13}$

(a) $\sqrt{\frac{8}{18}} = \sqrt{\frac{4}{9}} = \frac{2}{3} = 0.\overline{6}$ (b) $\frac{7}{3} = 2.\overline{3}$ (c) $\sqrt{0.01} = \sqrt{\frac{1}{100}} = \frac{1}{10} = 0.1$

(d) $\sqrt{13}$, 13 is not a perfect square.

Ans: (d). $\sqrt{13}$

13. $\sqrt{27} + \sqrt{12} =$ ___ (a) $\sqrt{39}$ (b) $5\sqrt{6}$ (c) $5\sqrt{3}$ (d) $3\sqrt{5}$

$\sqrt{27} + \sqrt{12} = \sqrt{3^2 \times 3} + \sqrt{2^2 \times 3} = 3\sqrt{3} + 2\sqrt{3} = (3+2)\sqrt{3} = 5\sqrt{3}$

Ans: (c). $5\sqrt{3}$.

14. If $\sqrt{80} = k\sqrt{5}$, then $k =$ ___ (a) 2 (b) 4 (c) 8 (d) 16

$\sqrt{80} = k\sqrt{5} \Rightarrow \sqrt{4^2 \times 5} = k\sqrt{5} \Rightarrow 4\sqrt{5} = k\sqrt{5} \Rightarrow \boxed{k=4}$ Ans: (b). 4

15. $4\sqrt{7} \times 2\sqrt{3} =$ ____ (a) $6\sqrt{10}$ (b) $8\sqrt{21}$ (c) $8\sqrt{10}$ (d). $6\sqrt{21}$

Ans: (b) $8\sqrt{21}$

$4\sqrt{7} \times 2\sqrt{3} = 8\sqrt{21}$.

16. When written with a rational denominator, the expression $\frac{2\sqrt{3}}{3\sqrt{2}}$ can be simplified as ____

(a) $\frac{\sqrt{2}}{3}$ (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{\sqrt{6}}{3}$ (d) $\frac{2}{3}$

$\frac{2\sqrt{3}}{3\sqrt{2}} = \frac{2\sqrt{3}}{3\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\cancel{2}\sqrt{6}}{3(\cancel{2})} = \frac{\sqrt{6}}{3}$ Ans: (c). $\frac{\sqrt{6}}{3}$.

17. When $(2\sqrt{5} - \sqrt{2})^2$ is simplified, we get

(a) $4\sqrt{5}+2\sqrt{2}$ (b) $22-4\sqrt{10}$ (c) $8-4\sqrt{10}$ (d) $2\sqrt{10}-2$

$(2\sqrt{5} - \sqrt{2})^2 = 4(5) - 2(2\sqrt{5})(\sqrt{2}) + 2 = 20 - 4\sqrt{10} + 2$

$= 22 - 4\sqrt{10}$ Ans: (b) $22-4\sqrt{10}$

18. $(0.000729)^{-\frac{3}{4}} \times (0.09)^{-\frac{3}{4}} =$ ____.

(a) $\frac{10^3}{3^3}$ (b) $\frac{10^5}{3^5}$ (c) $\frac{10^2}{3^2}$ (d) $\frac{10^6}{3^6}$

$(0.000729)^{-\frac{3}{4}} \times (0.09)^{-\frac{3}{4}}$

$= (729 \times 10^{-6})^{-\frac{3}{4}} \times (9 \times 10^{-2})^{-\frac{3}{4}}$

$= (9^3 \times 10^{-6})^{-\frac{3}{4}} \times (9 \times 10^{-2})^{-\frac{3}{4}}$

$= 9^{-\frac{9}{4}} \times 10^{+\frac{18}{4}} \times 9^{-\frac{3}{4}} \times 10^{\frac{6}{4}}$

$= 9^{-\frac{9}{4}-\frac{3}{4}} \times 10^{\frac{18}{4}+\frac{6}{4}}$

$= 9^{-\frac{12}{4}} \times 10^{\frac{24}{4}} = 9^{-3} \times 10^{6} = (3^2)^{-3} \times 10^{6} = 3^{-6} \times 10^{6}$

$= \frac{10^6}{3^6}$ Ans: (d) $\frac{10^6}{3^6}$

19. If $\sqrt{9^x} = \sqrt[3]{9^2}$ then $x =$ ____ (a) $\frac{2}{3}$ (b) $\frac{4}{3}$ (c) $\frac{1}{3}$ (d) $\frac{5}{3}$

$\sqrt{9^x} = \sqrt[3]{9^2} \Rightarrow 9^{\frac{x}{2}} = 9^{\frac{2}{3}} \Rightarrow \frac{x}{2} = \frac{2}{3} \Rightarrow x = \frac{4}{3}$ Ans (b) $\frac{4}{3}$

20. The length and breadth of a rectangular plot are 5×10^5 and 4×10^4 meters respectively. Its area is ____ (a) $9 \times 10^1 m^2$ (b) $9 \times 10^9 m^2$

(c) $2\times10^{10}\ m^2$ (d) $20\times10^{20}\ m^2$

Area = $l \times b$

$= 5\times10^5 \times 4\times10^4\ m^2$

$= 20 \times 10^5\times10^4\ m^2$

$= 2\times10 \times 10^5\times10^4\ m^2$

$= 2\times10^{1+5+4}\ m^2$

Area = $2\times10^{10}\ m^2$

Ans : (c). $2\times10^{10}\ m^2$