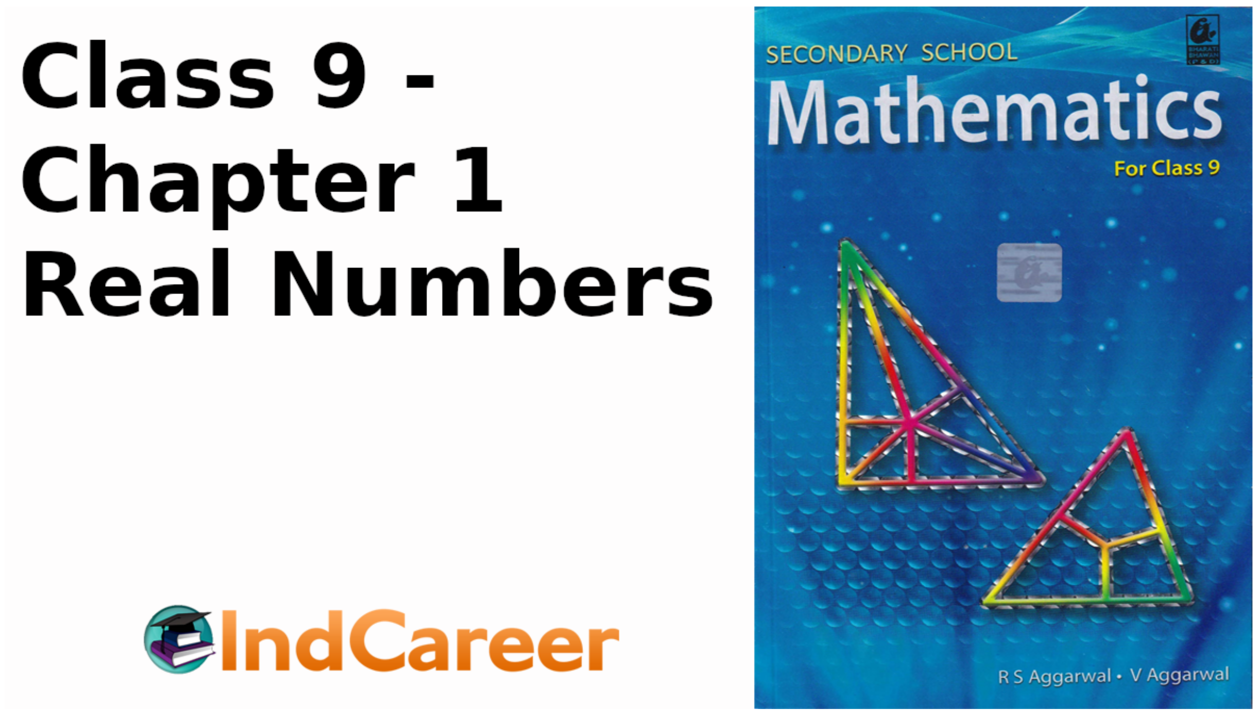
RS Aggarwal Solutions for Class 9 Maths Chapter 1–Real Numbers



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RS Aggarwal Solutions for Class 9 Maths Chapter 1–Real Numbers

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RS Aggarwal 9th Maths Chapter 1, Class 9 Maths Chapter 1 solutions

Ex 1A

Question 1.

Solution:

A number in the form of pq where p and q are integers and q ≠ 0, is called a rational number

$$e.g.\ \frac{3}{4},\frac{8}{7},\frac{1}{5},\frac{8}{1},\frac{0}{1},\frac{18}{15},\frac{17}{19},\frac{23}{7},\frac{1}{9},\frac{4}{11}.$$

are all rational numbers.

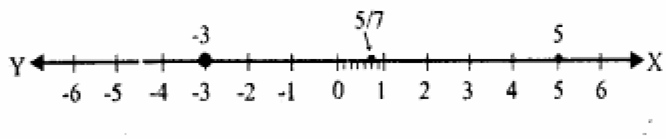
Question 2.

Solution:

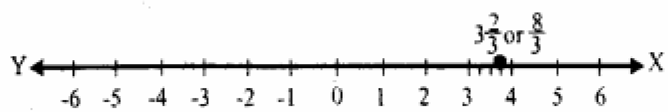
The given rational number are represented on a number line on given below :

(*i*) 5 (*ii*) -3

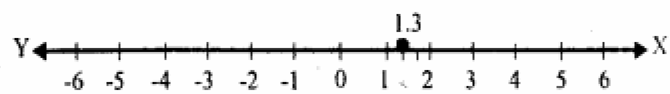
(*iii*) $\frac{5}{7}$



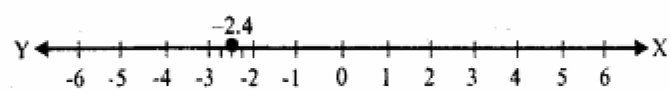
(*iv*) $\frac{8}{3} = 2\frac{2}{3}$



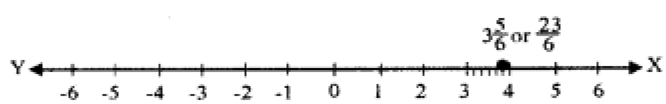
(*v*) 1.3



(*vi*) -2.4



(*vii*) $\frac{23}{6} = 3\frac{5}{6}$



Question 3.

Solution:

We know that, if a and b are two rational numbers, then a rational number between a and b will be

$\frac{1}{2}(a + b)$, Hence.

(*i*) One rational number between $\frac{1}{4}$ and $\frac{1}{3}$

$$= \frac{1}{2}\left[\frac{1}{4}+\frac{1}{3}\right]=\frac{1}{2}\left(\frac{3+4}{12}\right) = \frac{1}{2}\times\frac{7}{12}=\frac{7}{24}$$

(*ii*) One rational number between $\frac{3}{8}$ and $\frac{2}{5}$.

$$= \frac{1}{2}\left[\frac{3}{8}+\frac{2}{5}\right]=\frac{1}{2}\left[\frac{15+16}{40}\right] = \frac{1}{2}\times\frac{31}{40}=\frac{31}{80}$$

(*iii*) One rational number between 1.3 and 1.4

$$= \frac{1}{2}[1.3 + 1.4] = \frac{1}{2} \times 2.7 = 1.35$$

(*iv*) One rational number between 0.75 and 1.2

$$= \frac{1}{2}[0.75 + 1.2] = \frac{1}{2} \times 1.95 = 0.975$$

(*v*) One rational number between –1 and $\frac{1}{2}$

$$= \frac{1}{2}\left[-1 + \frac{1}{2}\right] = \frac{1}{2} \times \left(-\frac{1}{2}\right) = -\frac{1}{4}$$

(*vi*) One rational number between $\frac{-3}{4}$ and $\frac{-2}{5}$

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

$$= -\frac{1}{2}\left[\frac{3}{4}+\frac{2}{5}\right] = -\frac{1}{2}\left(\frac{15+8}{20}\right)$$

$$= -\frac{1}{2}\times\frac{23}{20} = -\frac{23}{40} \text{ Ans.}$$

Question 4.

Solution:

Here, n = 3, x = 15, y = 14

$$\therefore d = \frac{y-x}{n+1} = \frac{\frac{1}{4}-\frac{1}{5}}{3+1} = \frac{\frac{5-4}{20}}{4} = \frac{\frac{1}{20}}{4}$$

$$= \frac{1}{20 \times 4} = \frac{1}{80}$$

$\therefore$ First rational number $= x + d$

$$= \frac{1}{5} + \frac{1}{80} = \frac{16+1}{80} = \frac{17}{80}$$

Second rational number $= x + 2d$

$$= \frac{1}{5} + \frac{2}{80} = \frac{16+2}{80} = \frac{18}{80}$$

and third rational number $= x + 3d$

$$= \frac{1}{5} + \frac{3}{80} = \frac{16+3}{80} = \frac{19}{80}$$

Hence, three rational numbers are

$\frac{17}{80}, \frac{18}{80}, \frac{19}{80}$ Ans.

Question 5.

Solution:

Here, n=5, x = 25, y = 34

$$\therefore\ d = \frac{y-x}{n+1} = \frac{\frac{3}{4}-\frac{2}{5}}{5+1} = \frac{\frac{15-8}{20}}{6} = \frac{\frac{7}{20}}{6}$$

$$= \frac{7}{20\times 6} = \frac{7}{120}$$

Now, first rational number = $x + d$

$$= \frac{2}{5}+\frac{7}{120} = \frac{48+7}{120} = \frac{55}{120}$$

Second rational number = $x + 2d$

$$= \frac{2}{5}+\frac{2\times 7}{120} = \frac{2}{5}+\frac{14}{120}$$

$$= \frac{48+14}{120} = \frac{62}{120}$$

Third rational number = $x + 3d$

$$= \frac{2}{5}+\frac{3\times 7}{120} = \frac{2}{5}+\frac{21}{120} = \frac{48+21}{120} = \frac{69}{120}$$

Fourth rational number = $x + 4d$

$$= \frac{2}{5}+\frac{4\times 7}{120} = \frac{2}{5}+\frac{28}{120} = \frac{48+28}{120} = \frac{76}{120}$$

Fifth rational number = $x + 5d$

$$= \frac{2}{5}+\frac{5\times 7}{120} = \frac{2}{5}+\frac{35}{120} = \frac{48+35}{120} = \frac{83}{120}$$

Hence, five rational numbers are $\frac{55}{120}, \frac{62}{120}, \frac{69}{120}, \frac{76}{120}$ and $\frac{83}{120}$

Question 6.

Solution:

Here, n = 6, x = 3, y = 4

$$\therefore\ d = \frac{y-x}{n+1} = \frac{4-3}{6+1} = \frac{1}{7}$$

$\therefore$ First rational number $= x + d$

$$= 3 + \frac{1}{7} = \frac{21+1}{7} = \frac{22}{7}$$

Second rational number $= x + 2d$

$$= 3 + \frac{2\times 1}{7} = 3 + \frac{2}{7} = \frac{21+2}{7} = \frac{23}{7}$$

Third rational number $= x + 3d$

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

Fourth rational number $= x + 4d$

$$= 3 + \frac{4\times 1}{7} = 3 + \frac{4}{7} = \frac{21+4}{7} = \frac{25}{7}$$

Fifth rational number $= x + 5d$

$$= 3 + \frac{5\times 1}{7} = 3 + \frac{5}{7} = \frac{21+5}{7} = \frac{26}{7}$$

Sixth rational number $= x + 6d$

$$= 3 + \frac{6\times 1}{7} = 3 + \frac{6}{7} = \frac{21+6}{7} = \frac{27}{7}$$

Hence, six rational numbers are

$$\frac{22}{7}, \frac{23}{7}, \frac{24}{7}, \frac{25}{7}, \frac{26}{7} \text{ and } \frac{27}{7} \text{ Ans.}$$

Question 7.

Solution:

Here, $n = 16$, $x = 2.1$, $y = 2.2$

$$\therefore\ d = \frac{y-x}{n+1} = \frac{2.2-2.1}{16+1} = \frac{0.1}{17} = 0.005$$

$\therefore$ First rational number $= x + d$

$= 2.1 + 0.005$

Second rational number $= x + 2d$

$= 2.1 + 2 \times 0.005$

$= 2.1 + 0.01 = 2.11$

Third rational number $= x + 3d$

$= 2.1 + 3 \times 0.005$

$= 2.1 + 0.015 = 2.115$

Fourth rational number $= x + 4d$

$= 2.1 + 4 \times 0.005$

$= 2.1 + 0.02 = 2.12$

Fifth rational number $= x + 5d$

$= 2.1 + 5 \times 0.005$

$= 2.1 + 0.025 = 2.125$

Sixth rational number $= x + 6d$

$= 2.1 + 6 \times 0.005$

$= 2.1 + 0.03 = 2.13$

Seventh rational number $= x + 7d$

$= 2.1 + 7 \times 0.005$

$= 2.1 + 0.035 = 2.135$

Similarly, other rational numbers will be.

$x + 8d, x + 9d, x + 10d, x + 11d, x + 12d,$

$x + 13d, x + 14d, x + 15d$ and $x + 16d$

or $(2.1 + 0.04), (2.1 + 0.045), (2.1 + 0.05),$

$(2.1 + 0.055), (2.1 + 0.06), (2.1 + 0.065),$

$(2.1 + 0.07), (2.1 + 0.075)$ and $(2.1 + 0.08)$

$\Rightarrow$ 2.14, 2.145, 2.15, 2.155, 2.16, 2.165, 2.17, 2.175 and 2.18

Hence 16 rational numbers will be.

2.105, 2.11, 2.115, 2.12, 2.125, 2.13, 2.135, 2.14, 2.145, 2.15, 2.155, 2.16, 2.165, 2.17, 2.175 and 2.18 Ans.

Ex 1 B

Question 1.

Solution:

We know that a fraction pq is terminating if prime factors of q are 2 and 5 only.

Hence.

(i) 1380 and 16125 are the terminating decimals.

Question 2.

Solution:

(i) $\frac{5}{8} = 0.625$

```
8)5.000(0.625
  48
  --
   20
   16
   --
    40
    40
    --
     ×
```

(ii) $\frac{9}{16} = 0.5625$ Ans.

```
16)9.0000(0.5625
   80
   ---
   100
    96
   ---
     40
     32
     --
     80
     80
     --
      ×
```

(iii) $\frac{7}{25} = 0.28$

```
25)7.00(0.28
   50
   ---
   200
   200
   ---
    ×
```

(iv) $\frac{11}{24} = 0.458333... = 0.458\overline{3}$

```
24)11.000000(0.458333...
   96
   ---
   140
   120
   ---
    200
    192
    ---
      80
      72
      --
      80
      72
      --
      80
      72
      --
       8
```

(v) $2\frac{5}{12} = 2.41666....$

$= 2.41\overline{6}$

$$
\begin{array}{r}
12\overline{)5.00000}(0.41666.... \\
\underline{48} \\
20 \\
\underline{12} \\
80 \\
\underline{72} \\
80 \\
\underline{72} \\
80 \\
\underline{72} \\
\underline{8}
\end{array}
$$

Question 3.

Solution:

(i) Let,x = $0.\overline{3}$ = 0.3333…(i)

Then, 10x = 3.3333….

$$9x = 3 \quad \Rightarrow \quad x = \frac{3}{9} = \frac{1}{3}$$

$\therefore\ 0.\overline{3} = \frac{1}{3}$ Ans.

(*ii*) Let $x = 1.\overline{3} = 1.3333\ ....$ ...(*i*)
Then $10x = 13.3333....$ ...(*ii*)
Subtracting (*i*) from (*ii*), we get :

$$9x = 12 \quad \Rightarrow \quad x = \frac{12}{9} = \frac{4}{3} = 1\frac{1}{3}$$

$\therefore\ 1.\overline{3} = 1\frac{1}{3}$ Ans.

(*iii*) Let $x = 0.\overline{34} = 0.34343434..$ ...(*i*)
Then $100x = 34.34343434....$ ...(*ii*)
Subtracting (*i*) from (*ii*), we get :

$$99x = 34 \Rightarrow x = \frac{34}{99}$$

$\therefore\ 0.\overline{34} = \frac{34}{99}$ Ans.

(*iv*) Let $x = 3.\overline{14} = 3.14\ 14\ 14\ 14.$ ...(*i*)
Then $100x = 314.\ 14\ 14\ 14\ 14...$ ...(*ii*)
Subtracting (*i*) from (*ii*), we get :

$$99x = 311 \quad \Rightarrow \quad x = \frac{311}{99}$$

$\therefore \; 3.\overline{14} = \dfrac{311}{99}$ Ans.

(*v*) Let $x = 0.\overline{324} = 0.324\,324\,324...$ ...(*i*)

Then $1000x = 324.324\,324\,324...$ ...(*ii*)

Subtracting (*i*) from (*ii*), we get :

$$999x = 324 \quad \Rightarrow \quad x = \frac{324}{999}$$

$$\Rightarrow \quad x = \frac{324 \div 27}{999 \div 27}$$

(H.C.F. of 324 and 999 = 27)

$$= \frac{12}{37}$$

$$\therefore \quad 0.\overline{324} = \frac{12}{37} \text{ Ans.}$$

(*vi*) Let $x = 0.1\overline{7}$

Then $10x = 1.\overline{7} = 1.7777.....$ ...(*i*)

and $100x = 17.7777.....$ ...(*ii*)

Subtracting (*i*) from (*ii*) we get :

$$90x = 16 \quad \Rightarrow \quad x = \frac{16}{90} = \frac{16 \div 2}{90 \div 2}$$

(H.C.F. of 16 and 90 = 2)

$$\therefore \quad x = \frac{8}{45}$$

Hence $0.1\overline{7} = \dfrac{8}{45}$ Ans.

(*vii*) Let $x = 0.5\bar{4}$

Then $10x = 5.\bar{4} = 5.4444...$ ...(*i*)

and $100x = 54.4444.....$ ...(*ii*)

Subtracting (*i*) from (*ii*), we get :

$$90x = 49 \Rightarrow x = \frac{49}{90}$$

$$\therefore \quad 0.5\bar{4} = \frac{49}{90} \text{ Ans.}$$

(*viii*) Let $x = 0.1\overline{63}$

Then $10x = 1.\overline{63} = 1.63\ 63\ 63\ 63..$ (*i*)

and $1000x = 163.\ 63\ 63\ 63\ 63..$ (*ii*)

Subtracting (*i*) from (*ii*) we get :

$$990x = 162 \quad \Rightarrow \quad x = \frac{162}{990}$$

$$\Rightarrow x = \frac{162 \div 18}{990 \div 18}$$

(HCF of 162 and 990 = 18)

$$= \frac{9}{55}$$

$$\therefore \quad 0.1\overline{63} = \frac{9}{55} \text{ Ans.}$$

Question 4.

Solution:

(i) True, because set of natural numbers is a subset of whole number.

(ii) False, because the number 0 does not belong to the set of natural numbers.

(iii) True, because a set of integers is a subset of a rational numbers.

(iv) False, because the set of rational numbers is not a subset of whole numbers.

(v) True, because rational number can be expressed as terminating or repeating decimals.

(vi) True, because every rational number can be express as repeating decimals.

(vii) True, because 0 = 01, which is a rational number Ans.

Ex 1 C

Question 1.

Solution:

Irrational numbers : Numbers which are not rational numbers, are called irrational numbers. Rational numbers can be expressed in terminating decimals or repeating decimals while irrational number can't.

12 , 23 , 75 etc.are rational numbers and π, √2, √3, √5, √6….etc are irrational numbers

Question 2.

Solution:

(i) √4 = ±2, it is a rational number

(ii) √196 = ±14 it is a rational number

(iii) √21 It is irrational number.

(iv) √43 It is irrational number.

(v) 3 + √3 It is irrational number because sum of a rational and an irrational number is irrational

(vi) √7 – 2 It is irrational number because difference of a rational and irrational number is irrational

(vii) 23√6 . It is irrational number because product of a rational and an irrational number is an irrational number.

(viii) $0.\overline{6}$ = 0.6666…. It is rational number because it is a repeating decimal.

(ix) 1.232332333…. It is irrational number because it not repeating decimal

(x) 3.040040004…. It is irrational number because it is not repeating decimal.

(xi) 3.2576 It is rational number because it is a terminating decimal.

(xii) 2.3565656…. = $2.3\overline{56}$ It is rational number because it is a repeating decimal.

(xiii) π It is an irrational number

(xiv) 227. It is a rational number which is in form of pq Ans.

Question 3.

Solution:

(i) Let X’OX be a horizontal line, taken as the x-axis and let O be the origin. Let O represent 0.

Taken OA = 1 unit and draw AB ⊥ OA such that AB = 1 unit. Join OB, Then, With O as centre and OC as radius, draw an arc, meeting OX at Q. Then

$$OQ = OC = \sqrt{3} \text{ units.}$$

Thus, the point Q represents $\sqrt{3}$ on the real line.

Now, draw CD ⊥ OC such that CD = 1 unit.

Join OD. Then,

$$OD = \sqrt{OC^2 + CD^2} = \sqrt{(\sqrt{3})^2 + 1^2}$$

$$= \sqrt{4} = 2 \text{ units.}$$

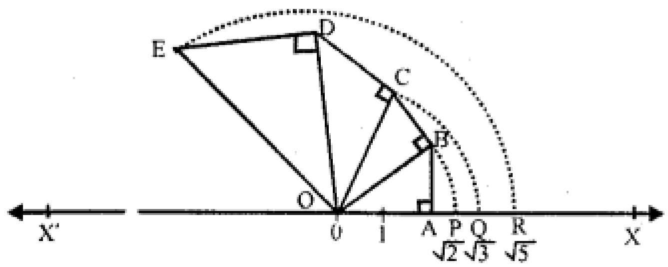
Now, dra\ ⌐E ⊥ OD such that DE = 1 unit.

Join OE = Then,

$$OE = \sqrt{OD^2 + DE^2} = \sqrt{2^2 + 1^2} = \sqrt{5} \text{ units.}$$

With O as centre and OE as radius draw an arc, meeting OX at R. Then, OR = OE $= \sqrt{5}$ units.

Thus, the point R represents $\sqrt{5}$ on the real line.



Hence, the points P, Q, R represent the numbers $\sqrt{2}, \sqrt{3}$ and $\sqrt{5}$ respectively.

Question 4.

Solution:

Firstly we represent √5 on the real line X'OX. Then we will find √6 and √7 on that real line.

Now, draw a horizontal line X'OX, taken as x-axis

With O as centre and OC as radius, draw an arc, meeting OX at Q.

Then, $OQ = OC = \sqrt{6}$.

Thus, Q represents $\sqrt{6}$ on the real line.

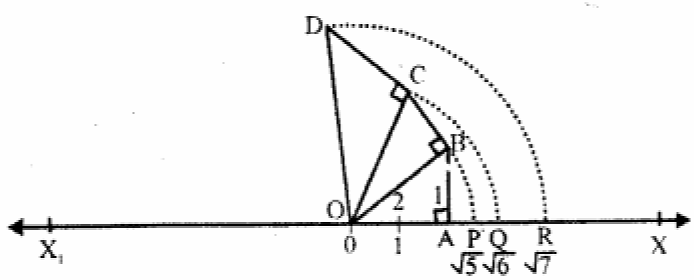
Now, draw $CD \perp OC$ and set off CD = 1 unit.

Join OD. Then,

$OD = \sqrt{OC^2 + CD^2} = \sqrt{(\sqrt{6})^2 + 1^2} = \sqrt{7}$.

With O as centre and OD as radius, draw an arc, meeting OX at R. Then,

$OR = OD = \sqrt{7}$.



Thus, the points P,Q,R represent the real numbers $\sqrt{5}, \sqrt{6}$ and $\sqrt{7}$ respectively.

Question 5.

Solution:

(i) 4 + √5 : It is irrational number because in it, 4 is a rational number and √5 is irrational and sum of a rational and an irrational is also an irrational.

(ii) (-3 + √6) It is irrational number because in it, -3 is a rational and √6 is irrational and sum or difference of a rational and irrational is an irrational.

(iii) 5√7 : It is irrational because 5 is rational and √7 is irrational and product of a rational and an irrational is an irrational.

(iv) -3√8 : It is irrational because -3 is a rational and √8 is an irrational and product of a rational and an irrational is also an irrational.

(v) 25√ It is irrational because 2 is a rational and √5 is an irrational and quotient of a rational and an irrational is also an irrational.

(vi) 43√ It is irrational because 4 is a rational and √3 is an irrational number and quotient of a rational and irrational is also an irrational.

Question 6.

Solution:

(i) True.

(ii) False, as the sum of two irrational number is irrational is not always true.

(iii) True.

(iv) False, as the product of two irrational numbers is irrational is not always true.

(v) True.

(vi) True.

(vii) False as a real number can be either rational or irrational.

Ex 1 D

Question 1.

Solution:

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

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

$=(2+1)\sqrt{3}-(5-2)\sqrt{2}$

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

(ii) $2\sqrt{2}+5\sqrt{3}-7\sqrt{5}+3\sqrt{3}-\sqrt{2}+\sqrt{5}$

$=2\sqrt{2}-\sqrt{2}+5\sqrt{3}+3\sqrt{3}-7\sqrt{5}+\sqrt{5}$

$=(2-1)\sqrt{2}+(5+3)\sqrt{3}-(7-1)\sqrt{5}$

$=\sqrt{2}+8\sqrt{3}-6\sqrt{5}$

(iii) $\frac{2}{3}\sqrt{7}-\frac{1}{2}\sqrt{2}+6\sqrt{11}+\frac{1}{3}\sqrt{7}+\frac{3}{2}\sqrt{2}-\sqrt{11}$

$=\frac{2}{3}\sqrt{7}+\frac{1}{3}\sqrt{7}-\frac{1}{2}\sqrt{2}+\frac{3}{2}\sqrt{2}+6\sqrt{11}-\sqrt{11}$

$=\left(\frac{2}{3}+\frac{1}{3}\right)\sqrt{7}-\left(\frac{1}{2}-\frac{3}{2}\right)\sqrt{2}+(6-1)\sqrt{11}$

$=\left(\frac{2+1}{3}\right)\sqrt{7}-\left(\frac{1-3}{2}\right)\sqrt{2}+5\sqrt{11}$

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

$=\sqrt{7}+\sqrt{2}+5\sqrt{11}$ **Ans.**

Question 2.

Solution:

(i) $3\sqrt{5} \times 2\sqrt{5} = 3 \times 2 \left(\sqrt{5}\right)^2$

$= 6 \times 5 = 30$

(ii) $6\sqrt{15} \times 4\sqrt{3} = 6 \times 4 \times \sqrt{15} \times \sqrt{3}$

$= 24 \times \sqrt{15 \times 3} = 24 \times \sqrt{5 \times 3 \times 3}$

$= 24 \times 3\sqrt{5} = 72\sqrt{5}$

(iii) $2\sqrt{6} \times 3\sqrt{3} = 2 \times 3 \times \sqrt{6} \times \sqrt{3}$

$= 6 \times \sqrt{6 \times 3}$

$= 6 \times \sqrt{2 \times 3 \times 3}$

$= 6 \times 3\sqrt{2} = 18\sqrt{2}$

(iv) $3\sqrt{8} \times 3\sqrt{2} = 3 \times 3 \times \sqrt{8} \times \sqrt{2}$

$= 9 \times \sqrt{8 \times 2} = 9 \times \sqrt{16}$

$= 9 \times 4 = 36$

Question 3.

Solution:

(i) $16\sqrt{6} \div 4\sqrt{2}$

$= \frac{16\sqrt{6}}{4\sqrt{2}} = 4\sqrt{\frac{6}{2}} = 4\sqrt{3}$

(ii) $12\sqrt{15} \div 4\sqrt{3} = \frac{12\sqrt{15}}{4\sqrt{3}} = 3\sqrt{\frac{15}{3}}$

$= 3\sqrt{5}$

(iii) $18\sqrt{21} \div 6\sqrt{7}$

$= \frac{18\sqrt{21}}{6\sqrt{7}} = 3\sqrt{\frac{21}{7}} = 3\sqrt{3}$ Ans.

Question 4.

Solution:

(i) $\left(4+\sqrt{2}\right)\left(4-\sqrt{2}\right) = (4)^2 - \left(\sqrt{2}\right)^2$

$\{\because (a + b)(a - b) = a^2 - b^2\}$

$= 16 - 2 = 14$ Ans.

(ii) $\left(\sqrt{5}+\sqrt{3}\right)\left(\sqrt{5}-\sqrt{3}\right) = \left(\sqrt{5}\right)^2 - \left(\sqrt{3}\right)^2$

$= 5 - 3$

$\{\because (a + b)(a - b) = a^2 - b^2\}$

$= 2$ Ans.

(iii) $\left(6-\sqrt{6}\right)\left(6+\sqrt{6}\right) = (6)^2 - \left(\sqrt{6}\right)^2$

$= 36 - 6$

$\{\because (a + b)(a - b) = a^2 - b^2\}$

$= 30$ Ans.

(iv) $\left(\sqrt{5}-\sqrt{2}\right)\left(\sqrt{2}-\sqrt{3}\right)$

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

$= \sqrt{10}-\sqrt{15}-\sqrt{4}+\sqrt{6}$

$= \sqrt{10}-\sqrt{15}-2+\sqrt{6}$ Ans.

(v) $\left(\sqrt{5}-\sqrt{3}\right)^2=\left(\sqrt{5}\right)^2+\left(\sqrt{3}\right)^2-2\times\sqrt{5}\times\sqrt{3}$

$\{\because (a - b)^2 = a^2 + b^2 - 2ab\}$

$= 5 + 3 - 2 \times \sqrt{15}$

$= 8 - 2\sqrt{15}$ Ans.

(vi) $\left(3-\sqrt{3}\right)^2 = (3)^2 + \left(\sqrt{3}\right)^2 - 2\times3\times\sqrt{3}$

$\{\because (a-b)^2 = a^2 + b^2 - 2ab\}$

$= 9 + 3 - 6\sqrt{3} = 12 - 6\sqrt{3}$ Ans.

Question 5.

Solution:

(i) Draw a line segment AB = 3.2 units (cm) and extend it to C such that BC = 1 unit.

(ii) Find the mid-point O of AC.

(iii) With centre O and OA as radius draw a semicircle on AC

(iv) Draw BD ⊥ AC meeting the semicircle at D.

(v) Join BD which is √3.2 units.

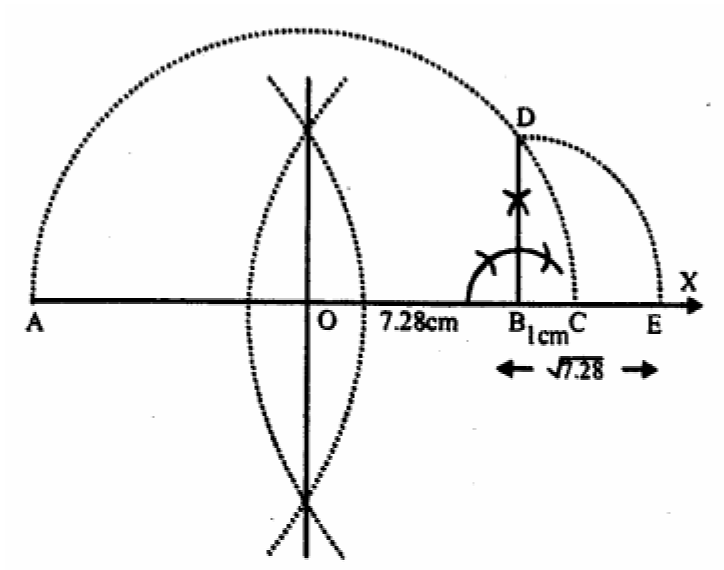
(vi) With centre B and radius BD, draw an arc meeting AC when produced at E.

Then BE = BD = √3.2 units. Ans.

Question 6.

Solution:

(i) Draw a line segment AB = 7.28 units and produce is to C such that BC = 1 unit (cm)



(ii) Find the mid-point O of AC.

(iii) With centre O and radius OA, draw a semicircle on AC.

(iv) Draw a perpendicular BD at AC meeting the semicircle at D

Then BD = $\sqrt{7.28}$ units.

(v) With centre B and radius BD, draw an arc which meet AC produced at E.

Then BE = BD = $\sqrt{7.28}$ units.

Question 7.

Solution:

(A) For Addition

(i) Closure property: The sum of two real numbers is always a real number.

(ii) Associative Law : (a + b) + c = a + (b + c), for all values of a, b and c.

(iii) Commutative Law : a + b = b + a for all real values of a and b.

(iv) Existance of Additive Identity : 0 is the real number such that: 0 + a = a + 0 = afor every real value of a.

(v) Existance of addtive inverse : For each real value of a, there exists a real value (-a) such that a + (-a) = (-a) + a = 0, Then (a) and (-a) are called the additive inverse of each other.

(v) Existence of Multiplicative Inverse. For each non zero real number a, there exists a real number 1a such that a . 1a = 1a . a = 1

a and 1a are called multiplicative inverse or reciprocal of each other.

(B) Multiplication

(i) Closure property: The product of two real numbers is always a real number.

(ii) Associative law : ab(c) = a(bc) for all real values of a, b and c

(iii) Commutative law : ab=ba for all real numbers a and b

(iv) Existance of Multiplicative Identity: clearly is a real number such that 1.a = a.1 = a for every value of a.

Ex 1 E

Question 1.

Solution:

Here,RF of √7 is √7

$$\therefore \frac{1}{\sqrt{7}} = \frac{1\sqrt{7}}{\sqrt{7}\times\sqrt{7}}$$

(Multiplying and dividing by RF $\sqrt{7}$)

$$= \frac{\sqrt{7}}{7} \text{ Ans.}$$

Question 2.

Solution:

Here RF √3 is √3

$$\therefore \quad \frac{\sqrt{5}}{2\sqrt{3}} = \frac{\sqrt{5}\times\sqrt{3}}{2\sqrt{3}\times\sqrt{3}}$$

(Multiplying and dividing by $\sqrt{3}$)

$$= \frac{\sqrt{15}}{2\times 3} = \frac{\sqrt{15}}{6} \text{ Ans.}$$

Question 3.

Solution:

Here RF of 1(2+3√) is 1(2−3√)

$$\therefore \quad \frac{1}{2+\sqrt{3}} = \frac{1\times\left(2-\sqrt{3}\right)}{\left(2+\sqrt{3}\right)\left(2-\sqrt{3}\right)}$$

(Multiplying and dividing by $2-\sqrt{3}$)

$$= \frac{2-\sqrt{3}}{(2)^2-\left(\sqrt{3}\right)^2}$$

$[\because (a+b)(a-b) = a^2 - b^2]$

Question 4.

Solution:

Here RF is √5 + 2

$$\therefore \quad \frac{1}{\sqrt{5}-2} = \frac{1\times(\sqrt{5}+2)}{(\sqrt{5}-2)(\sqrt{5}+2)}$$

(Multiplying and dividing by $\sqrt{5}+2$)

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

$[\because (a+b)(a-b) = a^2 - b^2]$

$$= \frac{\sqrt{5}+2}{5-4} = \frac{\sqrt{5}+2}{1} = \sqrt{5}+2 \text{ Ans.}$$

Question 5.

Solution:

Here RF is 5 – 3√2

Question 6.

Solution:

Here RF is √6 + √5

$$\therefore \frac{1}{\sqrt{6}-\sqrt{5}} = \frac{1+\left(\sqrt{6}+\sqrt{5}\right)}{\left(\sqrt{6}-\sqrt{5}\right)\left(\sqrt{6}+\sqrt{5}\right)}$$

(Multiplying and dividing by $\left(\sqrt{6}+\sqrt{5}\right)$

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

$[\because (a+b)(a-b) = a^2 - b^2]$

$$= \frac{\sqrt{6}+\sqrt{5}}{6-5} = \frac{\sqrt{6}+\sqrt{5}}{1} = \sqrt{6}+\sqrt{5} \text{ Ans.}$$

Question 7.

Solution:

Here RF = √7 – √3

Here, RF $= \sqrt{7}-\sqrt{3}$

$$\therefore \frac{4}{\sqrt{7}+\sqrt{3}} = \frac{4\left(\sqrt{7}-\sqrt{3}\right)}{\left(\sqrt{7}+\sqrt{3}\right)\left(\sqrt{7}-\sqrt{3}\right)}$$

{Multiplying and dividing by $\left(\sqrt{7}-\sqrt{3}\right)$}

$$= \frac{4\left(\sqrt{7}-\sqrt{3}\right)}{\left(\sqrt{7}\right)^2-\left(\sqrt{3}\right)^2}$$

$[\because (a+b)(a-b) = a^2 - b^2]$

$$= \frac{4\left(\sqrt{7}-\sqrt{3}\right)}{7-3} = \frac{4\left(\sqrt{7}-\sqrt{3}\right)}{4} = \sqrt{7}-\sqrt{3} \text{ Ans.}$$

Question 8.

Solution:

Here RF = √3 – 1

$$\therefore \frac{\sqrt{3}-1}{\sqrt{3}+1} = \frac{(\sqrt{3}-1)(\sqrt{3}-1)}{(\sqrt{3}+1)(\sqrt{3}-1)}$$

[Multiplying and dividing by $(\sqrt{3}-1)$]

$$= \frac{(\sqrt{3}-1)^2}{(\sqrt{3})^2-(1)^2}$$ [$\because (a+b)(a-b) = a^2 - b^2$ and $(a-b)^2 = a^2 + b^2 - 2ab$]

Question 9.

Solution:

Here RF = (3-2√2)

$$\therefore \quad \frac{3-2\sqrt{2}}{3+2\sqrt{2}} = \frac{(3-2\sqrt{2})(3-2\sqrt{2})}{(\sqrt{3}+2\sqrt{2})(3-2\sqrt{2})}$$

[Multiplying and dividing by $(3-2\sqrt{2})$]

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

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

[$\because (a-b)^2 = a^2+b^2-2ab$ and $(a+b)(a-b) = a^2-b^2$]

$$= \frac{9+4\times2-12\sqrt{2}}{9-4\times2} = \frac{9+8\times-12\sqrt{2}}{9-8}$$

$$= \frac{17-12\sqrt{2}}{1} = 17-12\sqrt{2} \text{ Ans.}$$

Find the values of a and b in each of the following :

Question 10.

Solution:

3√+13√−1, RF = √3+1

(Multiplying and dividing by √3+1)

$$\frac{\sqrt{3}+1}{\sqrt{3}-1} = \frac{(\sqrt{3}+1)(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$$

$$= \frac{(\sqrt{3}+1)^2}{(\sqrt{3})^2-(1)^2}$$

$$= \frac{(\sqrt{3})^2+(1)^2+2\sqrt{3}\times 1}{3-1} = \frac{3+1+2\sqrt{3}}{2}$$

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

$\therefore\ 2+\sqrt{3} = a + b\sqrt{3}$

Comparing, we get :

$a = 2$ and $b = 1$ Ans.

Question 11.

Solution:

3+2√3−2√, RF is 3+√2

(Multiplying and dividing by 3+√2)

$$\frac{3+\sqrt{2}}{3-\sqrt{2}} = \frac{\left(3+\sqrt{2}\right)\left(3+\sqrt{2}\right)}{\left(3-\sqrt{2}\right)\left(3+\sqrt{2}\right)} = \frac{\left(3+\sqrt{2}\right)^2}{(3)^2-\left(\sqrt{2}\right)^2}$$

$$= \frac{(3)^2+\left(\sqrt{2}\right)^2+2\times3\times\sqrt{2}}{9-2}$$

$$= \frac{9+2+6\sqrt{2}}{7} = \frac{11+6\sqrt{2}}{7} = \frac{11}{7}+\frac{6}{7}\sqrt{2}$$

$$\therefore \quad \frac{11}{7}+\frac{6}{7}\sqrt{2} = a + b\sqrt{2}$$

Comparing we get :

$a = \frac{11}{7}$, $b = \frac{6}{7}$ Ans.

Question 12.

Solution:

In 5−6√5+6√, RF is (5-√6)

(Multiplying and dividing by 5-√6)

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

$[\because (a+b)^2 = a^2 + b^2 - 2ab$ and $(a+b)(a-b) = a^2 - b^2]$

$$= \frac{(5)^2+(\sqrt{6})^2-2\times5\times\sqrt{6}}{25-6} = \frac{25+6-10\sqrt{6}}{19}$$

$$= \frac{31-10\sqrt{6}}{19} = \frac{31}{19} - \frac{10}{19}\sqrt{6}$$

$$\therefore \quad \frac{31}{19} - \frac{10}{19}\sqrt{6} = a - b\sqrt{6}$$

Comparing, we get :

$a = \frac{31}{19}$ and $b = \frac{10}{19}$ Ans.

Question 13.

Solution:

In 5+23√7+43√, RF is 7-4√3

(Multiplying and dividing by 7-4√3)

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

$$= \frac{35-20\sqrt{3}+14\sqrt{3}-8\times3}{(7)^2-(4\sqrt{3})^2} = \frac{35-6\sqrt{3}-24}{49-16\times3}$$

$$= \frac{11-6\sqrt{3}}{49-48} = \frac{11-6\sqrt{3}}{1}$$

$$\therefore \quad 11 - 6\sqrt{3} = a - b\sqrt{3}$$

Comparing, we get :

$a = 11$, $b = 6$ Ans.

Question 14.

Solution:

$$\frac{\sqrt{5}-1}{\sqrt{5}+1} = \frac{\left(\sqrt{5}-1\right)\left(\sqrt{5}-1\right)}{\left(\sqrt{5}+1\right)\left(\sqrt{5}-1\right)} = \frac{\left(\sqrt{5}-1\right)^2}{\left(\sqrt{5}\right)^2-(5)^2}$$

[Here RF = $\left(\sqrt{5}-2\right)$]

$$= \frac{\left(\sqrt{5}\right)^2+(1)^2-2\times\sqrt{5}\times 1}{\left(\sqrt{5}\right)^2-(1)^2} = \frac{5+1-2\sqrt{5}}{4}$$

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

$$\frac{\sqrt{5}+1}{\sqrt{5}-1} = \frac{\left(\sqrt{5}+1\right)\left(\sqrt{5}+1\right)}{\left(\sqrt{5}-1\right)\left(\sqrt{5}+1\right)}$$

Here RF = $\left(\sqrt{5}+1\right)$

$$= \frac{\left(\sqrt{5}+1\right)^2}{\left(\sqrt{5}-1\right)\left(\sqrt{5}+1\right)} = \frac{\left(\sqrt{5}\right)^2+(1)^2+2\times\sqrt{5}\times 1}{\left(\sqrt{5}\right)^2-(1)^2}$$

$$= \frac{5+1+2\times\sqrt{5}\times 1}{5-1}$$

$$= \frac{6+2\sqrt{5}}{4} = \frac{3+\sqrt{5}}{2} \qquad \text{(Dividing by 2)}$$

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

$$= \frac{3-\sqrt{5}+3+\sqrt{5}}{2} = \frac{6}{2} = 3 \text{ Ans.}$$

Question 15.

Solution:

$$\frac{4+\sqrt{5}}{4-\sqrt{5}} = \frac{(4+\sqrt{5})(4+\sqrt{5})}{(4-\sqrt{5})(4+\sqrt{5})}$$

{Here RF = $(4+\sqrt{5})$}

$$= \frac{(4+\sqrt{5})^2}{(4)^2-(\sqrt{5})^2} = \frac{16+5+2\times 4\sqrt{5}}{16-5}$$

$$= \frac{21+8\sqrt{5}}{11}$$

and $$\frac{4-\sqrt{5}}{4+\sqrt{5}} = \frac{(4-\sqrt{5})(4-\sqrt{5})}{(4+\sqrt{5})(4-\sqrt{5})}$$

Here, RF = $(4-\sqrt{5})$

Question 16.

Solution:

x = (4-√15)

$$\therefore \quad \frac{1}{x}=\frac{1}{4-\sqrt{15}}=\frac{1\times\left(4+\sqrt{15}\right)}{\left(4-\sqrt{15}\right)\left(4+\sqrt{15}\right)}$$

Here, RF = $\left(4+\sqrt{15}\right)$

$$\frac{4+\sqrt{15}}{(4)^2-\left(\sqrt{15}\right)^2}=\frac{4+\sqrt{15}}{16-15}=\frac{4+\sqrt{15}}{1}=4+\sqrt{15}$$

$$\therefore \quad x+\frac{1}{x}=4-\sqrt{15}+4+\sqrt{15}=8 \text{ Ans.}$$

Question 17.

Solution:

x = 2+√3

$$\therefore \quad \frac{1}{x} = \frac{1}{2+\sqrt{3}} = \frac{1\left(2-\sqrt{3}\right)}{\left(2+\sqrt{3}\right)\left(2-\sqrt{3}\right)}$$

[Here, RF = $(2-\sqrt{3})$]

$$= \frac{2-\sqrt{3}}{(2)^2-\left(\sqrt{3}\right)^2} = \frac{2-\sqrt{3}}{4-3} = \frac{2-\sqrt{3}}{1}$$

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

$$\therefore \quad x + \frac{1}{x} = 2 + \sqrt{3} + 2 - \sqrt{3} = 4 \text{ Ans.}$$

Squaring both sides,

$$\left(x+\frac{1}{x}\right)^2 = (4)^2 \quad \Rightarrow \quad x^2 + \frac{1}{x^2} + 2 = 16$$

$$\Rightarrow x^2 + \frac{1}{x^2} = 16 - 2 = 14 \text{ Ans.}$$

Question 18.

Solution:

$$\frac{1}{3-\sqrt{8}}=\frac{1\times(3+\sqrt{8})}{(3-\sqrt{8})(3+\sqrt{8})}$$

$$=\frac{3+\sqrt{8}}{(3)^2-(\sqrt{8})^2}=\frac{3+\sqrt{8}}{9-8}=\frac{3+\sqrt{8}}{1}=3+\sqrt{8} \qquad \ldots(i)$$

$$\frac{1}{\sqrt{8}-\sqrt{7}}=\frac{1(\sqrt{8}+\sqrt{7})}{(\sqrt{8}-\sqrt{7})(\sqrt{8}+\sqrt{7})}$$

$$=\frac{\sqrt{8}+\sqrt{7}}{(\sqrt{8})^2-(\sqrt{7})^2}=\frac{\sqrt{8}+\sqrt{7}}{8-7}=\frac{\sqrt{8}+\sqrt{7}}{1}=\sqrt{8}+\sqrt{7}$$

$$\frac{1}{\sqrt{7}-\sqrt{6}}=\frac{1\times(\sqrt{7}+\sqrt{6})}{(\sqrt{7}-\sqrt{6})(\sqrt{7}+\sqrt{6})}=\frac{\sqrt{7}+\sqrt{6}}{(\sqrt{7})^2-(\sqrt{6})^2}=\frac{\sqrt{7}+\sqrt{6}}{7-6}=\frac{\sqrt{7}+\sqrt{6}}{1}=\sqrt{7}+\sqrt{6}$$

$$\frac{1}{\sqrt{6}-\sqrt{5}}=\frac{1\times(\sqrt{6}+\sqrt{5})}{(\sqrt{6}-\sqrt{5})(\sqrt{6}+\sqrt{5})}=\frac{\sqrt{6}+\sqrt{5}}{(\sqrt{6})^2-(\sqrt{5})^2}=\frac{\sqrt{6}+\sqrt{5}}{6-5}=\frac{\sqrt{6}+\sqrt{5}}{1}=\sqrt{6}+\sqrt{5}$$

$$\frac{1}{\sqrt{5}-2}=\frac{1\times(\sqrt{5}+2)}{(\sqrt{5}-2)(\sqrt{5}+2)}=\frac{\sqrt{5}+2}{(\sqrt{5})^2-(2)^2}=\frac{\sqrt{5}+2}{5-4}=\frac{\sqrt{5}+2}{1}=\sqrt{5}+2$$

Now L.H.S. $=\frac{1}{3-\sqrt{8}}-\frac{1}{\sqrt{8}-\sqrt{7}}+\frac{1}{\sqrt{7}-\sqrt{6}}-\frac{1}{\sqrt{6}-\sqrt{5}}+\frac{1}{\sqrt{5}-2}$

$=3+\sqrt{8}-(\sqrt{8}+\sqrt{7})+(\sqrt{7}+\sqrt{6})-(\sqrt{6}+\sqrt{5})+\sqrt{5}+2$

$=3+\sqrt{8}-\sqrt{8}-\sqrt{7}+\sqrt{7}+\sqrt{6}-\sqrt{6}-\sqrt{5}+\sqrt{5}+2$

$=5=$ R.H.S. Hence Proved.

Ex 1 F

Question 1.

Solution:

We know that

$a^p \times a^q = a^{p+q}$

∴ Therefore

(i) $6^{\frac{2}{5}} \times 6^{\frac{3}{5}} = 6^{\left(\frac{2}{5}+\frac{3}{5}\right)}$ $\{\because\ a^p \times a^q = a^{p+q}\}$

$= 6^{\frac{2+3}{5}} = 6^{\frac{5}{5}} = 6^1 = 6$ Ans.

(ii) $3^{\frac{1}{2}} \times 3^{\frac{1}{3}} = 3^{\frac{1}{2}+\frac{1}{3}}$ $\{\because\ a^p \times a^q = a^{p+q}\}$

$= 3^{\frac{3+2}{6}} = 3^{\frac{5}{6}}$ Ans.

(iii) $7^{\frac{5}{6}} \times 7^{\frac{2}{3}} = 7^{\frac{5}{6}+\frac{2}{3}}$

$\{\because\ a^p \times a^q = a^{p+q}\}$

$= 7^{\frac{5+4}{6}} = 7^{\frac{9}{6}} = 7^{\frac{3}{2}}$ Ans.

Question 2.

Solution:

We know that

$a^p \div a^q = a^{p-q}$

Therefore

(i) $\frac{6^{\frac{1}{4}}}{6^{\frac{1}{5}}} = 6^{\frac{1}{4}-\frac{1}{5}}$ $\qquad [\because a^p \div a^q = a^{p-q}]$

$= 6^{\frac{5-4}{20}} = 6^{\frac{1}{20}}$

(ii) $\frac{8^{\frac{1}{2}}}{8^{\frac{2}{3}}} = 8^{\frac{1}{2}-\frac{2}{3}}$ $\qquad [\because a^p \div a^q = a^{p-q}]$

$= 8^{\frac{3-4}{6}} = 8^{\frac{-1}{6}}$

(iii) $\frac{5^{\frac{6}{7}}}{5^{\frac{2}{3}}} = 5^{\frac{6}{7}-\frac{2}{3}}$

$= 5^{\frac{18-14}{21}} = 5^{\frac{4}{21}}$ Ans.

Question 3.

Solution:

We know that

$a^p \times b^p = (ab)^p$

Therefore

(i) $3^{\frac{1}{4}} \times 5^{\frac{1}{4}} = (3 \times 5)^{\frac{1}{4}}$

$\{\because a^p \times b^p = (ab)^p\}$

$= (15)^{\frac{1}{4}}$

(ii) $2^{\frac{5}{8}} \times 3^{\frac{5}{8}} = (2 \times 3)^{\frac{5}{8}}$

$= (6)^{\frac{5}{8}} \quad \{\because a^p \times b^p = (ab)^p\}$

(iii) $6^{\frac{1}{2}} \times 7^{\frac{1}{2}} = (6 \times 7)^{\frac{1}{2}}$

$\{\because a^p \times b^p = (ab)^p\}$

$= (42)^{\frac{1}{2}}$ Ans.

Question 4.

Solution:

We know that

$(a^p)^q = a^{pq}$

(i) $(3^4)^{\frac{1}{4}} = 3^{4 \times \frac{1}{4}} = 3^1 = 3$

(ii) $(3^{\frac{1}{3}})^4 = 3^{\frac{1}{3} \times 4} = 3^{\frac{4}{3}}$

(iii) $\left(\frac{1}{3^4}\right)^{\frac{1}{2}} = \frac{1}{3^{4 \times \frac{1}{2}}} = \frac{1}{3^2} = 3^{-2}$

Question 5.

Solution:

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

$$(ii)\quad (125)^{\frac{1}{3}} = (5^3)^{\frac{1}{3}} = 5^{3\times\frac{1}{3}} = 5^1 = 5$$

$$(iii)\quad (64)^{\frac{1}{6}} = (2^6)^{\frac{1}{6}} = 2^{6\times\frac{1}{6}} = 2^1 = 2 \text{ Ans.}$$

Question 6.

Solution:

$$(i)\ (25)^{\frac{3}{2}} = (5^2)^{\frac{3}{2}} = 5^{2\times\frac{3}{2}} = 5^3 = 5\times5\times5 = 125$$

$$(ii)\quad (32)^{\frac{2}{5}} = (2^5)^{\frac{2}{5}} = 2^{5\times\frac{2}{5}} = 2^2 = 2\times2 = 4$$

$$(iii)\quad (81)^{\frac{3}{4}} = (3^4)^{\frac{3}{4}} = 3^{4\times\frac{3}{4}} = 3^3$$

$$= 3 \times 3 \times 3 = 27 \text{ Ans.}$$

Question 7.

Solution:

$$(i)\quad (64)^{-\frac{1}{2}} = \frac{1}{(8^2)^{\frac{1}{2}}} = \frac{1}{8^{2\times\frac{1}{2}}} = \frac{1}{8}$$

$$(ii)\quad (8)^{-\frac{1}{3}} = \frac{1}{(8)^{\frac{1}{3}}} = \frac{1}{(2^3)^{\frac{1}{3}}} = \frac{1}{2^{3\times\frac{1}{3}}} = \frac{1}{2}$$

$$(iii)\ (81)^{-\frac{1}{4}} = \frac{1}{(81)^{\frac{1}{4}}} = \frac{1}{(3^4)^{\frac{1}{4}}} = \frac{1}{3^{4\times\frac{1}{4}}} = \frac{1}{3} \text{ Ans.}$$

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