PRACTICE SET 2.1 PAGE NO: 21

1. Classify the decimal form of the given rational numbers into terminating and non-terminating recurring type.
i. 13/5
ii. 2/11
iii. 29/16
iv. 17/125
v. 11/6

Solution:
i. $\frac{13}{5} = 2.6$
∵ The division is exact
∴ it is a terminating decimal.

ii. $\frac{2}{11} = 0.181818 \ldots..$
∵ The division never ends and the digits '18' is repeated endlessly
∴ it is a non-terminating recurring type decimal.

iii. $\frac{29}{16} = 1.8125$
∵ The division is exact
∴ it is a terminating decimal.

iv. $\frac{17}{125} = 0.136$
∵ The division is exact
∴ it is a terminating decimal.

v. $\frac{11}{6} = 1.83333 \ldots..$
∵ The division never ends and the digit '3' is repeated endlessly
∴ it is a non-terminating recurring type decimal.

2. Write the following rational numbers in decimal form.

i. 127/200
ii. 25/99
iii. 23/7
iv. 4/5
v. 17/8

Solution:

i. $\frac{127}{200} = 0.635$

ii. $\frac{25}{99} = 0.252525 ....$

iii. $\frac{23}{7} = 3.285714285714285714 \ldots \ldots ..$

iv. $\frac{4}{5} = 0.8$

v. $\frac{17}{8} = 2.125$

3. Write the following rational numbers in form.

i. 0.6^{*}
ii. $0.\overline{37}$
iii. $3.\overline{17}$
iv. $15.\overline{89}$
v. $2.\overline{514}$

Solution:

i. $0.\dot{6}$
Let $x = 0.\dot{6} = 0.6666 \ldots$
⇒ 10x = 6.66666……
Now,
10x - x = 6.66 – 0.6666
⇒9x = 6

$\Rightarrow x = \frac{6}{9}$

$\Rightarrow 0.\dot{6} = \frac{6}{9} = \frac{2}{3}$

ii. $0.\overline{37}$

Let $x = 0.\overline{37} = 0.3737 \ldots$

$\Rightarrow$ 100x = 37.3737......

Now,

100x - x = 37.3737 – 0.3737

$\Rightarrow$ 99x = 37

$\Rightarrow x = \frac{37}{99}$

$\Rightarrow 0.\overline{37} = \frac{37}{99}$

iii. $3.\overline{17}$

Let $x = 3.\overline{17} = 3.1717 \ldots$

$\Rightarrow$ 100x = 317.1717......

Now,

100x - x = 317.1717 – 3.1717

$\Rightarrow$ 99x = 314

$\Rightarrow x = \frac{314}{99}$

$\Rightarrow 3.\overline{17} = \frac{314}{99}$

iv. $15.\overline{89}$

Let $x = 15.\overline{89} = 15.8989 \ldots$

$\Rightarrow$ 100x = 1589.8989......

Now,

100x - x = 1589.8989 – 15.8989

$\Rightarrow$ 99x = 1574

$\Rightarrow x = \frac{1574}{99}$

$\Rightarrow 15.\overline{89} = \frac{1574}{99}$

v. $2.\overline{514}$

Let $x = 2.\overline{514} = 2.514514\ldots$

$\Rightarrow 1000x = 2514.514514\ldots\ldots$

Now,

$1000x - x = 2514.514514 - 2.514514$

$\Rightarrow 999x = 2512$

$\Rightarrow x = \frac{2512}{999}$

$\Rightarrow 2.\overline{514} = \frac{2512}{999}$

PRACTICE SET 2.2 PAGE NO: 25

1. Show that is 4√2 an irrational number.

Solution:

Let us assume that 4√2 is a rational number

$\therefore\ 4\sqrt{2} = \frac{a}{b}$

where, b≠0 and a, b are integers

$\Rightarrow\ \sqrt{2} = \frac{a}{4b}$

∵ a, b are integers

∴ 4b is also integer

$\Rightarrow\ \frac{a}{4b}$ is rational which cannot be possible

$\because\ \frac{a}{4b} = \sqrt{2}$ which is an irrational number

∵ it is contradicting our assumption

∴ the assumption was wrong

Hence, 4√2 is an irrational number

2. Prove that 3 + √5 is an irrational number.

Solution:

Let us assume that 3 + √5 is a rational number

$\therefore\ 3 + \sqrt{5} = \frac{a}{b}$

where, b≠0 and a, b are integers

$\Rightarrow\ \sqrt{5} = \frac{a}{b} - 3$

$\Rightarrow\ \sqrt{5} = \frac{a - 3b}{b}$

∵ a, b are integers ∴ a – 3b is also integer

$\Rightarrow\ \frac{a-3b}{b}$ is rational which cannot be possible

$\because\ \frac{a-3b}{b} = \sqrt{5}$ which is an irrational number

∵ it is contradicting our assumption ∴ the assumption was wrong

Hence, 3 + √5 is an irrational number

3. Represent the numbers √5 and √10 on a number line.

Solution:

Given √5

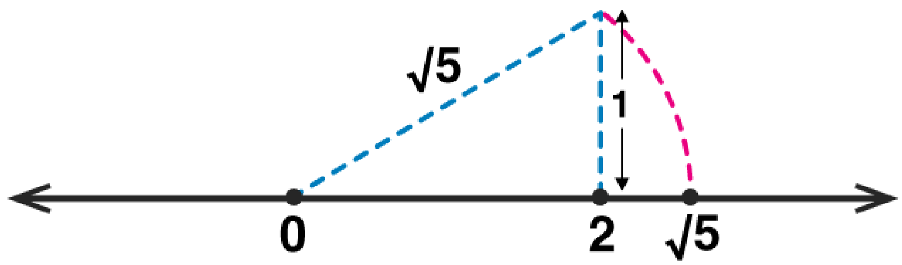
By Pythagoras theorem,

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

$\Rightarrow (\sqrt{5})^2 = 4 + 1$

$\Rightarrow \sqrt{5} = \sqrt{4+1}$

First mark 0 and 2 on the number line. Then, draw a perpendicular of 1 unit from 2. And Join the top of perpendicular and 0. This line would be equal to √5. Now measure the line with compass and marc an arc on the number line with the same measurement. This point is √5.



Given that √10

Also,

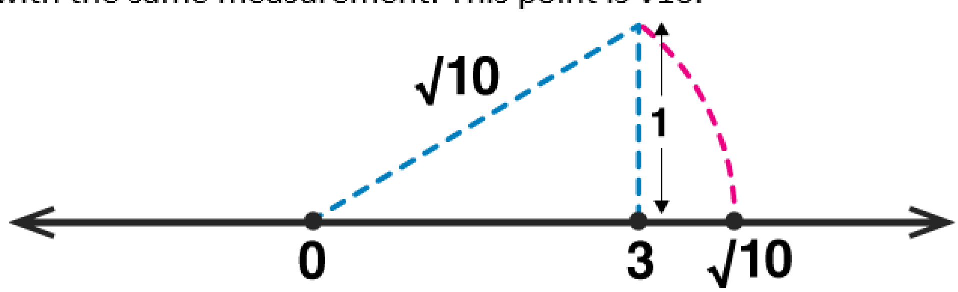
By Pythagoras theorem, we can write as

$(\sqrt{10})^2 = 3^2 + 1^2$

$\Rightarrow (\sqrt{10})^2 = 9 + 1$

$\Rightarrow \sqrt{10} = \sqrt{9+1}$

First mark 0 and 3 on the number line. Then, draw a perpendicular of 1 unit from 3. And Join the top of perpendicular and 0. This line would be equal to √10. Now measure the line with compass and marc an arc on the number line with the same measurement. This point is √10.



4. Write any three rational numbers between the two numbers given below.

(i) 0.3 and -0.5

Solution:

Given 0.3 and -0.5

To find a rational number x between two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, we use

$$x = \frac{1}{2}\left(\frac{a}{b} + \frac{c}{d}\right)$$

Therefore, to find rational number x (let) between

$0.3 = \frac{3}{10}$ and $-0.5 = \frac{-5}{10}$

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

$$\Rightarrow x = \frac{1}{2} \times \left(\frac{3-5}{10}\right)$$

$$\Rightarrow x = \frac{1}{2} \times \frac{-2}{10}$$

$$\Rightarrow x = \frac{-1}{10} = -0.1$$

Now if we find a rational number between $\frac{3}{10}$ and $\frac{-1}{10}$ it will also be between 0.3 and -0.5 since $\frac{-1}{10}$ lies between 0.3 and -0.5.

Therefore, to find rational number y (let) between $\frac{3}{10}$ and $\frac{-1}{10}$

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

$$\Rightarrow y = \frac{1}{2}\left(\frac{3-1}{10}\right)$$

$$\Rightarrow y = \frac{1}{2} \times \frac{2}{10}$$

$$\Rightarrow y = \frac{1}{10} = 0.1$$

Now if we find a rational number between $\frac{-1}{10}$ and $\frac{1}{10}$ it will also be between 0.3 and -0.5 since $\frac{1}{10}$ lies between 0.3 and -0.5.

Therefore, to find rational number z (let) between $\frac{1}{10}$ and $\frac{-5}{10}$.

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

$$\Rightarrow z = \frac{1}{2}\left(\frac{1-5}{10}\right)$$

$\Rightarrow z = \frac{1}{2} \times \frac{-4}{10}$

$\Rightarrow z = \frac{-2}{10} = -0.2$

Hence the numbers are -0.2, -0.1 and 0.1

(ii) -2.3 and -2.33

Solution:

Given -2.3 and -2.33

To find a rational number x between two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, we use

$x = \frac{1}{2}\left(\frac{a}{b} + \frac{c}{d}\right)$

Therefore, to find rational number x (let) between $-2.3 = \frac{-23}{10}$ and $-2.33 = \frac{-233}{100}$

$x = \frac{1}{2}\left(\frac{-23}{10} + \frac{-233}{100}\right)$

On simplifying we get

$\Rightarrow x = \frac{1}{2} \times \left(\frac{-230 - 233}{100}\right)$

$\Rightarrow x = \frac{1}{2} \times \frac{-463}{100}$

$\Rightarrow$ x = -2.315

Now if we find a rational number between $-2.315 = \frac{-2315}{1000}$ and $-2.3 = \frac{-23}{10}$ it will also be between -2.3 and -2.33 since -2.315 lies between -2.3 and -2.33

Therefore, to find rational number y (let) between $\frac{-2315}{1000}$ and $\frac{-23}{10}$

$y = \frac{1}{2}\left(\frac{-2315}{1000} + \frac{-23}{10}\right)$

Taking LCM and simplifying we get

$\Rightarrow y = \frac{1}{2}\left(\frac{-2315 - 2300}{1000}\right)$

$\Rightarrow y = \frac{1}{2} \times \frac{-4615}{1000}$

$\Rightarrow$ y = -2.3075

Now if we find a rational number between $-2.315 = \frac{-2315}{1000}$ and $-2.33 = \frac{-233}{100}$ it will also be between -2.3 and -2.33 since -2.315 lies between -2.3 and -2.33

Therefore, to find rational number z (let) between $\frac{-2315}{1000}$ and $\frac{-233}{100}$

$$z = \frac{1}{2}\left(\frac{-2315}{1000} + \frac{-233}{100}\right)$$

$$\Rightarrow z = \frac{1}{2}\left(\frac{-2315 - 2330}{1000}\right)$$

$$\Rightarrow z = \frac{1}{2} \times \frac{-4645}{1000}$$

⇒ z = -2.3225

Hence the numbers are -2.3225, -2.3075 and -2.315

(iii) 5.2 and 5.3

Solution:

Given 5.2 and 5.3

To find a rational number x between two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, we use

$$x = \frac{1}{2}\left(\frac{a}{b} + \frac{c}{d}\right)$$

Therefore, to find rational number x (let) between $5.2 = \frac{52}{10}$ and $5.3 = \frac{53}{10}$

$$x = \frac{1}{2}\left(\frac{52}{10} + \frac{53}{10}\right)$$

$$\Rightarrow x = \frac{1}{2} \times \left(\frac{52 + 53}{10}\right)$$

On simplifying we get

$$\Rightarrow x = \frac{1}{2} \times \frac{105}{10}$$

⇒ x = 5.25

Now if we find a rational number between $5.25 = \frac{525}{100}$ and $5.2 = \frac{52}{10}$ it will also be between 5.2 and 5.3 since 5.25 lies between 5.2 and 5.3

Therefore, to find rational number y (let) between $5.25 = \frac{525}{100}$ and $5.2 = \frac{52}{10}$

$y = \frac{1}{2}\left(\frac{525}{100} + \frac{52}{10}\right)$

$\Rightarrow y = \frac{1}{2}\left(\frac{525 + 520}{100}\right)$

On simplifying we get

$\Rightarrow y = \frac{1}{2} \times \frac{1045}{100}$

$\Rightarrow$ y = 5.225

Now if we find a rational number between $5.25 = \frac{525}{100}$ and $5.3 = \frac{53}{10}$ it will also be between 5.2 and 5.3 since 5.25 lies between 5.2 and 5.3

Therefore, to find rational number z (let) between $5.25 = \frac{525}{100}$ and $5.3 = \frac{53}{10}$

$z = \frac{1}{2}\left(\frac{525}{100} + \frac{53}{10}\right)$

$\Rightarrow z = \frac{1}{2}\left(\frac{525 + 530}{100}\right)$

On simplifying we get

$\Rightarrow z = \frac{1}{2} \times \frac{1055}{100}$

$\Rightarrow$ z = 5.275

Hence the numbers are 5.225, 5.25 and 5.275

(iv) -4.5 and 4.6

Solution:

Given -4.5 and 4.6

To find a rational number x between two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, we use

$x = \frac{1}{2}\left(\frac{a}{b} + \frac{c}{d}\right)$

Therefore, to find rational number x (let) between $-4.5 = \frac{-45}{10}$ and $4.6 = \frac{46}{10}$

$x = \frac{1}{2}\left(\frac{-45}{10} + \frac{46}{10}\right)$

$\Rightarrow x = \frac{1}{2} \times \left(\frac{-45 + 46}{10}\right)$

$\Rightarrow x = \frac{1}{2} \times \frac{1}{10}$

$\Rightarrow$ x = 0.05

Now if we find a rational number between $-4.5 = \frac{-45}{10}$ and $0.05 = \frac{5}{100}$ it will also be between -4.5 and 4.6 since 0.05 lies between -4.5 and 4.6

Therefore, to find rational number y (let) between $-4.5 = \frac{-45}{10}$ and $0.05 = \frac{5}{100}$

$$y = \frac{1}{2}\left(\frac{-45}{10} + \frac{5}{100}\right)$$

$$\Rightarrow y = \frac{1}{2}\left(\frac{-450+5}{100}\right)$$

On simplifying we get

$$\Rightarrow y = \frac{1}{2} \times \frac{-445}{100}$$

⇒ y = -2.225

Now if we find a rational number between $4.6 = \frac{46}{10}$ and $0.05 = \frac{5}{100}$ it will also be between -4.5 and 4.6 since 0.05 lies between -4.5 and 4.6

Therefore, to find rational number z (let) between $4.6 = \frac{46}{10}$ and $0.05 = \frac{5}{100}$

$$z = \frac{1}{2}\left(\frac{46}{10} + \frac{5}{100}\right)$$

$$\Rightarrow z = \frac{1}{2}\left(\frac{460+5}{100}\right)$$

On simplifying we get

$$\Rightarrow z = \frac{1}{2} \times \frac{465}{100}$$

⇒ z = 2.325

Hence the numbers are -2.225, 0.05and 2.325

PRACTICE SET 2.3 PAGE NO: 30

1. State the order of the surds given below.

i. $\sqrt[3]{7}$

ii. $5\sqrt{12}$

iii. $\sqrt[4]{10}$

iv. $\sqrt{39}$

v. $\sqrt[3]{18}$

Solution:

i. Given $\sqrt[3]{7}$

In $\sqrt[n]{a}$, n is called the order of the surd.
Therefore, here the order of surd is 3.

ii. Given $\sqrt[5]{12}$

In $\sqrt[n]{a}$, n is called the order of the surd.
Therefore, here the order of surd is 5.

iii. Given $\sqrt[4]{10}$

In $\sqrt[n]{a}$, n is called the order of the surd.
Therefore, here the order of surd is 4.

iv. Given
$\sqrt{39}$

In $\sqrt[n]{a}$, n is called the order of the surd.
Therefore, here the order of surd is 2.

v. Given $\sqrt[3]{18}$

In $\sqrt[n]{a}$, n is called the order of the surd.
Therefore, here the order of surd is 3.

2. State which of the following are surds. Justify.

i. $\sqrt[3]{51}$

ii. $\sqrt[4]{51}$

iii. $\sqrt[5]{81}$

iv. $\sqrt{256}$

v. $\sqrt[3]{64}$

vi. $\sqrt{\frac{22}{7}}$

Solution:

i. $\sqrt[3]{51}$

Surds are numbers left in root form (√) to express its exact value. It has an infinite number of non-recurring decimals. Therefore, surds are irrational numbers.

It is a surd ∵ it cannot be expressed as a rational number.

ii. $\sqrt[4]{51}$

Surds are numbers left in root form (√) to express its exact value. It has an infinite number of non-recurring decimals. Therefore, surds are irrational numbers.

It is a surd ∵ it cannot be expressed as a rational number.

iii. $\sqrt[5]{81} = \sqrt[5]{3^4}$

Surds are numbers left in root form (√) to express its exact value. It has an infinite number of non-recurring decimals. Therefore, surds are irrational numbers.

It is a surd ∵ it cannot be expressed as a rational number.

iv. $\sqrt{256} = \sqrt{162} = 16$

Surds are numbers left in root form (√) to express its exact value. It has an infinite number of non-recurring decimals. Therefore, surds are irrational numbers.

It is not a surd ∵ it is a rational number.

v. $\sqrt[3]{64} = \sqrt[3]{4^3} = 4$

Surds are numbers left in root form (√) to express its exact value. It has an infinite number of non-recurring decimals. Therefore, surds are irrational numbers.
It is not a surd ∵ it is a rational number.

vi. Given $\sqrt{\frac{22}{7}}$

Surds are numbers left in root form (√) to express its exact value. It has an infinite number of non-recurring decimals. Therefore, surds are irrational numbers.
It is a surd ∵ it cannot be expressed as a rational number.

3. Classify the given pair of surds into like surds and unlike surds.
i. √52, 5√13
ii. √68, 5√3
iii. 4√18, 7√2
iv. 19√12, 6√3
v. 5√22, 7√33
vi. 5√5, √75

Solution:
Two or more surds are said to be similar or like surds if they have the same surd-factor.
Two or more surds are said to be dissimilar or unlike when they are not similar.
Therefore,

i. Given √52, 5√13
given surd can be written as
√52 = √ (2×2×13) = 2√13
5√13
∵ both surds have same surd-factor that is √13.
∴ they are like surds.

ii. Given √68, 5√3
Given surd can be written as
√68 = √ (2×2×17) = 2√17

5√3
∵ both surds have different surd-factors √17 and √3.
∴ they are unlike surds.

iii. Given 4√18, 7√2
Given surd can be written as
4√18 = 4 √ (2×3×3) = 4×3√2 = 12√2
7√2
∵ both surds have same surd-factor i.e., √2.
∴ they are like surds.

iv. Given 19√12, 6√3
Given surd can be written as
19√12 = 19√ (2×2×3) = 19×2√3 = 38√3
6√3
∵ both surds have same surd-factor i.e., √3.
∴ they are like surds.

v. Given 5√22, 7√33
∵ both surds have different surd-factors √22 and √33.
∴ they are unlike surds.

vi. Given 5√5, √75
5√5
Given surd can be written as
√75 = √ (5×5×3) = 5√3
∵ both surds have different surd-factors √5 and √3.
∴ they are unlike surds.

4. Simplify the following surds.
i. √27
ii. √50
iii. √250
iv. √112
v. √168

Solution:

i. Given question can be written as

$\sqrt{27} = \sqrt{3 \times 3 \times 3}$

$\Rightarrow \sqrt{27} = \sqrt{3 \times (3)^2}$

On simplifying we get

$\Rightarrow \sqrt{27} = 3\sqrt{3}$

ii. Given question can be written as

$\sqrt{50} = \sqrt{2 \times 5 \times 5}$

On simplifying we get

$\Rightarrow \sqrt{50} = \sqrt{2 \times (5)^2}$

$\Rightarrow \sqrt{50} = 5\sqrt{2}$

iii. The given question can be written as

$\sqrt{250} = \sqrt{2 \times 5 \times 5 \times 5}$

On simplifying we get

$\Rightarrow \sqrt{250} = \sqrt{10 \times (5)^2}$

$\Rightarrow \sqrt{250} = 5\sqrt{10}$

iv. The given question can be written as

$\sqrt{112} = \sqrt{2 \times 2 \times 2 \times 2 \times 7}$

$\Rightarrow \sqrt{112} = \sqrt{(2)^2 \times (2)^2 \times 7}$

On simplifying we get

$\Rightarrow \sqrt{112} = 2 \times 2 \times \sqrt{7}$

$\Rightarrow \sqrt{112} = 4\sqrt{7}$

v. Given question can be written as

$\sqrt{168} = \sqrt{2 \times 2 \times 2 \times 3 \times 7}$

$= \sqrt{(2)^2 \times 2 \times 3 \times 7}$

On simplifying we get

$= 2 \times \sqrt{42}$

$= 2\sqrt{42}$

PRACTICE SET 2.4 PAGE NO: 32

1. Multiply
i. $\sqrt{3}(\sqrt{7} - \sqrt{3})$
ii. $(\sqrt{5} - \sqrt{7})\sqrt{2}$
iii. $(3\sqrt{2} - \sqrt{3})(4\sqrt{3} - \sqrt{2})$

Solution:
i. Given $\sqrt{3}(\sqrt{7} - \sqrt{3})$
$= \sqrt{3} \times \sqrt{7} - \sqrt{3} \times \sqrt{3}$
$[\because \sqrt{a}(\sqrt{b} - \sqrt{c}) = \sqrt{a} \times \sqrt{b} - \sqrt{a} \times \sqrt{c}]$
$= \sqrt{21} - 3$

ii. Given $(\sqrt{5} - \sqrt{7})\sqrt{2}$
$= \sqrt{5} \times \sqrt{2} - \sqrt{7} \times \sqrt{2}$
$[\because \sqrt{a}(\sqrt{b} - \sqrt{c}) = \sqrt{a} \times \sqrt{b} - \sqrt{a} \times \sqrt{c}]$
$= \sqrt{10} - \sqrt{14}$

iii. Given $(3\sqrt{2} - \sqrt{3})(4\sqrt{3} - \sqrt{2})$
$= 3\sqrt{2}(4\sqrt{3} - \sqrt{2}) - \sqrt{3}(4\sqrt{3} - \sqrt{2})$
$[\because \sqrt{a}(\sqrt{b} - \sqrt{c}) = \sqrt{a} \times \sqrt{b} - \sqrt{a} \times \sqrt{c}]$
$= 3\sqrt{2} \times 4\sqrt{3} - 3\sqrt{2} \times \sqrt{2} - \sqrt{3} \times 4\sqrt{3} + \sqrt{3} \times \sqrt{2}$
$= 12\sqrt{6} - 3 \times 2 - 4 \times 3 + \sqrt{6}$
$= 12\sqrt{6} - 6 - 12 + \sqrt{6}$
$= 13\sqrt{6} - 18$

2. Rationalize the denominator.

i. $\frac{1}{\sqrt{7} + \sqrt{2}}$

ii. $\frac{3}{2\sqrt{5} - 3\sqrt{2}}$

iii. $\frac{4}{7 + 4\sqrt{3}}$

iv. $\frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$

Solution:

i. The rationalizing factor of √7 + √2 is √7 – √2. Therefore, multiply both numerator and denominator by √7 – √2.

$$\frac{1}{\sqrt{7}+\sqrt{2}} = \frac{1}{\sqrt{7}+\sqrt{2}} \times \frac{\sqrt{7}-\sqrt{2}}{\sqrt{7}-\sqrt{2}}$$

The above equation can be written as

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

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

[∵ $(a - b)(a + b) = a^2 - b^2$]

On simplifying we get

$$\Rightarrow \frac{1}{\sqrt{7}+\sqrt{2}} = \frac{\sqrt{7}-\sqrt{2}}{7-2}$$

$$\Rightarrow \frac{1}{\sqrt{7}+\sqrt{2}} = \frac{\sqrt{7}-\sqrt{2}}{5}$$

ii. The rationalizing factor of 2√5 – 3√2 is 2√5 + 3√2. Therefore, multiply both numerator and denominator by 2√5 + 3√2.

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

The above equation can be written as

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

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

[∵ $(a - b)(a + b) = a^2 - b^2$]

On simplifying we get

$$\Rightarrow \frac{3}{2\sqrt{5}-3\sqrt{2}} = \frac{6\sqrt{5}+9\sqrt{2}}{20-18}$$

$$\Rightarrow \frac{3}{2\sqrt{5}-3\sqrt{2}} = \frac{6\sqrt{5}\ +\ 9\sqrt{2}}{2}$$

iii. The rationalizing factor of 7 + 4√3 is 7 – 4√3. Therefore, multiply both numerator and denominator by 7 – 4√3.

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

The above equation can be written as

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

$$\Rightarrow \frac{4}{7+4\sqrt{3}} = \frac{28-16\sqrt{3}}{(7)^2-(4\sqrt{3})^2}$$

[∵ (a - b) (a + b) = $a^2 - b^2$]

On simplifying we get

$$\Rightarrow \frac{4}{7+4\sqrt{3}} = \frac{28-16\sqrt{3}}{49-48}$$

$$\Rightarrow \frac{4}{7+4\sqrt{3}} = 28-16\sqrt{3}$$

iv. The rationalizing factor of √5 + √3 is √5 - √3. Therefore, multiply both numerator and denominator by √5 - √3.

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

The above equation can be written as

$$\Rightarrow \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}} = \frac{(\sqrt{5}-\sqrt{3})(\sqrt{5}-\sqrt{3})}{(\sqrt{5}+\sqrt{3})(\sqrt{5}-\sqrt{3})}$$

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

[∵ (a - b) (a + b) = $a^2 - b^2$]

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

[∵ $(a - b)^2 = a^2 + b^2 - 2ab$]

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

On simplifying we get

$$\Rightarrow \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}} = \frac{8-2\sqrt{15}}{2}$$

$$\Rightarrow \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}} = \frac{2[4-\sqrt{15}]}{2}$$

$$\Rightarrow \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}} = 4-\sqrt{15}$$

PRACTICE SET 2.5 PAGE NO: 33

1. Find the value.
(i) |15 - 2|
(ii) |4 - 9|
(iii) |7| × |-4|

Solution:
i. Given |15 - 2|
Absolute value describes the distance of a number on the number line from 0 without considering which direction from zero the number lies. The absolute value of a number is never negative.
Therefore,
|15 - 2| = |13| = 13

ii. Given |4 - 9|
Absolute value describes the distance of a number on the number line from 0 without considering which direction from zero the number lies. The absolute value of a number is never negative.
Therefore,
|4 - 9| = |-5| = 5

iii. Given |7| × |-4|
Absolute value describes the distance of a number on the number line from 0 without considering which direction from zero the number lies. The absolute value of a number is never negative.
Therefore,
|7| × |-4| = 7 × 4 = 28

2. Solve.
i. |3x - 5| = 1
ii. |7 – 2x| = 5
iii. $\left|\frac{8-x}{2}\right| = 5$

iv. $\left|5+\frac{x}{4}\right|=5$

Solution:

i. Given |3x - 5| = 1

The above expression can be written as

⇒ 3x - 5 = 1 or 3x - 5 = -1

⇒ 3x = 1 + 5 or 3x = -1 + 5

⇒ 3x = 6 or 3x = 4

$\Rightarrow\ x = \frac{6}{3} \text{ or } x = \frac{4}{3}$

$\Rightarrow\ x = 2 \text{ or } x = \frac{4}{3}$

ii. Given |7 – 2x| = 5

The above expression can be written as

⇒ 7 – 2x = 5 or 7 – 2x = -5

⇒ 2x = 7 - 5 or 2x = 7 + 5

⇒ 2x = 2 or 2x = 12

$\Rightarrow\ x = 1 \text{ or } x = \frac{12}{2}$

⇒ x = 1 or x = 6

iii. Given

$\left|\frac{8-x}{2}\right| = 5$

The above expression can be written as

$\Rightarrow \frac{8-x}{2} = 5 \text{ or } \frac{8-x}{2} = -5$

⇒ 8 – x = 2 × 5 or 8 – x = 2 × -5

⇒ 8 – x = 10 or 8 – x = -10

⇒ x = 8 – 10 or x = 8 + 10

⇒ x = -2 or x = 18

iv. Given

$\left|5+\frac{x}{4}\right| = 5$

The above expression can be written as

$\Rightarrow 5 + \frac{x}{4} = 5 \text{ or } 5 + \frac{x}{4} = -5$

$\Rightarrow \frac{20 + x}{4} = 5 \text{ or } \frac{20 + x}{4} = -5$

$\Rightarrow 20 + x = 4 \times 5 \text{ or } 20 + x = 4 \times -5$

$\Rightarrow 20 + x = 20 \text{ or } 20 + x = -20$

$\Rightarrow x = 20 - 20 \text{ or } x = -20 - 20$

$\Rightarrow x = 0 \text{ or } x = -40$

PROBLEM SET 2 PAGE NO: 34

1. Choose the correct alternative answer for the questions given below.

i. Which one of the following is an irrational number?

A. √16/25

B. √5

C. 3/9

D. √196

Solution:

B. √5

Explanation:

An irrational number is a number that cannot be expressed as a fraction p/q for any integers p and q and q ≠ 0.

Since √5 cannot be written as p/q it is an irrational number

Therefore √5 is an irrational number.

ii. Which of the following is an irrational number?

A. 0.17

B. $1.\overline{513}$

C. $0.27\overline{46}$

D. 0.101001000....

Solution:

D. 0.101001000....

Explanation:

An irrational number is a number that cannot be expressed as a fraction p/q for any integers p and q and q ≠ 0.

0.101001000.... is an irrational number because it is a non-terminating and non-`repeating decimal.

Therefore, 0.101001000.... is an irrational number.

iii. Decimal expansion of which of the following is non-terminating recurring?

A. 2/5
B. 3/16
C. 3/11
D. 137/25

Solution:
C. 3/11

Explanation:
A non-terminating recurring decimal representation means that the number will have an infinite number of digits to the right of the decimal point and those digits will repeat themselves.

$$\frac{3}{11} = 0.2727 \ldots = 0.\overline{27}$$

∵ it has an infinite number of digits to the right of the decimal point which are repeating themselves ∴ it is a non-terminating recurring decimal.

iv. Every point on the number line represent, which of the following numbers?
A. Natural numbers
B. Irrational numbers
C. Rational numbers
D. Real numbers.

Solution:
D. Real numbers.

Explanation:
Every point of a number line is assumed to correspond to a real number, and every real number to a point. Therefore, every point on the number line represent a real number.

v. The number 0.4 in p/q form is …………
A. 4/9
B. 40/9
C. 3.6/9
D. 36/9

Solution:

C. 3.6/9

Explanation:

$0.4 = \frac{4}{10}$

∵ the denominator of all the above options is 9 ∴ we multiply both numerator and denominator by 0.9 as 10 × 0.9 = 9

$\Rightarrow 0.4 = \frac{4 \times 0.9}{10 \times 0.9}$

$\Rightarrow 0.4 = \frac{3.6}{9}$

vi. What is √n, if n is not a perfect square number?
A. Natural number
B. Rational number
C. Irrational number
D. Options A, B, C all are correct.

Solution:
C. Irrational number

Explanation:
If n is not a perfect square number, then √n cannot be expressed as ratio of a and b where a and b are integers and b ≠ 0
Therefore, √n is an Irrational number

vii. Which of the following is not a surd?
A. √7
B. 3√17
C. 3√64
D. √193

Solution:
C. 3√64

Explanation:

$\sqrt[3]{64} = \sqrt[3]{4 \times 4 \times 4}$

$\Rightarrow \sqrt[3]{64} = \sqrt[3]{4^3}$

$\Rightarrow \sqrt[3]{64} = 4$

Which is a rational number

Therefore, $\sqrt[3]{64}$ is not a surd.

viii. What is the order of the surd $\sqrt[3]{\sqrt{5}}$?

A. 3
B. 2
C. 6
D. 5

Solution:
C. 6

Explanation:

$\sqrt[3]{\sqrt{5}} = \sqrt[3]{(5)^{\frac{1}{2}}}$

$\Rightarrow \sqrt[3]{\sqrt{5}} = \sqrt[3\times2]{5}$

$\Rightarrow \sqrt[3]{\sqrt{5}} = \sqrt[6]{5}$

Therefore, the order of the surd $\sqrt[3]{\sqrt{5}}$ is 6.

ix. Which one is the conjugate pair of 2√5 + √3?

A. -2√5 + √3
B. -2√5 - √3
C. 2√3 + √5
D. √3 + 2√5

Solution:
A. -2√5 + √3

Explanation:
A math conjugate is formed by changing the sign between two terms in a binomial. For

instance, the conjugate of x + y is x - y.
Now,
$2\sqrt{5} + \sqrt{3} = \sqrt{3} + 2\sqrt{5}$
Its conjugate pair = $\sqrt{3} - 2\sqrt{5} = -2\sqrt{5} + \sqrt{3}$
∴ The conjugate pair of $2\sqrt{5} + \sqrt{3} = -2\sqrt{5} + \sqrt{3}$

x. The value of $|12 – (13 + 7) \times 4|$ is ....
A. -68
B. 68
C. -32
D. 32

Solution:
B. 68

Explanation:
$|12 – (13 + 7) \times 4| = |12 – 20 \times 4|$
(Solving it according to BODMAS)
$\Rightarrow |12 – (13 + 7) \times 4| = |12 – 80|$
$\Rightarrow |12 – (13 + 7) \times 4| = |-68|$
$\Rightarrow |12 – (13 + 7) \times 4| = 68$