CHAPTER 1 NUMBER SYSTEMS

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Question 1. Classify the following numbers as rational or irrational:

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

(ii) $\left(3+\sqrt{23}\right)-\sqrt{23}$

(iii) $\frac{2\sqrt{7}}{7\sqrt{7}}$

(iv) $\frac{1}{\sqrt{2}}$

(v) 2π

Solution :

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

We know that $\sqrt{5}=2.236....,$ which is an irrational number.

$2-\sqrt{5}=2-2.236....$

$=-0.236....,$

which is also an irrational number.

Therefore, we conclude that $2-\sqrt{5}$ is an irrational number.

(ii) $\left(3+\sqrt{23}\right)-\sqrt{23}$

$\left(3+\sqrt{23}\right)-\sqrt{23}=3+\sqrt{23}-\sqrt{23}$

= 3

Therefore, we conclude that $\left(3+\sqrt{23}\right)-\sqrt{23}$ is a rational number.

(iii) $\frac{2\sqrt{7}}{7\sqrt{7}}$

We can cancel $\sqrt{7}$ in the numerator and denominator, as $\sqrt{7}$ is the common number in numerator as well as denominator, to get

$$\frac{2\sqrt{7}}{7\sqrt{7}}=\frac{2}{7}$$

Therefore, we conclude that $\frac{2\sqrt{7}}{7\sqrt{7}}$ is a rational number.

(iv) $\frac{1}{\sqrt{2}}$

We know that $\sqrt{2}=1.414....,$ which is an irrational number .

We can conclude that, when 1 is divided by $\sqrt{2}$, we will get an irrational number.

Therefore, we conclude that $\frac{1}{\sqrt{2}}$ is an irrational number.

(v) 2π

We know that

$\pi=3.1415....,$ which is an irrational number.

We can conclude that 2π will also be an irrational number.

Therefore, we conclude that 2π is an irrational number.

Question 2. Simplify each of the following expressions

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

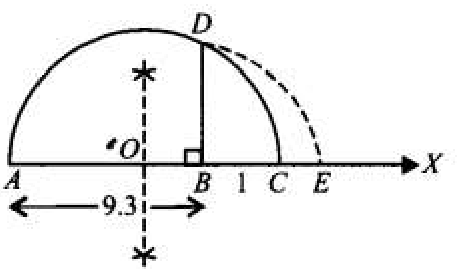
(iii) $(\sqrt{5}+\sqrt{2})^2$ **(iv) $(\sqrt{5}-\sqrt{2})(\sqrt{5}+\sqrt{2})$**

Solution :

(i) (3 + √3)(2 + √2)
= 2(3 + √3) + √2(3 + √3)
= 6 + 2√3 + 3√2 + √6
Thus, (3 + √3)(2 + √2) = 6 + 2√3 + 3√2 + √6
(ii) (3 + √3)(3 – √3) = (3)2 – (√3)2
= 9 – 3 = 6
Thus, (3 + √3)(3 – √3) = 6
(iii) (√5 + √2)2 = (√5)2 + (√2)2 + 2(√5)(√2)
= 5 + 2 + 2√10 = 7 + 2√10
Thus, (√5 + √2)2 = 7 + 2√10
(iv) (√5 – √2)(√5 + √2) = (√5)2 – (√2)2 = 5 – 2 = 3
Thus, (√5 – √2) (√5 + √2) = 3

Question 3. Recall, π is defined as the ratio of the circumference (say c) of a circle to its diameter (say d). That is π = $\frac{c}{d}$. This seems to contradict the fact that n is irrational. How will you resolve this contradiction?
Solution : When we measure the length of a line with a scale or with any other device, we only get an approximate ational value, i.e. c and d both are irrational.
∴ $\frac{c}{d}$ is irrational and hence π is irrational.
Thus, there is no contradiction in saying that it is irrational.

Question 4. Represent $\sqrt{9.3}$on the number line.
Solution :
Draw a line segment AB = 9.3 units and extend it to C such that BC = 1 unit.
Find mid point of AC and mark it as O.
Draw a semicircle taking O as centre and AO as radius. Draw BD ⊥ AC.
Draw an arc taking B as centre and BD as radius meeting AC produced at E such that BE = BD = $\sqrt{9.3}$units.



Question 5. Rationalise the denominator of the following

(i) $\frac{1}{\sqrt{7}}$ **(ii)** $\frac{1}{\sqrt{7}-\sqrt{6}}$ **(iii)** $\frac{1}{\sqrt{5}+\sqrt{2}}$ **(iv)** $\frac{1}{\sqrt{7}-2}$

Solution :

(i) $\frac{1}{\sqrt{7}} = \frac{1 \times \sqrt{7}}{\sqrt{7} \times \sqrt{7}} = \frac{\sqrt{7}}{7}$

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

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

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

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

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

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