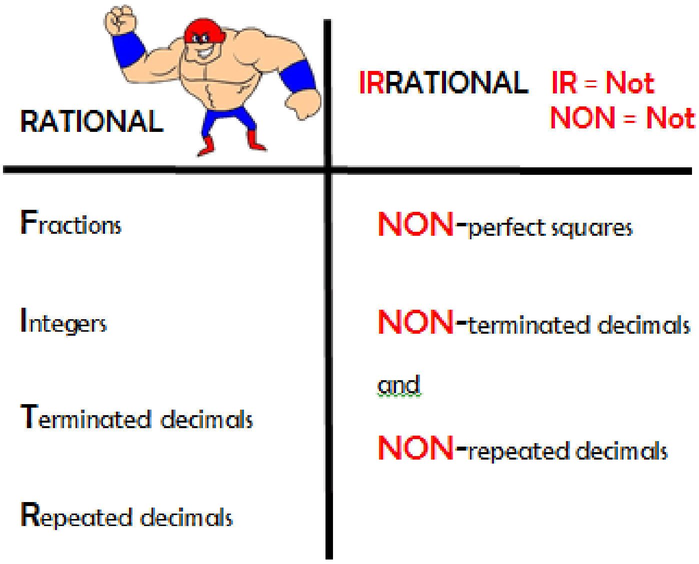
NCERT Class 9 Solutions: Number Systems (Chapter 1) Exercise 1.5 – Part 1

Q-1 Classify the following numbers as rational or irrational:

1. $2-\sqrt{5}$
2. $\left(3+\sqrt{23}\right)-\sqrt{23}$
3. $\frac{2\sqrt{7}}{7\sqrt{7}}$
4. $\frac{1}{\sqrt{2}}$
5. 2π

Solution:



- Given multiple numbers and classify the numbers as rational or irrational

1. $2-\sqrt{5}=2-2.2360679\ldots=-0.2360679\ldots$

Since it is non-terminating and non-recurring number

So, it is an irrational number

1. $\left(3+\sqrt{23}\right)-\sqrt{23}=3+\sqrt{23}-\sqrt{23}=3=\frac{3}{1}$

Since the number can be written $\frac{p}{q}$ form

So, it is a rational number

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

Since the number can be written $\frac{p}{q}$ form

So, it is a rational number

1. $\frac{1}{\sqrt{2}} = \frac{1 \times \sqrt{2}}{\sqrt{2} \times \sqrt{2}} = \frac{\sqrt{2}}{2} = \frac{1.4142135623 \ldots}{2} = 0.707106 \ldots$

Since it is non-terminating and non-recurring number

So, it is an irrational number

1. $2\pi = 2 \times 3.141528 \ldots = 6.283056 \ldots$

Since it is non-terminating and non-recurring number

So, it is an irrational number

Q-2 Simplify each of the following expressions:

1. $(3+\sqrt{3})\,(2+\sqrt{2})$
2. $(3+\sqrt{3})-(3-\sqrt{3})$
3. $(\sqrt{5}+\sqrt{2})^2$
4. $(\sqrt{5}-\sqrt{2})\,(\sqrt{5}+\sqrt{2})$

Solution:

1. $(3+\sqrt{3})\,(2+\sqrt{2}) = 3 \times 2 + 3\sqrt{2} + 2\sqrt{3} + \sqrt{3} \times \sqrt{2} = 6 + 3\sqrt{2} + 2\sqrt{3} + \sqrt{6}$
2. $(3+\sqrt{3})-(3-\sqrt{3})$

Using identify $(a+b)\,(a-b) = a^2 - b^2$

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

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

Using identify $(a+b)^2 = a^2 + b^2 + 2ab$

$$(\sqrt{5}+\sqrt{2})^2 = 5 + 2 + 2\sqrt{5}\sqrt{2} = 7 + 2\sqrt{10}$$

1. $(\sqrt{5}-\sqrt{2})\,(\sqrt{5}+\sqrt{2})$

Using identify $(a+b)\,(a-b) = a^2 - b^2$

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

Q-3 Recall is defined as the ratio of the circumference (say c) of a circle to its diameter (say d) . That is, $\pi = \frac{c}{d}$. Thus seems to contradict the fact that is irrational. How will you resolve this contradiction?

Solution:

- There is no contradiction. The question can be put in this way. If either or both c and d are irrational than π can never be rational.
- Now if any of c and d are irrational (i.e.. with infinite many digits after decimal point) we would know that only if we can measure both the diameter and circumference with extreme accuracy. Suppose we have a circle whose circumference is either c =

10.12345678912345678123456712345678123456789234567891 or c = 10.12345678912345678123456712345678123456789234567892. So any normal instrument cannot be used to distinguish between the two. So how would we know if circumference is either rational or irrational?

- In practice we cannot even measure an object in real life to such accuracy to give its size an exact finite decimal expansion with the certainty. The alternative is to use mathematics to determine what c should be, ideally, for some given d. The irrational π is telling us that even if we start with a finite decimal d and do the mathematics correctly, we will never reach the last digit of c.