NCERT Solutions Class 9 Maths
Chapter 1: Number Systems
EXERCISE 1.4

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Quick Summary: In NCERT Solutions Class 9 Maths Chapter 1 Exercise 1.4, students learn fundamental operations on real numbers including classification of rational and irrational numbers and their decimal expansions. This exercise covers critical concepts like rationalizing denominators, simplifying surds, and geometric representation of irrational numbers on the number line, which are essential for building strong foundations in algebra and coordinate geometry for CBSE board exams.

Key Takeaways:

- Rational numbers can be expressed as (p)/(q) where q ≠ 0, while irrational numbers cannot be expressed in this form
- Rationalizing denominators involves multiplying by the conjugate: (1)/(√a) + √b = √a - √ba - b
- Decimal expansions of rational numbers are either terminating or non-terminating repeating, while irrational numbers have non-terminating non-repeating decimals
- Geometric construction using compass and ruler helps represent irrational numbers like √9.3 accurately on the number line

Complete Solutions

Question 1

QUESTION

Classify the following numbers as rational or irrational:

(i) 2 - √5
(ii) (3 + √23) - √23
(iii) 2√77√7
(iv) (1)/(√2)
(v) 2π

SOLUTION

We need to classify the given numbers as either rational or irrational. Remember that a rational number can be expressed in the form where and are integers and , while an irrational number cannot be expressed in this form.

(i)

Step 1: Analyze the number

We have the number . We know that 2 is a rational number, and is an irrational number.

Step 2: Apply the properties of rational and irrational numbers

The difference between a rational number and an irrational number is always irrational.

Step 3: Conclude

Therefore, is an irrational number.

(ii)

Step 1: Simplify the expression

We can simplify the expression by removing the parentheses:

Step 2: Combine like terms

The and terms cancel each other out:

Step 3: Conclude

Since 3 can be written as , it is a rational number.

(iii)

Step 1: Simplify the expression

We can simplify the fraction by canceling out the common factor from the numerator and the denominator:

Step 2: Conclude

Since is in the form where and are integers and , it is a rational number.

(iv)

Step 1: Analyze the number

We have . We know that 1 is a rational number, and is an irrational number.

Step 2: Apply the properties of rational and irrational numbers

The quotient of a rational number and an irrational number is always irrational (provided the rational number is non-zero).

Step 3: Conclude

Therefore, is an irrational number.

(v)

Step 1: Analyze the number

We have . We know that 2 is a rational number, and is an irrational number.

Step 2: Apply the properties of rational and irrational numbers

The product of a non-zero rational number and an irrational number is always irrational.

Step 3: Conclude

Therefore, is an irrational number.

ANSWER

(i) Irrational

(ii) Rational

(iii) Rational

(iv) Irrational

(v) Irrational

Question 2

QUESTION

Simplify each of the following expressions:

(i) (3 + √3)(2 + √2)
(ii) (3 + √3)(3 - √3)
(iii) (√5 + √2)^2
(iv) (√5 - √2)(√5 + √2)

SOLUTION

This question tests our ability to simplify expressions involving surds (irrational numbers) using algebraic identities and basic arithmetic operations.

(i)

Step 1: Expand the expression using the distributive property (FOIL method).

Multiply each term in the first bracket with each term in the second bracket:

Step 2: Simplify each term.

Final Answer:

(ii)

Step 1: Recognize this as an identity: , where and .

Step 2: Apply the identity.

Step 3: Simplify.

Final Answer: 6

(iii)

Step 1: Recognize this as an identity: , where and .

Step 2: Apply the identity.

Step 3: Simplify each term.

Step 4: Combine like terms.

Final Answer:

(iv)

Step 1: Recognize this as an identity: , where and .

Step 2: Apply the identity.

Step 3: Simplify.

Final Answer: 3

ANSWER

(i) $6 + 3\sqrt{2} + 2\sqrt{3} + \sqrt{6}$

(ii) 6

(iii) $7 + 2\sqrt{10}$

(iv) 3

Question 3

QUESTION

Recall that π is defined as the ratio of the circumference (say c) of a circle to its diameter (say d). That is, π = (c)/(d). This seems to contradict the fact that π is irrational. How will you resolve this contradiction?

SOLUTION

The question highlights a common point of confusion regarding the irrationality of and its definition as the ratio of a circle's circumference to its diameter.

Step 1: Understand the definition of

is defined as the ratio of a circle's circumference () to its diameter ():

The question points out that if and are measurable quantities, then their ratio should be a rational number, seemingly contradicting the fact that is irrational.

Step 2: Acknowledge the limitations of measurement

When we measure the circumference or diameter of a circle using a scale or any other measuring device, we only obtain approximate values. These measurements are limited by the precision of the instrument and our ability to read it accurately.

Step 3: Explain why measured values are rational approximations

Any measurement we take will be a rational number, as it can be expressed as a finite decimal or a fraction. However, this doesn't mean that the actual values of and are necessarily rational.

Step 4: Resolve the apparent contradiction

The contradiction arises from the assumption that our measurements are perfectly accurate. In reality, either or (or both) could be irrational numbers. When we measure them, we are only obtaining rational approximations of their true values.

Therefore, even though we express as a ratio of two measured quantities, , where and are rational approximations, this does not contradict the fact that itself is irrational.

Final Answer: There is no contradiction. Measurement using a scale only gives approximate rational values, so you may not realise that either or is irrational.

ANSWER

There is no contradiction. Measurement using a scale only gives approximate rational values, so you may not realise that either c or d is irrational.

Question 4

QUESTION

Represent √9.3 on the number line.

SOLUTION

We need to represent on the number line. This involves a geometric construction to find a length equal to and then marking that length on the number line.

Step 1: Draw a line segment AB = 9.3 units

Draw a line and mark a point A on it. Using a ruler, measure 9.3 units from A and mark the point as B. So, the length of the line segment AB is 9.3 units.

Step 2: Extend the line segment AB to C such that BC = 1 unit

Extend the line segment AB by 1 unit from point B. Mark this new point as C. Now, the length of AC is units.

Step 3: Find the midpoint of AC

Let's call the midpoint O. To find O, we need to find the middle point of the line segment AC. The length of AC is 10.3 units, so the midpoint O will be at a distance of units from A.

Step 4: Draw a semicircle with center O and radius OC

With O as the center and OC as the radius (which is equal to OA), draw a semicircle. Since O is the midpoint, OA = OC = 5.15 units.

Step 5: Draw a perpendicular line BD to AC, intersecting the semicircle at D

At point B, draw a line perpendicular to AC. This line should intersect the semicircle at a point, which we will call D. BD is the perpendicular from B to the semicircle.

Step 6: BD =

The length of BD is equal to . This is a geometric property related to the mean proportional. We have constructed BD such that its length represents the square root of 9.3.

Step 7: Transfer the length BD onto the number line

With B as the center and BD as the radius, draw an arc that intersects the line AC at point E. The distance BE is equal to BD, which is . Since B represents 9.3 on our initial scale, E now represents relative to the origin A, but the distance BE from B is exactly .

Therefore, the point E on the number line represents from point B.

ANSWER

Refer Fig. 1.17.

Question 5

QUESTION

Rationalise the denominators of the following:

(i) (1)/(√7)
(ii) (1)/(√7) - √6
(iii) (1)/(√5) + √2
(iv) (1)/(√7) - 2

SOLUTION

We are asked to rationalize the denominators of four different expressions. Rationalizing the denominator means rewriting the expression so that there are no irrational numbers in the denominator.

(i)

Step 1: Multiply both the numerator and denominator by .

Step 2: Simplify.

Final Answer:

(ii)

Step 1: Multiply both the numerator and denominator by the conjugate of the denominator, which is .

Step 2: Simplify using the difference of squares formula: .

Final Answer:

(iii)

Step 1: Multiply both the numerator and denominator by the conjugate of the denominator, which is .

Step 2: Simplify using the difference of squares formula: .

Final Answer:

(iv)

Step 1: Multiply both the numerator and denominator by the conjugate of the denominator, which is .

Step 2: Simplify using the difference of squares formula: .

Final Answer:

ANSWER

(i) $\sqrt{77}$

(ii) $\sqrt{7} + \sqrt{6}$

(iii) $\sqrt{5} - \sqrt{23}$

(iv) $\sqrt{7} + 23$

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📐 Key Formulas

Important Formulas for Exercise 1.4

Formula / Concept	Description
Rational Numbers	A number is rational if it can be written in the form (p)/(q), where p and q are integers and q ≠ 0. Its decimal expansion is either terminating or non-terminating recurring.
Irrational Numbers	A number is irrational if it cannot be written in the form (p)/(q). Its decimal expansion is non-terminating and non-recurring.
Real Numbers	The collection of all rational and irrational numbers together make up the real numbers.

Formula / Concept	Description
Operations on Rational and Irrational Numbers	• The sum or difference of a rational number and an irrational number is irrational. • The product or quotient of a non-zero rational number with an irrational number is irrational. • The sum, difference, product, or quotient of two irrational numbers might be rational or irrational.
Identity I	$\sqrt{ab} = \sqrt{a}\ \sqrt{b}$
Identity II	$\sqrt{(a)/(b)} = \sqrt{a}\sqrt{b}$
Identity III	$(\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b}) = a - b$
Identity IV	$(a + \sqrt{b})(a - \sqrt{b}) = a^2 - b$
Identity V	$(\sqrt{a} + \sqrt{b})^2 = a + 2\sqrt{ab} + b$
Identity VI	$(\sqrt{a} - \sqrt{b})^2 = a - 2\sqrt{ab} + b$
Rationalization of the Denominator	The process of converting a denominator that contains a radical (an irrational number) into a rational number by multiplying the numerator and denominator by a suitable expression.
Rationalizing Factor for $(1)/(\sqrt{a}) \pm \sqrt{b}$	To rationalize the denominator of an expression like $(1)/(\sqrt{a}) + \sqrt{b}$, we multiply the numerator and denominator by its conjugate, $\sqrt{a} - \sqrt{b}$.
Successive Magnification	A method to visualize the representation of terminating and non-terminating recurring decimal numbers on the number line by progressively magnifying intervals.

❓ Top FAQs

Q1. How many questions are in NCERT Solutions Class 9 Maths Chapter 1 Number Systems Exercise 1.4 for CBSE 2025-26?

Exercise 1.4 of NCERT Solutions for Class 9 Maths Chapter 1 Number Systems contains exactly 5 questions. These questions focus on operations on real numbers, including visualizing rational and irrational numbers on the number line and understanding decimal expansions of real numbers for CBSE board exam 2025-26.

Q2. Where can I download free PDF of NCERT Solutions for Class 9 Maths Chapter 1 Number Systems Exercise 1.4 with step by step solutions?

You can download the free PDF of NCERT Solutions for Class 9 Maths Chapter 1 Number Systems Exercise 1.4 from official NCERT website or various educational portals offering step by step solutions. These PDFs contain detailed explanations for all 5 questions covering rational and irrational numbers, making them ideal for CBSE board exam 2025-26 preparation.

Q3. How many marks does Number Systems Chapter 1 carry in CBSE Class 9 Maths board exam 2025-26 syllabus?

Chapter 1 Number Systems carries 10 marks weightage under Unit I in the CBSE Class 9 Maths board exam 2025-26. Exercise 1.4 is particularly important as it covers operations on real numbers and decimal expansions, which are frequently asked in board examinations.

Q4. Which is the most difficult question in Exercise 1.4 of NCERT Solutions Class 9 Maths Chapter 1 Number Systems for step by step practice?

Question 2 in Exercise 1.4 of NCERT Solutions Class 9 Maths Chapter 1 is considered the most challenging as it involves visualizing multiple rational and irrational numbers on the number line using successive magnification. Students are advised to practice this question with step by step solutions to master the concept of representing real numbers geometrically for CBSE board exam 2025-26.

Q5. What is the difference between Rational and Irrational Numbers in NCERT Class 9 Maths Chapter 1 Number Systems Exercise 1.4?

In NCERT Class 9 Maths Chapter 1 Exercise 1.4, rational numbers are those that can be expressed as p/q where q≠0 and have terminating or repeating decimal expansions, while irrational numbers cannot be expressed as fractions and have non-terminating non-repeating decimal expansions. Understanding this concept is crucial for solving all 5 questions in Exercise 1.4 and scoring well in CBSE board exam 2025-26.

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