NCERT Solutions Class 9 Maths
Chapter 1: Number Systems
EXERCISE 1.2

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Quick Summary: In NCERT Solutions Class 9 Maths Chapter 1 Exercise 1.2, students learn about irrational numbers and their properties through detailed problem-solving exercises. This exercise covers the classification of rational and irrational numbers, decimal expansions of real numbers, and geometric representation on number lines, which are essential concepts for CBSE Class 9 board exams and higher mathematics.

Key Takeaways:

- Understanding that numbers like $\sqrt{2}$, $\sqrt{5}$ are irrational while $\sqrt{4}$, $\sqrt{9}$ are rational
- Learning geometric construction methods to represent irrational numbers like $\sqrt{5}$ on the number line using Pythagorean theorem
- Mastering the identification of rational vs irrational numbers based on their decimal expansions (terminating/non-terminating repeating vs non-terminating non-repeating)
- Developing problem-solving skills for classifying real numbers into natural, whole, integers, rational, and irrational categories

Complete Solutions

Question 1

QUESTION

State whether the following statements are true or false. Justify your answers:

(i) Every irrational number is a real number.
(ii) Every point on the number line is of the form $\sqrt{m}$, where m is a natural number.
(iii) Every real number is an irrational number.

SOLUTION

This question tests our understanding of the definitions of real, irrational, and natural numbers, and how they relate to the number line.

(i) Every irrational number is a real number.

Step 1: Recall the definitions

A **real number** is any number that can be represented on the number line. This includes both rational and irrational numbers.

An **irrational number** is a number that cannot be expressed as a fraction , where and are integers and . Examples include , , and .

Step 2: Analyze the statement

Since real numbers encompass both rational and irrational numbers, every irrational number must necessarily be a real number.

Step 3: Conclusion

The statement is **True**, since the collection of real numbers is made up of rational and irrational numbers.

(ii) Every point on the number line is of the form , where is a natural number.

Step 1: Recall the definitions

A **natural number** is a positive integer (1, 2, 3, ...).

The **number line** includes all real numbers, both positive and negative, as well as zero.

Step 2: Analyze the statement

The square root of a natural number will always be non-negative. However, the number line contains negative numbers. For example, -1 is on the number line, but it cannot be expressed as where is a natural number, because the square root of a natural number is always positive or zero.

Step 3: Conclusion

The statement is **False**, no negative number can be the square root of any natural number.

(iii) Every real number is an irrational number.

Step 1: Recall the definitions

A **real number** is any number that can be represented on the number line.

An **irrational number** is a number that cannot be expressed as a fraction , where and are integers and .

Step 2: Analyze the statement

Real numbers include both rational and irrational numbers. Rational numbers *can* be expressed as a fraction . For example, the number 2 is a real number, but it can be expressed as , which means it is a rational number, not an irrational number.

Step 3: Conclusion

The statement is **False**, for example 2 is real but not irrational.

ANSWER

(i) True, since the collection of real numbers is made up of rational and irrational numbers.

(ii) False, no negative number can be the square root of any natural number.

(iii) False, for example 2 is real but not irrational.

Question 2

QUESTION

Are the square roots of all positive integers irrational? If not, give an example of the square root of a number that is a rational number.

SOLUTION

This question asks us to determine if the square root of every positive integer is irrational. If not, we need to provide a counterexample.

Step 1: Understand Rational and Irrational Numbers

A **rational number** can be expressed in the form , where and are integers and . Integers are rational numbers (e.g., 2 can be written as).

An **irrational number** cannot be expressed in the form . Examples include , , and .

Step 2: Consider Some Examples

Let's examine the square roots of the first few positive integers:

, which is rational.

is irrational.

is irrational.

, which is rational.

is irrational.

, which is rational.

Step 3: Identify a Counterexample

From the examples above, we see that , , and are all rational numbers. These are square roots of perfect squares.

Step 4: Provide the Answer

No, the square roots of all positive integers are not irrational. For example, is a rational number.

Final Answer: No. For example, is a rational number.

ANSWER

No. For example, $\sqrt{4} = 2$ is a rational number.

Question 3

QUESTION

Show how √5 can be represented on the number line.

SOLUTION

We need to represent on the number line. This involves using the Pythagorean theorem to construct lengths corresponding to square roots.

Step 1: Represent on the number line.

Draw a number line and mark a point O representing 0. Mark a point A representing 1 such that OA = 1 unit. Thus, we have represented on the number line.

Step 2: Represent on the number line.

At A, draw a perpendicular line segment AB of length 1 unit. Join OB. By the Pythagorean theorem, in right triangle OAB, we have:

Therefore, . Now, with O as the center and OB as the radius, draw an arc intersecting the number line at point C. Then, OC = .

Step 3: Represent on the number line.

At C, draw a perpendicular line segment CD of length 1 unit. Join OD. By the Pythagorean theorem, in right triangle OCD, we have:

Therefore, . Now, with O as the center and OD as the radius, draw an arc intersecting the number line at point E. Then, OE = .

Step 4: Represent on the number line.

At E, draw a perpendicular line segment EF of length 1 unit. Join OF. By the Pythagorean theorem, in right triangle OEF, we have:

Therefore, . Now, with O as the center and OF as the radius, draw an arc intersecting the number line at point G. Then, OG = .

Step 5: Represent on the number line.

At G, draw a perpendicular line segment GH of length 1 unit. Join OH. By the Pythagorean theorem, in right triangle OGH, we have:

Therefore, . Now, with O as the center and OH as the radius, draw an arc intersecting the number line at point I. Then, OI = .

Thus, point I on the number line represents .

ANSWER

Repeat the procedure as in Fig. 1.8 several times. First obtain $\sqrt{4}$ and then $\sqrt{5}$.

Question 4

QUESTION

Classroom activity (Constructing the ‘square root spiral’): Follow the steps to construct the square root spiral starting with a unit segment OP_1 and repeatedly drawing perpendicular unit segments to obtain points P_1, P_2, P_3, ... depicting $\sqrt{2}$, $\sqrt{3}$, $\sqrt{4}$, ...

SOLUTION

This question is a classroom activity that demonstrates a visual and geometric way to represent square roots of consecutive natural numbers. It involves constructing a 'square root spiral'.

Step 1: Start with a unit segment

Draw a line segment of length 1 unit (e.g., 1 cm or 1 inch) on a piece of paper. This will be the base of our spiral.

Step 2: Construct a perpendicular unit segment at

At point , construct a line segment perpendicular to and of length 1 unit. Label the endpoint of this segment as . You can use a protractor or set square to ensure the angle is exactly 90 degrees.

Step 3: Find the length of

Using the Pythagorean theorem on triangle , we have: So, the length of is units.

Step 4: Construct a perpendicular unit segment at

At point , construct a line segment perpendicular to and of length 1 unit. Label the endpoint of this segment as .

Step 5: Find the length of

Using the Pythagorean theorem on triangle , we have: So, the length of is units.

Step 6: Repeat the process

Continue this process, each time constructing a perpendicular unit segment at the latest point to obtain . The length of will be .

Step 7: Observe the spiral

As you continue this process, you will see a spiral forming. Each line segment represents the square root of a natural number. This is the 'square root spiral'.

This activity provides a visual representation of irrational numbers like , etc., and helps in understanding their geometric significance.

ANSWER

Construction activity—no specific written answer required.

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📐 Key Formulas

Important Formulas for Exercise 1.2

Formula / Concept	Description
\textReal Numbers (R)	The collection of all rational numbers and irrational numbers forms the set of real numbers.
\textRational Numbers (Q)	A number s is called rational if it can be written in the form (p)/(q), where p and q are integers and q ≠ 0.
Decimal Expansion of Rational Numbers	The decimal expansion of a rational number is either terminating or non-terminating recurring (repeating). • **Terminating Decimals:** The decimal ends after a finite number of digits (e.g., (1)/(4) = 0.25). • **Non-terminating Recurring Decimals:** The decimal continues infinitely, but a block of digits repeats indefinitely (e.g., (1)/(3) = 0.333... = 0.\overline3).
\textIrrational Numbers	A number s is called irrational if it cannot be written in the form (p)/(q), where p and q are integers and q ≠ 0.
Decimal Expansion of Irrational Numbers	The decimal expansion of an irrational number is non-terminating and non-recurring (non-repeating). This means the digits continue infinitely without ever repeating a pattern. Examples: √2 \approx 1.41421356..., π \approx 3.14159265...
Identifying Irrational Numbers	• Numbers that are not perfect squares (e.g., √2, √3, √5) are irrational. • Numbers like π and e are irrational.

Formula / Concept	Description
Properties of Operations with Irrational Numbers	• The sum or difference of a rational number and an irrational number is always irrational. • The product or quotient of a non-zero rational number and an irrational number is always irrational. • The sum, difference, product, or quotient of two irrational numbers can be either rational or irrational. Example: $\sqrt{2} + (-\sqrt{2}) = 0$ (rational), but $\sqrt{2} + \sqrt{3}$ (irrational). Example: $\sqrt{2} \times \sqrt{2} = 2$ (rational), but $\sqrt{2} \times \sqrt{3} = \sqrt{6}$ (irrational).
Representing Irrational Numbers on the Number Line	Irrational numbers like $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ can be represented on the number line using the Pythagorean theorem. For example, to represent $\sqrt{5}$: \textHypotenuse^2 = \textBase^2 + \textPerpendicular^2 (√5)^2 = 2^2 + 1^2 5 = 4 + 1 This means a right-angled triangle with a base of 2 units and a perpendicular of 1 unit will have a hypotenuse of $\sqrt{5}$ units.

❓ Top FAQs

Q1. How many questions are in NCERT Solutions Class 9 Maths Chapter 1 Number Systems Exercise 1.2?

Exercise 1.2 of NCERT Solutions for Class 9 Maths Chapter 1 Number Systems contains exactly 4 questions. These questions focus on irrational numbers and their decimal expansions, which carry significant weightage in CBSE board exam 2025-26. Students can access step by step solutions for all 4 questions through free PDF download.

Q2. Where can I download free PDF of NCERT Solutions for Class 9 Maths Chapter 1 Number Systems Exercise 1.2?

You can download the free PDF of NCERT Solutions for Class 9 Maths Chapter 1 Number Systems Exercise 1.2 from the official NCERT website or various educational platforms offering CBSE 2025-26 study materials. These PDFs include step by step solutions for all 4 questions on irrational numbers and decimal expansions. The solutions are updated as per the latest CBSE syllabus 2025-26.

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

Number Systems (Chapter 1) carries 10 marks in CBSE Class 9 Maths board exam 2025-26 under Unit I. Exercise 1.2 specifically covers irrational numbers and decimal expansions, which are crucial topics for scoring full marks. Students should thoroughly practice NCERT Solutions for Class 9 Maths Chapter 1 Exercise 1.2 to excel in their examinations.

Q4. Which is the most difficult question in Exercise 1.2 of NCERT Solutions Class 9 Maths Chapter 1 Number Systems?

Question 4 is generally considered the most difficult in Exercise 1.2 of NCERT Solutions Class 9 Maths Chapter 1 Number Systems as it involves classifying numbers as rational or irrational with justification. Students preparing for CBSE board exam 2025-26 should focus on understanding the decimal expansion concepts with step by step solutions. Free PDF download materials provide detailed explanations for this challenging question.

Q5. What is the difference between Rational and Irrational Numbers in NCERT Class 9 Maths Chapter 1 Exercise 1.2?

In NCERT Solutions for Class 9 Maths Chapter 1 Exercise 1.2, rational numbers are defined as numbers that can be expressed in p/q form where $q \neq 0$ and have terminating or repeating decimal expansions. Irrational numbers cannot be expressed in p/q form and have non-terminating, non-repeating decimal expansions. Understanding this distinction is essential for CBSE Class 9 board exam 2025-26.

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