NCERT Solutions Class 9 Maths
Chapter 1: Number Systems
EXERCISE 1.3

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Quick Summary: In NCERT Solutions Class 9 Maths Chapter 1 Exercise 1.3, students learn about decimal expansions of real numbers and how to classify them as terminating or non-terminating recurring decimals. This exercise covers the conversion between fractions and decimals, identifying rational and irrational numbers, which are fundamental concepts for CBSE Class 9 board exams and higher mathematics.

Key Takeaways:

- Rational numbers have decimal expansions that are either terminating or non-terminating recurring, expressible as (p)/(q) where $q \neq 0$
- Converting recurring decimals like 0.333... to fractions using algebraic methods and the formula for geometric series
- Identifying terminating decimals by checking if the denominator has only factors of 2 and 5 after simplification
- Understanding that irrational numbers have non-terminating, non-recurring decimal expansions that cannot be expressed as fractions

Complete Solutions

Question 1

QUESTION

Write the following in decimal form and say what kind of decimal expansion each has:

(i) (36)/(100)
(ii) (1)/(11)
(iii) (4)/(8)
(iv) (3)/(13)
(v) (2)/(11)
(vi) (329)/(400)

SOLUTION

This question asks us to convert given fractions into decimal form and then classify the decimal expansion as either terminating or non-terminating repeating.

(i)

Step 1: Divide 36 by 100

Dividing 36 by 100 is equivalent to moving the decimal point two places to the left.

Step 2: Write the decimal form

Step 3: Classify the decimal expansion

Since the decimal expansion ends after a finite number of digits, it is a terminating decimal.

Answer: 0.36, terminating.

(ii)

Step 1: Divide 1 by 11 using long division

When we divide 1 by 11, we get 0.090909...

Step 2: Write the decimal form

The bar over 09 indicates that the digits 09 repeat indefinitely.

Step 3: Classify the decimal expansion

Since the decimal expansion repeats and does not terminate, it is a non-terminating repeating decimal.

Answer: , non-terminating repeating.

(iii)

Step 1: Divide 33 by 8 using long division

Performing long division, we find that

Step 2: Write the decimal form

Step 3: Classify the decimal expansion

Since the decimal expansion ends after a finite number of digits, it is a terminating decimal.

Answer: 4.125, terminating.

(iv)

Step 1: Divide 3 by 13 using long division

Performing long division, we find that

Step 2: Write the decimal form

The bar over 230769 indicates that these digits repeat indefinitely.

Step 3: Classify the decimal expansion

Since the decimal expansion repeats and does not terminate, it is a non-terminating repeating decimal.

Answer: , non-terminating repeating.

(v)

Step 1: Divide 2 by 11 using long division

Performing long division, we find that

Step 2: Write the decimal form

The bar over 18 indicates that these digits repeat indefinitely.

Step 3: Classify the decimal expansion

Since the decimal expansion repeats and does not terminate, it is a non-terminating repeating decimal.

Answer: , non-terminating repeating.

(vi)

Step 1: Divide 329 by 400 using long division

Performing long division, we find that

Step 2: Write the decimal form

Step 3: Classify the decimal expansion

Since the decimal expansion ends after a finite number of digits, it is a terminating decimal.

Answer: 0.8225, terminating.

ANSWER

(i) 0.36, terminating.

(ii) 0.\overline{09}, non-terminating repeating.

(iii) 4.125, terminating.

(iv) 0.230769\overline{,} non-terminating repeating.

(v) 0.\overline{18}, non-terminating repeating.

(vi) 0.8225, terminating.

Question 2

QUESTION

You know that (1)/(7) = 0.142857\overline. Can you predict the decimal expansions of (2)/(7) , (3)/(7) , (4)/(7) , (5)/(7) , (6)/(7) without actually doing the long division? If so, how?

SOLUTION

This question asks us to find the decimal expansions of multiples of without performing long division, using the given decimal expansion of . This tests our understanding of how multiplication affects decimal representations of rational numbers.

Step 1: Understand the given information

We are given that . This means the block of digits '142857' repeats indefinitely.

Step 2: Calculate

We can write as . Therefore, we multiply the decimal expansion of by 2:

The digits simply shift cyclically.

Step 3: Calculate

Similarly,

Step 4: Calculate

Step 5: Calculate

Step 6: Calculate

Final Answer:

ANSWER

(2)/(7) = 2 × (1)/(7) = 0.285714

(3)/(7) = 3 × (1)/(7) = 0.428571

(4)/(7) = 4 × (1)/(7) = 0.571428

(5)/(7) = 5 × (1)/(7) = 0.714285

(6)/(7) = 6 × (1)/(7) = 0.857142

Question 3

QUESTION

Express the following in the form (p)/(q), where p and q are integers and q ≠ 0:

(i) 0.\overline{6}
(ii) 0.47\overline{7}
(iii) 0.001

SOLUTION

This question asks us to convert repeating decimals into fractions of the form , where and are integers and . This tests our understanding of rational numbers and how to manipulate them.

(i)

Step 1: Let . This means

Step 2: Multiply both sides by 10 since only one digit is repeating:

Step 3: Subtract the original equation from the new equation:

Step 4: Solve for :

Step 5: Simplify the fraction:

Therefore,

(ii)

Step 1: Let . This means

Step 2: Multiply both sides by 10 to move the decimal point past the non-repeating digit:

Step 3: Multiply both sides by 10 again (100x) to move one repeating digit to the left of the decimal:

Step 4: Subtract the equation from Step 2 from the equation in Step 3:

Step 5: Solve for :

Therefore,

(iii)

Step 1: Let . This means

Step 2: Multiply both sides by 1000 since three digits are repeating:

Step 3: Subtract the original equation from the new equation:

Step 4: Solve for :

Therefore,

ANSWER

(i) (2)/(3)

(ii) (43)/(90)

(iii) (1)/(999)

Question 4

QUESTION

Express 0.99999... in the form (p)/(q). Are you surprised by your answer?

SOLUTION

This question asks us to convert the repeating decimal 0.99999... into a fraction in the form and then comment on the result.

Step 1: Assign a variable

Let

Step 2: Multiply by 10

Since only one digit is repeating, we multiply both sides of the equation by 10:

Step 3: Subtract the original equation

Subtract the original equation from the new equation :

Step 4: Solve for x

Divide both sides by 9:

Step 5: Express in p/q form

Therefore, . We can write 1 as , which is in the form .

Final Answer: or 1

Surprise: Yes, the answer is surprising. It seems counter-intuitive that a number that appears to be slightly less than 1 is actually equal to 1. This is because 0.99999... represents an infinite, non-terminating decimal. In the realm of real numbers, there is no number strictly between 0.99999... and 1. They are the same number.

ANSWER

1

Question 5

QUESTION

What can the maximum number of digits be in the repeating block of digits in the decimal expansion of (1)/(17)? Perform the division to check your answer.

SOLUTION

We are asked to find the maximum possible number of digits in the repeating block of the decimal expansion of , and then verify this by performing the division.

Step 1: Determine the maximum possible length of the repeating block

When we divide 1 by 17, the remainders at each step of the division must be less than the divisor, which is 17. Therefore, the possible remainders are 1, 2, 3, ..., 16. There are 16 possible non-zero remainders.

The maximum number of digits in the repeating block of the decimal expansion will be one less than the divisor. In this case, the divisor is 17, so the maximum number of digits in the repeating block is .

Step 2: Perform the long division to find the decimal expansion of

We perform long division of 1 divided by 17:

Step 3: Count the number of digits in the repeating block

By performing the long division, we find that the decimal expansion of is . The repeating block is 0588235294117647.

Counting the digits in the repeating block, we find that there are 16 digits.

Final Answer: The maximum number of digits in the repeating block of the decimal expansion of is 16, and the decimal expansion is 0.0588235294117647.

Conclusion: The maximum number of digits in the repeating block is confirmed by performing the long division. The number of digits in the repeating block is always less than the divisor.

ANSWER

0.0588235294117647

Question 6

QUESTION

Look at several examples of rational numbers in the form (p)/(q) (q ≠ 0), where p and q are integers with no common factors other than 1 and having terminating decimal expansions. Can you guess what property q must satisfy?

SOLUTION

This question explores the relationship between the denominator of a rational number and its decimal representation, specifically when the decimal expansion terminates.

Step 1: Understand Terminating Decimal Expansions

A terminating decimal expansion means that the decimal representation of the number ends after a finite number of digits. For example, and are terminating decimals.

Step 2: Consider Examples of Rational Numbers with Terminating Decimal Expansions

Let's look at some examples of rational numbers in the form where and have no common factors other than 1, and their decimal expansions terminate:

-
-
-
-
-
-
-
-

Step 3: Analyze the Denominators (q)

Now, let's examine the prime factorization of the denominators in these examples:

- 2 = 2
- 4 =
- 5 = 5
- 8 =
- 10 = 2 x 5
- 16 =
- 20 = x 5
- 25 =

Step 4: Identify the Pattern

Notice that the prime factorizations of the denominators only contain the prime numbers 2 and/or 5. There are no other prime factors present.

Step 5: State the Property of q

From the examples, we can guess that for a rational number to have a terminating decimal expansion, the prime factorization of must be of the form , where and are non-negative integers. In other words, the prime factorization of has only powers of 2 or powers of 5 or both.

Final Answer: The prime factorisation of has only powers of 2 or powers of 5 or both.

ANSWER

The prime factorisation of q has only powers of 2 or powers of 5 or both.

Question 7

QUESTION

Write three numbers whose decimal expansions are non-terminating non-recurring.

SOLUTION

We need to write three numbers whose decimal expansions are non-terminating and non-recurring. This means the numbers are irrational numbers.

Step 1: Understand Non-Terminating Non-Recurring Decimals

A non-terminating decimal is a decimal that goes on forever without ending. A non-recurring decimal is a decimal where the digits do not repeat in a pattern.

Examples of non-terminating recurring decimals are: and . These are rational numbers.

Non-terminating non-recurring decimals are irrational numbers.

Step 2: Constructing Non-Terminating Non-Recurring Decimals

To create such numbers, we need to ensure there is no repeating pattern and the decimal continues indefinitely.

Step 3: Example 1

Let's create a number with increasing numbers of zeros between the ones:

Here, the number of zeros between consecutive 1s keeps increasing, so there is no repeating block.

Step 4: Example 2

Similarly, we can create another number:

Here, the number of zeros between consecutive 2s keeps increasing, so there is no repeating block.

Step 5: Example 3

Another example:

Here, the number of zeros between consecutive 3s keeps increasing, so there is no repeating block.

Final Answer:

The three numbers are: 0.01001000100001..., 0.02002000200002..., 0.003000300003...

ANSWER

0.010001000100001..., 0.0200200020002000..., 0.003000300003...

Question 8

QUESTION

Find three different irrational numbers between the rational numbers (5)/(7) and (9)/(11).

SOLUTION

This question asks us to find three irrational numbers between two given rational numbers. The key idea is to create non-repeating, non-terminating decimals.

Step 1: Convert the rational numbers to decimal form

First, we convert and to decimal form:

So, we need to find three irrational numbers between approximately 0.714 and 0.818.

Step 2: Construct irrational numbers

Irrational numbers have non-repeating and non-terminating decimal expansions. We can create such numbers by writing decimals with a pattern that ensures no repetition.

Step 3: Generate the three irrational numbers

Let's create three such numbers:

Irrational Number 1: 0.7507500750007500075...

This number starts with 0.75, then adds an extra 0 between each 75 in each subsequent group. This ensures it is non-repeating.

Irrational Number 2: 0.767076700767000767...

This number starts with 0.7670, then adds an extra 0 between each 767 in each subsequent group. This ensures it is non-repeating.

Irrational Number 3: 0.808008000800080008...

This number starts with 0.80, then adds an extra 0 between each 80 in each subsequent group. This ensures it is non-repeating.

Step 4: Verify the numbers lie between the given rationals

We can see that:

Final Answer:

The three irrational numbers are: 0.7507500750007500075..., 0.767076700767000767..., 0.808008000800080008...

ANSWER

0.7507500750007500075..., 0.767076700767000767..., 0.808008000800080008...

Question 9

QUESTION

Classify the following numbers as rational or irrational:

(i) √23
(ii) √225
(iii) 0.3796
(iv) 7.478478...
(v) 1.101001000100001...

SOLUTION

This question tests our understanding of rational and irrational numbers. A rational number can be expressed in the form , where and are integers and . Irrational numbers cannot be expressed in this form. Terminating and repeating decimals are rational, while non-terminating and non-repeating decimals are irrational.

(i)

Step 1: Determine if 23 is a perfect square.

23 is not a perfect square. The square root of a non-perfect square is always irrational.

Step 2: Conclude.

is irrational.

(ii)

Step 1: Determine if 225 is a perfect square.

Yes, 225 is a perfect square because .

Step 2: Simplify.

Step 3: Conclude.

Since 15 can be written as , it is a rational number.

(iii) 0.3796

Step 1: Recognize the type of decimal.

0.3796 is a terminating decimal.

Step 2: Convert to a fraction.

0.3796 =

Step 3: Conclude.

Since it can be written as a fraction, 0.3796 is rational.

(iv) 7.478478...

Step 1: Recognize the type of decimal.

7.478478... is a repeating decimal (7.478).

Step 2: Recall the property of repeating decimals.

Repeating decimals are rational numbers.

Step 3: Conclude.

7.478478... is rational.

(v) 1.101001000100001...

Step 1: Recognize the type of decimal.

1.101001000100001... is a non-terminating and non-repeating decimal.

Step 2: Recall the property of non-repeating, non-terminating decimals.

Non-terminating and non-repeating decimals are irrational numbers.

Step 3: Conclude.

1.101001000100001... is irrational.

ANSWER

(i) irrational
(ii) rational
(iii) rational
(iv) rational
(v) irrational

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🧮 Key Formulas

Important Formulas for Exercise 1.3

Formula / Concept	Description
Rational Numbers	A number is called rational if it can be written in the form (p)/(q), where p and q are integers and q ≠ 0.
Irrational Numbers	A number is called irrational if it cannot be written in the form (p)/(q), where p and q are integers and q ≠ 0.
Real Numbers	The collection of all rational and irrational numbers together make up the collection of real numbers.
Terminating Decimal Expansion	The decimal expansion terminates or ends after a finite number of steps. A rational number has a terminating decimal expansion if the prime factorization of the denominator (q) is of the form 2^n 5^m, where n and m are non-negative integers.
Non-Terminating Recurring Decimal Expansion	The decimal expansion does not terminate, but a block of digits repeats periodically. A rational number can have a non-terminating recurring decimal expansion.
Decimal Expansion of Rational Numbers	The decimal expansion of a rational number is either terminating or non-terminating recurring (repeating).
Decimal Expansion of Irrational Numbers	The decimal expansion of an irrational number is always non-terminating and non-recurring.
Converting a Pure Recurring Decimal to (p)/(q) form	To convert a number like x = 0.\overlinea: 1. Let x = 0.aaa... 2. Multiply by 10: 10x = a.aaa... 3. Subtract the first equation from the second: 9x = a 4. Solve for x: x = (a)/(9)
Converting a Mixed Recurring Decimal to (p)/(q) form	To convert a number like x = 0.b\overlinea: 1. Let x = 0.baaa... 2. Multiply by 10 to separate the non-repeating part: 10x = b.aaa... 3. Multiply the new equation by 10 for the repeating part: 100x = ba.aaa... 4. Subtract the second equation from the third: 90x = ba - b 5. Solve for x.

❓ Top FAQs

Q1. How many questions are in NCERT Solutions Class 9 Maths Chapter 1 Number Systems Exercise 1.3?

Exercise 1.3 of NCERT Solutions for Class 9 Maths Chapter 1 Number Systems contains exactly 9 questions. These questions focus on rational and irrational numbers, their decimal expansions, and real number representations. Students can access step by step solutions for all 9 questions to prepare effectively 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 1.3?

You can download the free PDF of NCERT Solutions for Class 9 Maths Chapter 1 Number Systems Exercise 1.3 from the official NCERT website or reputed educational portals. These step by step solutions are available in PDF format for the CBSE board exam 2025-26 session. The solutions cover all 9 questions with detailed explanations of rational and irrational numbers concepts.

Q3. How many marks does Number Systems Chapter 1 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 1.3 focuses on decimal expansions of real numbers, rational and irrational numbers which are crucial topics. Students should practice NCERT Solutions for Class 9 Maths Chapter 1 thoroughly to score full marks in this unit.

Q4. Which is the most difficult question in Exercise 1.3 of NCERT Solutions Class 9 Maths Chapter 1 Number Systems?

Questions 6, 7, and 8 in Exercise 1.3 of NCERT Solutions Class 9 Maths Chapter 1 Number Systems are considered most challenging by students. These questions involve representing real numbers on number line and understanding decimal expansions of rational and irrational numbers. Step by step solutions with free PDF download can help students master these difficult concepts for CBSE board exam 2025-26.

Q5. What is the difference between Rational and Irrational Numbers in NCERT Solutions Class 9 Maths Chapter 1 Exercise 1.3?

In NCERT Solutions Class 9 Maths Chapter 1 Exercise 1.3, rational numbers are those with terminating or repeating decimal expansions (like 1/2 = 0.5 or 1/3 = 0.333...), while irrational numbers have non-terminating and non-repeating decimal expansions (like $\sqrt{2}$ or π). Exercise 1.3 contains 9 questions helping students distinguish between these real numbers through step by step solutions for CBSE board exam 2025-26.

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