Class 9 Maths Chapter 3: The World of Numbers - Notes, Important Questions and MCQs (2026-27)

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These Class 9 Maths Chapter 3 notes cover “The World of Numbers” from the new NCERT textbook Ganita Manjari (Part I, 2026-27): the history of counting, India’s gift of zero and place value, integers, rational numbers and their density, irrational numbers like √2 and π, the real number line, terminating and repeating decimals, converting repeating decimals into fractions and cyclic numbers – with tables, solved examples, Q&A, 10 MCQs and a free PDF.

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Chapter Overview

Numbers grew with human needs – from tally marks on bones to trade, astronomy and modern science. Indian mathematicians gave the world the decimal place-value system and treated zero as a number; Brahmagupta also gave rules for working with negative numbers.

Rational numbers p/q fill the number line densely, but lengths like √2 and π cannot be written as fractions – these are irrational. Together, rational and irrational numbers form the real numbers, a continuous number line. Decimal expansions reveal the difference: rationals terminate or repeat, irrationals neither end nor repeat.

Important Topics and Concepts

The Story of Numbers

- The Ishango bone (around 20,000 BCE, Congo) carries tally notches – early evidence of counting.
- Harappan cities like Lothal and Harappa used standardised weights, showing need for measurement.
- India developed the decimal place-value system and the concept of zero (śhūnya); the Bakhshali manuscript uses a dot for zero.
- Brahmagupta (7th century CE) gave rules for arithmetic with zero and negative numbers.

Integers and Rational Numbers

- Integers: …, –2, –1, 0, 1, 2, … – natural numbers, zero and negatives.
- A rational number can be written as p/q where p and q are integers and $q \neq 0$.
- Rational numbers can be marked on the number line by dividing unit lengths into equal parts.
- Density: between any two rational numbers there are infinitely many rational numbers (e.g. their average lies between them).

Irrational Numbers

- An irrational number cannot be written as p/q – e.g. $\sqrt{2}$, $\sqrt{3}$, π.
- The irrationality of $\sqrt{2}$ was first proved (by contradiction) around 400 BCE; Āryabhaṭa (499 CE) suspected π is irrational, proved by Lambert in 1761.
- $\sqrt{2}$ can be constructed on the number line as the diagonal of a unit square (Baudhāyana–Pythagoras theorem); repeating the construction gives $\sqrt{3}$, $\sqrt{4}$, … (square-root spiral).
- Irrationals fill the “gaps” left by rationals on the number line.

Real Numbers and Decimal Expansions

- Real numbers = all rational + all irrational numbers; every point on the number line is a real number.
- Rational numbers give either terminating decimals (7/20 = 0.35) or non-terminating repeating decimals (1/3 = 0.333…).
- A fraction in lowest terms terminates only if its denominator has no prime factors other than 2 and 5.
- Irrational numbers have non-terminating, non-repeating decimals ($\sqrt{2}$ = 1.41421…, π = 3.14159…).

Converting Repeating Decimals and Cyclic Numbers

- Pure repeating: let x = decimal, multiply by 10^n (n = digits in the repeating block), subtract and solve.
- Mixed repeating: first multiply by 10^m to shift non-repeating digits, then by 10^n, subtract and solve.
- Example: $x = 0.4545\ldots \rightarrow 100x = 45.4545\ldots \rightarrow 99x = 45 \rightarrow x = 5/11$.
- 0.999… = 1, shown by the same method.
- 1/7 = 0.142857…; multiplying 142857 by 1 to 6 gives cyclic shifts of the same digits – a cyclic number.

Solved Examples

Board-pattern practice.

- Express 0.777… as p/q. x = 0.777…; 10x = 7.777…; 9x = 7; x = 7/9.
- Express 0.2333… as p/q. 10x = 2.333…; 100x = 23.333…; 90x = 21; x = 7/30.
- Will 13/250 terminate? 250 = 2 × 5^3 → yes; 13/250 = 0.052.
- Will 4/15 terminate? 15 = 3 × 5 has factor 3 → repeating (0.2666…).
- Find two rationals between 1/3 and 1/2. Write as 4/12 and 6/12 → 5/12; also 9/24 = 3/8.

The Number Family

Set	Symbol	Examples	Decimal form
Natural numbers	N	1, 2, 3, …	Terminating
Whole numbers	W	0, 1, 2, …	Terminating
Integers	Z	–3, 0, 5	Terminating
Rational numbers	Q	3/4, –2/7, 0.333…	Terminating or repeating
Irrational numbers	—	√2, π	Non-terminating, non-repeating
Real numbers	R	All of the above	Any

Important Terms and Formulas

Term	Meaning
Rational number	p/q with integers p, q and q ≠ 0
Irrational number	Cannot be written as p/q
Real numbers	Union of rational and irrational numbers
Density property	Infinitely many rationals between any two
Terminating decimal	Decimal that ends, e.g. 0.35
Repeating decimal	Block of digits repeats forever
Termination test	Denominator (lowest terms) has only 2s and 5s
Cyclic number	142857 – multiples shift its digits
√2	1.41421… – diagonal of unit square
π	3.14159… – circumference ÷ diameter

Short Answer Questions

Q1. What is a rational number?

A number of the form p/q where p and q are integers and q ≠ 0.

Q2. Give two examples of irrational numbers.

√2 and π.

Q3. What is the density property of rational numbers?

Q4. Which decimals represent rational numbers?

Terminating decimals and non-terminating repeating decimals.

Q5. Without division, will 7/20 terminate?

Yes; $20 = 2^2 \times 5$ has only 2s and 5s.

Q6. Express 0.6666… as a fraction.

2/3.

Q7. What contribution did Brahmagupta make?

He gave rules for arithmetic with zero and negative numbers.

Q8. What are real numbers?

All rational and irrational numbers together; they fill the number line.

Long Answer Questions

Q1. Prove that √2 is irrational.

Assume $\sqrt{2} = p/q$ in lowest terms (p, q integers, no common factor).

Then $2 = p^2/q^2$, so $p^2 = 2q^2 – p^2$ is even, so p is even; let $p = 2k$.

$4k^2 = 2q^2$ gives $q^2 = 2k^2$, so q is also even.

Both p and q are even – contradicting lowest terms.

Hence √2 is irrational.

Q2. Explain how to convert 0.2454545… into a fraction.

Let x = 0.2454545…

Multiply by 10: 10x = 2.454545…

Multiply by 100: 1000x = 245.4545…

Subtract: 990x = 243.

x = 243/990 = 27/110.

Q3. Describe how to locate √2 and √3 on the number line.

Draw a unit square on the number line from 0 to 1.

Its diagonal from 0 has length √2 (by Baudhāyana–Pythagoras).

With compass at 0, cut the number line – that point is √2.

At √2 draw a perpendicular of 1 unit; the hypotenuse is √3.

Mark it on the line with a compass; continue for √4, √5…

MCQs with Answers

1. Which is irrational?(a) 0.25 (b) 2/3 (c) √5 (d) 0.333…Answer: (c) √5

2. Decimal expansion of a rational number is(a) always terminating (b) terminating or repeating (c) never repeating (d) always repeatingAnswer: (b) terminating or repeating

4. 3/8 has a decimal expansion that is(a) terminating (b) repeating (c) irrational (d) undefinedAnswer: (a) terminating

5. Ishango bone is about(a) 2,000 BCE (b) 20,000 BCE (c) 500 CE (d) 1000 CEAnswer: (b) 20,000 BCE

6. Rules for operations with zero and negatives were given by(a) Āryabhaṭa (b) Brahmagupta (c) Lambert (d) EuclidAnswer: (b) Brahmagupta

7. π was proved irrational in(a) 499 CE (b) 1761 (c) 1900 (d) 400 BCEAnswer: (b) 1761

8. 1/7 = 0.142857… The repeating block has(a) 3 digits (b) 6 digits (c) 7 digits (d) 2 digitsAnswer: (b) 6 digits

9. Real numbers include(a) only rationals (b) only irrationals (c) rationals and irrationals (d) only integersAnswer: (c) rationals and irrationals

10. Between any two rational numbers there are(a) no rationals (b) one rational (c) infinitely many rationals (d) two rationalsAnswer: (c) infinitely many rationals

Quick Revision Points

- History: Ishango bone, Harappan weights, zero, place value, Brahmagupta.
- $N \subset W \subset Z \subset Q \subset R$.
- Density of rationals.
- √2 proof by contradiction; π irrational (Lambert 1761).
- Terminate iff denominator = 2^a5^b.
- Repeating → fraction using 10^n; cyclic number 142857.

Chapter Summary

Numbers evolved from tally marks to the decimal place-value system, with India contributing zero and rules for negatives. Rational numbers p/q are dense on the number line, yet numbers like √2 and π cannot be written as fractions – they are irrational.

Rational and irrational numbers together form the real numbers. Rationals have terminating or repeating decimals, while irrationals have non-terminating, non-repeating decimals. Repeating decimals can be converted to fractions algebraically, and some, like 1/7, hide beautiful cyclic patterns.

Exam Tips and PYQ Pattern

- Practise the √2 irrationality proof step by step.
- Use the 2-and-5 test before dividing.
- Show multiplication by 10^n clearly when converting decimals.
- Learn the number family table.
- Remember a few history facts for MCQs.

Frequently Asked Questions

Is this chapter in the 2026-27 CBSE syllabus?

Yes. It is part of the new NCERT Class 9 Maths textbook “Ganita Manjari” (Part I), prescribed for the 2026-27 session.

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Yes. Use the free PDF link at the top of this page – no signup needed.

How do you know if a fraction has a terminating decimal?

In lowest terms, its denominator must have no prime factors other than 2 and 5.

What is the difference between rational and irrational numbers?

Rationals can be written as p/q and have terminating or repeating decimals; irrationals cannot and have non-terminating, non-repeating decimals.

Conclusion

The World of Numbers tells the story of how humanity built the real number line. Learn the tables and proofs, practise the solved examples here and save the free PDF for revision.

More Notes: Class 9 Maths Chapter 2: Introduction to Linear Polynomials notes | Class 9 Maths Chapter 4: Exploring Algebraic Identities notes | All Class 9 Maths notes

Author Bio: Written and reviewed by the Nextoper Editorial Team, a group of CBSE mathematics educators who build chapter notes directly from the NCERT textbook and past board paper patterns.

Freshness Note: These notes follow the NCERT Class 9 Maths textbook, Ganita Manjari (Parts I and II, first edition 2026, NCF-SE 2023), and the CBSE syllabus for the 2026-27 session. Last checked on 24 November 2026.