# 📘 CLASS 9 MATHEMATICS

## 📝 CHAPTER 3 – THE WORLD OF NUMBERS

### 🌟 FREE WORKSHEET | NEW NCERT GANITA MANJARI | 2026–27

**Name:** _____
**Class:** IX **Section:** _____
**Date:** _____

### 📌 Instructions

- Answer all questions.
- Show complete working wherever required.
- Use a number line for questions involving representation.
- Give reasons for reasoning-based questions.
- **Total Marks: 30**

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# 🟢 SECTION A – MCQs

### 1 × 6 = 6 marks

**1.** Which of the following represents the set of Natural Numbers?

A. {0, 1, 2, 3, ...}
B. {1, 2, 3, 4, ...}
C. {..., -2, -1, 0, 1, 2, ...}
D. {1/2, 1/3, 1/4, ...}

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**2.** According to the chapter, the mathematical concept of **Śhūnya** refers to:

A. Infinity
B. Zero
C. One
D. Negative numbers

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**3.** Which of the following is a rational number?

A. √2
B. π
C. -7/3
D. √5

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**4.** Which statement about rational numbers is correct?

A. There is no rational number between two rational numbers.
B. There is exactly one rational number between two rational numbers.
C. There are infinitely many rational numbers between two rational numbers.
D. Rational numbers occur only between integers.

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**5.** Which of the following has a terminating decimal expansion?

A. 1/3
B. 5/11
C. 3/20
D. 2/7

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**6.** Which of the following is irrational?

A. 0.75
B. 0.333...
C. √2
D. 7/8

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# 🟡 SECTION B – FILL IN THE BLANKS

**1 × 5 = 5 marks**

**7.** Natural Numbers are denoted by the symbol _____.

**8.** Integers include positive numbers, negative numbers and _____.

**9.** A rational number can be written in the form $p/q$, where $p$ and $q$ are integers and $q \neq$ _____.

**10.** The absolute value of any rational number is always _____.

**11.** Rational numbers have decimal expansions that are either terminating or _____.

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# 🟠 SECTION C – NUMBER SYSTEMS

### 2 × 4 = 8 marks

**12.** Classify each number as **Natural Number, Integer, Rational Number or Irrational Number**.

a) $7$

b) $-5$

c) $3/8$

d) $\sqrt{3}$

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**13.** Write the following in the form $p/q$.

a) $5$

b) $-8$

c) $0.75$

d) $-2.4$

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**14.** Find the value of each absolute value:

a) $|-7|$

b) $|5|$

c) $|-3/4|$

d) $|0|$

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**15.** State whether each statement is **True or False**. Give a reason.

a) Every integer is a rational number.

b) Every rational number is an integer.

c) Every natural number is a rational number.

d) Every irrational number is a real number.

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# 🔵 SECTION D – RATIONAL NUMBERS & NUMBER LINE

### 2 × 3 = 6 marks

**16. 📍 Number Line**

Represent the following on a number line:

a) $3/4$

b) $-5/4$

c) $9/4$

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**17.** Find **three distinct rational numbers** strictly between:

### $-1/2$ and $1/4$

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**18.** Find the distance between the following pairs of numbers on the number line:

a) $-4$ and $3$

b) $-3/2$ and $5/2$

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# 🟣 SECTION E – IRRATIONAL & REAL NUMBERS

### 1 × 3 = 3 marks

**19.** Explain why $\sqrt{2}$ is irrational.

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**20.** What is the difference between rational and irrational decimal expansions?

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**21.** Give:

a) One rational number between $\sqrt{2}$ and $\sqrt{3}$.

b) One irrational number between $1$ and $2$.

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# 🌟 SECTION F – DECIMAL EXPANSIONS

### 1 × 2 = 2 marks

**22.** Without performing long division, determine whether the following rational numbers have **terminating or non-terminating recurring** decimal expansions.

a) $7/20$

b) $4/15$

c) $13/250$

Give a reason based on the prime factors of the denominator.

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# 🧠 BONUS CHALLENGE

**23. 🔢 Cyclic Number Challenge**

The decimal expansion of:

**`1/7 = 0.142857142857...`**

has the repeating block **142857**.

Calculate:

`142857 × 2`

`142857 × 3`

`142857 × 4`

`142857 × 5`

`142857 × 6`

### What interesting pattern do you observe?

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# ⭐ SUPER CHALLENGE

**24.** Show algebraically that:

**`0.999... = 1`**

Let:

`x = 0.999...`

Multiply by 10 and subtract the original equation.

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# ✅ ANSWER KEY

## 🟢 SECTION A

**1.** B — `{1, 2, 3, 4, ...}`

**2.** B — Zero

**3.** C — `-7/3`

**4.** C — Infinitely many rational numbers

**5.** C — `3/20`

**6.** C — √2

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## 🟡 SECTION B

**7.** `N`

**8.** zero

**9.** zero

**10.** non-negative

**11.** repeating / recurring

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## 🟠 SECTION C

**12.**

a) 7 → **Natural Number**

b) $-5$ → **Integer**

c) $3/8$ → **Rational Number**

d) $\sqrt{3}$ → **Irrational Number**

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## 13.

a)

$5 = 5/1$

b)

$-8 = -8/1$

c)

$0.75 = 75/100 = 3/4$

d)

$-2.4 = -24/10 = -12/5$

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## 14.

a) $|-7| = 7$

b) $|5| = 5$

c) $|-3/4| = 3/4$

d) $|0| = 0$

The textbook defines absolute value as the distance of a number from 0 on the number line, so it is always non-negative.

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## 15.

a) **True**

Every integer can be written as $p/1$.

b) **False**

For example, $1/2$ is rational but not an integer.

c) **True**

For example:

$5 = 5/1$

d) **True**

Irrational numbers are part of the real number system.

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# 🔵 SECTION D

### 16.

**a)** $3/4$

Divide the interval from 0 to 1 into four equal parts and mark the third point.

**b)** $-5/4$

Divide the interval from −2 to −1 into four equal parts and mark the point one quarter to the right of −2.

**c)** $9/4$

$9/4 = 2\ 1/4$

So it lies between 2 and 3, one quarter of the way from 2.

The textbook uses exactly this method: divide a unit interval into $q$ equal parts for $p/q$.

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### 17.

One possible answer:

`-1/4, 0, 1/8`

All three lie between:

`-1/2` and `1/4`.

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**18.**

Distance formula:

**`|a - b|`**

a)

`|-4 - 3|`

`= |-7|`

**`= 7 units`**

b)

`|-3/2 - 5/2|`

`= |-8/2|`

`= 4`

**`= 4 units`**

The textbook gives the distance between two rational numbers `a` and `b` as `|a-b|`.

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# 🟣 SECTION E

**19.**

Assume that √2 is rational.

Then:

$\sqrt{2} = p/q$

where $p/q$ is in simplest form.

Squaring:

$2 = p^2/q^2$

Therefore:

$p^2 = 2q^2$

So $p^2$ is even, which means $p$ is even.

Let:

$p = 2k$

Substituting gives:

$q^2 = 2k^2$

Therefore $q$ is also even.

So both $p$ and $q$ have a common factor of 2, contradicting the fact that $p/q$ was in simplest form.

Therefore:

### ⭐ $\sqrt{2}$ is irrational.

This is the proof-by-contradiction approach presented in the textbook.

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### 20.

**Rational numbers:**

Their decimal expansion either:

✅ terminates

or

✅ repeats.

Example:

`3/8 = 0.375`

`5/11 = 0.454545...`

**Irrational numbers:**

Their decimal expansion:

❌ does not terminate

❌ does not repeat.

Example:

`√2 = 1.414213...`

The textbook uses decimal expansion as a way of distinguishing rational and irrational numbers.

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**21.**

a) One rational number between √2 and √3:

**3/2**

because:

`√2 ≈ 1.414`

`3/2 = 1.5`

`√3 ≈ 1.732`

Therefore:

`√2 < 3/2 < √3`

b) One irrational number between 1 and 2:

**√2**

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# 🌟 SECTION F

**22.**

For a fraction in lowest form, the decimal terminates when the denominator has **only 2 and/or 5 as prime factors**.

### a) `7/20`

`20 = 2² × 5`

### ✅ Terminating

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### b) `4/15`

`15 = 3 × 5`

It contains the prime factor 3.

### ✅ Non-terminating recurring

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### c) `13/250`

`250 = 2 × 5³`

### ✅ Terminating

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# 🧠 BONUS

**23.**

`142857 × 2 = 285714`

`142857 × 3 = 428571`

`142857 × 4 = 571428`

`142857 × 5 = 714285`

`142857 × 6 = 857142`

### 🔄 Pattern:

The same six digits:

**1, 4, 2, 8, 5, 7**

keep appearing but shift cyclically.

This is why `142857` is called a **cyclic number** in the textbook.

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# ⭐ SUPER CHALLENGE

**24.**

Let:

`x = 0.999...`

Multiply by 10:

`10x = 9.999...`

Subtract:

`10x - x = 9.999... - 0.999...`

`9x = 9`

Therefore:

## `x = 1`

Since `x = 0.999...`:

## ⭐ 0.999... = 1

The textbook also discusses the non-uniqueness of decimal representations and specifically explains that $0.999... = 1$.

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# 📌 CHAPTER 3 QUICK REVISION BOX

### 🔢 Natural Numbers

$N = \{1, 2, 3, ...\}$

### 0️⃣ Zero

$a + 0 = a$

$a - 0 = a$

$a \times 0 = 0$

### ➕➖ Integers

$Z = \{..., -2, -1, 0, 1, 2, ...\}$

### ➗ Rational Numbers

$p/q$, where:

$p, q \in Z$ and $q \neq 0$

### 📍 Absolute Value

$|x| \geq 0$

### 📏 Distance

Distance between $a$ and $b$:

$|a - b|$

### ♾️ Density

There are **infinitely many rational numbers between any two rational numbers**.

### √ Irrational Numbers

Cannot be expressed as `p/q`.

Examples:

`√2, √3, π`

### ℝ Real Numbers

**Rational + Irrational = Real Numbers**

### 🔢 Decimal Rule

**Denominator has only 2 and/or 5 → terminating decimal**

Otherwise:

**non-terminating recurring decimal**

### 🔄 Cyclic Number

`1/7 = 0.142857...`

Repeating block:

**142857**

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# 🏆 STUDENT SELF-CHECK

☐ I understand the evolution of the number system.
☐ I know the role of zero and Brahmagupta's rules.
☐ I can work with positive and negative integers.
☐ I can identify rational and irrational numbers.
☐ I can represent rational numbers on a number line.
☐ I can use absolute value to find distance.
☐ I can find rational numbers between two given numbers.

☐ I understand why √2 is irrational.
☐ I can distinguish terminating and recurring decimals.
☐ I can convert repeating decimals into fractions.
☐ I understand cyclic number patterns.
☐ I know how rational and irrational numbers form the real number system.

## ⭐ MY SCORE: _____ / 30

**25–30:** 🌟 Excellent!
**20–24:** 👏 Very Good!
**15–19:** 👍 Good – keep practising!
**Below 15:** 📚 Revise Chapter 3 and try again!