CHAPTER TEST: NUMBER SYSTEM
Mathematics | Class IX (2026/NumSys/09/001)

Solution

Section A (Multiple Choice Questions)

1. Every rational number is:
   (a) a natural number
   (b) an integer
   (c) a real number
   (d) a whole number

   Solution: Every rational number is a real number. $\boxed{C}$

2. Between two rational numbers, there exist:
   (a) no rational number
   (b) exactly one rational number
   (c) infinitely many rational numbers
   (d) only irrational numbers

   Solution: Between any two rational numbers, there exist infinitely many rational numbers. $\boxed{C}$

3. The decimal representation of an irrational number is always:
   (a) terminating
   (b) non-terminating repeating
   (c) non-terminating non-repeating
   (d) terminating repeating

   Solution: The decimal representation of an irrational number is always non-terminating non-repeating. $\boxed{C}$

4. Which of the following is an irrational number?
   (a) $\sqrt{16}$
   (b) $\sqrt{12}/\sqrt{3}$
   (c) 0.14
   (d) $0.4040040004\ldots$

   Solution: The number $0.4040040004\ldots$ is non-terminating non-repeating, hence irrational. $\boxed{D}$

5. The value of $0.999\ldots$ in the form p/q, where p and q are integers and $q \neq 0$, is:
   (a) 9/10
   (b) 1
   (c) 1/9

(d) 8/9

Solution: Let $x = 0.999\ldots$, then $10x = 9.999\ldots$. Subtracting, $9x = 9 \implies x = 1$. $\boxed{B}$

6. A rational number between $\sqrt{2}$ and $\sqrt{3}$ is:

   (a) $(\sqrt{2} + \sqrt{3})/2$
   (b) $\sqrt{2} \times \sqrt{3}$
   (c) 1.5
   (d) 1.8

   Solution: The number 1.5 is rational and lies between $\sqrt{2} \approx 1.414$ and $\sqrt{3} \approx 1.732$. $\boxed{C}$

7. If n is a natural number, then $\sqrt{n}$ is:

   (a) always a natural number
   (b) always a rational number
   (c) always an irrational number
   (d) either a natural number or an irrational number

   Solution: $\sqrt{n}$ is either a natural number (if n is a perfect square) or an irrational number. $\boxed{D}$

8. The sum of a non-zero rational number and an irrational number is always:

   (a) rational
   (b) irrational
   (c) a whole number
   (d) a natural number

   Solution: The sum of a non-zero rational number and an irrational number is always irrational. $\boxed{B}$

Section B (Very Short Answer Questions)

1. Find two rational numbers between 1/4 and 1/3 by using the mean method.

   Solution: Let $a = \frac{1}{4}$ and $b = \frac{1}{3}$. The mean of a and b is:

   $$\frac{a+b}{2} = \frac{\frac{1}{4} + \frac{1}{3}}{2} = \frac{7}{24}$$

   The mean of a and $\frac{7}{24}$ is:

   $$\frac{\frac{1}{4} + \frac{7}{24}}{2} = \frac{13}{48}$$

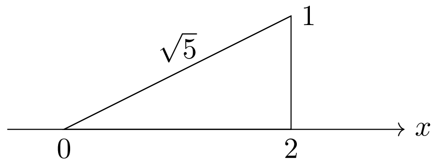
   Thus, the two rational numbers are $\frac{7}{24}$ and $\frac{13}{48}$.

2. Represent $\sqrt{5}$ on the number line using a compass and ruler.

   Solution:

   (a) Draw a number line and mark 0, 1, and 2.
   (b) At point 2, draw a perpendicular line of length 1 unit.

(c) Join the origin to the endpoint of the perpendicular. The hypotenuse is $\sqrt{5}$.



3. Examine whether $(3+\sqrt{23})-\sqrt{23}$ and $2\pi-2$ are rational or irrational.

   Solution:
   $$(3+\sqrt{23})-\sqrt{23}=3 \quad \text{(Rational)}$$
   $$2\pi-2 \quad \text{is irrational, since } \pi \text{ is irrational.}$$

4. Express $0.2\overline{35}$ in the form p/q, where $p, q \in \mathbb{Z}$ and $q \neq 0$.

   Solution: Let $x = 0.2\overline{35}$. Then,
   $$10x = 2.\overline{35}$$
   $$1000x = 235.\overline{35}$$
   Subtracting,
   $$990x = 233 \implies x = \frac{233}{990}$$

Section C (Short Answer Questions)

1. Prove that $\sqrt{3}$ is an irrational number.

   Solution: Assume $\sqrt{3}$ is rational. Then, $\sqrt{3}=\frac{p}{q}$, where p and q are co-prime integers.
   $$3q^2 = p^2 \implies p^2 \text{ is divisible by } 3 \implies p \text{ is divisible by } 3$$
   Let $p = 3k$. Then,
   $$3q^2 = 9k^2 \implies q^2 = 3k^2 \implies q \text{ is divisible by } 3$$
   This contradicts the assumption that p and q are co-prime. Hence, $\sqrt{3}$ is irrational.

2. Visualise the representation of 4.673 on the number line using successive magnification.

   Solution: The number 4.673 lies between 4 and 5. Magnify the interval $[4,5]$ to locate 4.6, then magnify $[4.6, 4.7]$ to locate 4.67, and finally magnify $[4.67, 4.68]$ to locate 4.673.

3. Show that a number whose decimal expansion is $0.1010010001\ldots$ is irrational.

   Solution: The decimal $0.1010010001\ldots$ is non-terminating non-repeating, hence irrational. In contrast, $0.\overline{10}$ is rational because it is repeating.

Section D (Long Answer Questions)

1. Describe the Square Root Spiral method. Using this method, explain how to construct the location of $\sqrt{2}, \sqrt{3}$, and $\sqrt{4}$ on a single diagram.

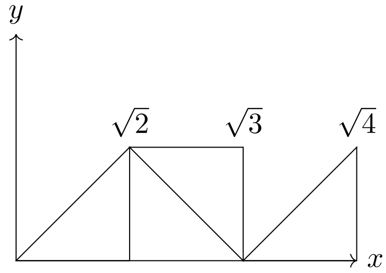
   Solution:

   (a) Start at the origin $(0,0)$.

(b) Draw a right triangle with legs 1 and 1. The hypotenuse is $\sqrt{2}$.

(c) From the endpoint of $\sqrt{2}$, draw a perpendicular of length 1. The new hypotenuse is $\sqrt{3}$.

(d) Repeat the process to get $\sqrt{4}$.



2. If a and b are rational numbers, find the values of a and b in the following equality:

$$\frac{5+2\sqrt{3}}{7+4\sqrt{3}} = a + b\sqrt{3}$$

Solution: Rationalize the denominator:

$$\frac{5+2\sqrt{3}}{7+4\sqrt{3}} \times \frac{7-4\sqrt{3}}{7-4\sqrt{3}} = \frac{(5+2\sqrt{3})(7-4\sqrt{3})}{49-48} = 35-20\sqrt{3}+14\sqrt{3}-24 = 11-6\sqrt{3}$$

Thus, $a = 11$ and $b = -6$.

Section E (Case Study Based Question)

1. To represent $\sqrt{10}$ on the number line, which integer coordinates (x, y) could Harpreet use as base and perpendicular in Pythagoras theorem?

(a) 1 and 2

(b) 3 and 1

(c) 2 and 2

(d) 5 and 5

Solution: Using 3 and 1:

$$\sqrt{3^2+1^2} = \sqrt{9+1} = \sqrt{10}$$

$\boxed{B}$

2. The distance $\sqrt{10}$ falls between which two consecutive natural numbers?

(a) 2 and 3

(b) 3 and 4

(c) 4 and 5

(d) 9 and 11

Solution: Since $3^2 = 9$ and $4^2 = 16$, $\sqrt{10}$ lies between 3 and 4. $\boxed{B}$

3. The engineer mentioned "non-terminating, non-recurring" decimals. These are:

(a) Integers

(b) Rational Numbers
(c) Irrational Numbers
(d) Whole Numbers

Solution: Non-terminating, non-recurring decimals are irrational numbers. $\boxed{C}$

4. If Harpreet measures a distance of $3.333\ldots$ meters, this distance is:

(a) Rational
(b) Irrational
(c) Not a Real number
(d) An Integer

Solution: The decimal $3.333\ldots$ is repeating, hence rational. $\boxed{A}$

5. Which of the following is a real number?

(a) Only Rational numbers
(b) Only Irrational numbers
(c) Both Rational and Irrational numbers
(d) Neither Rational nor Irrational numbers

Solution: Real numbers include both rational and irrational numbers. $\boxed{C}$