CHAPTER TEST: NUMBER SYSTEM
Mathematics | Class IX (2026/NumSys/09/002)

Solution

Section A (Multiple Choice Questions)

1. Every point on a number line represents:
   (a) a unique natural number
   (b) a unique rational number
   (c) a unique real number
   (d) a unique irrational number

   Solution: Every point on a number line represents a unique real number. $\boxed{C}$

2. The decimal expansion of π is:
   (a) 3.1416
   (b) Terminating
   (c) Non-terminating recurring
   (d) Non-terminating non-recurring

   Solution: The decimal expansion of π is non-terminating non-recurring. $\boxed{D}$

3. Which of the following is an irrational number?
   (a) $\sqrt{225}$
   (b) 0.3796
   (c) 7.478478...
   (d) 1.1010010001...

   Solution: The number 1.1010010001... is non-terminating non-repeating, hence irrational. $\boxed{D}$

4. A rational number between $\sqrt{2}$ and $\sqrt{3}$ is:
   (a) 1.5
   (b) $\frac{\sqrt{2}+\sqrt{3}}{2}$
   (c) 1.9
   (d) 1.1

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

5. The value of $0.\overline{23} + 0.\overline{22}$ is:
   (a) 0.45
   (b) $0.\overline{45}$
   (c) $\frac{45}{100}$
   (d) $\frac{9}{20}$

Solution: Let $x = 0.\overline{23}$ and $y = 0.\overline{22}$. Then,

$$x = \frac{23}{99}, \quad y = \frac{22}{99}$$

$$x + y = \frac{23 + 22}{99} = \frac{45}{99} = \frac{5}{11} = 0.\overline{45}$$

$\boxed{B}$

6. If x is a non-zero rational number and y is an irrational number, then xy is:

   (a) Always rational
   (b) Always irrational
   (c) Sometimes rational, sometimes irrational
   (d) An integer

   Solution: The product xy can be either rational or irrational, depending on the values of x and y. $\boxed{C}$

7. The standard form of the rational number $\frac{-48}{72}$ is:

   (a) $\frac{-4}{6}$
   (b) $\frac{-8}{12}$
   (c) $\frac{-2}{3}$
   (d) $\frac{2}{-3}$

   Solution: Simplifying $\frac{-48}{72}$ by dividing numerator and denominator by 24 gives $\frac{-2}{3}$. $\boxed{C}$

8. Which of the following numbers can be represented as a terminating decimal?

   (a) $\frac{1}{3}$
   (b) $\frac{3}{11}$
   (c) $\frac{7}{20}$
   (d) $\frac{2}{7}$

   Solution: The fraction $\frac{7}{20}$ can be written as $\frac{7}{2^2 \times 5}$, which has a terminating decimal expansion. $\boxed{C}$

Section B (Very Short Answer Questions)

1. Find two rational and two irrational numbers between 0.1 and 0.12.

   Solution:

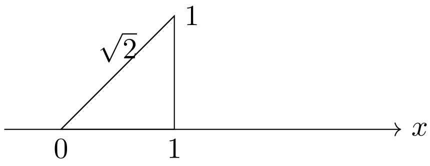
   - Rational numbers: $0.105 = \frac{21}{200}$ and $0.11 = \frac{11}{100}$
   - Irrational numbers: 0.1010010001... and 0.1101100110001...

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

   Solution:

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

(c) Join the origin to the endpoint of the perpendicular. The hypotenuse is $\sqrt{2}$.



3. Express $0.5\overline{7}$ in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

Solution: Let $x = 0.5\overline{7}$. Then,

$$10x = 5.\overline{7}$$

$$100x = 57.\overline{7}$$

Subtracting,

$$90x = 52 \implies x = \frac{52}{90} = \frac{26}{45}$$

4. Examine whether $(2 - \sqrt{3})^2$ is a rational or an irrational number.

Solution:

$$(2 - \sqrt{3})^2 = 4 - 4\sqrt{3} + 3 = 7 - 4\sqrt{3}$$

Since $\sqrt{3}$ is irrational, $7 - 4\sqrt{3}$ is irrational.

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

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

Solution:

(a) True. Every irrational number is a real number.
(b) False. Not every point on the number line is of the form $\sqrt{m}$.
(c) False. Every real number is either rational or irrational.

3. Visualise 3.765 on the number line using successive magnification.

Solution: The number 3.765 lies between 3 and 4. Magnify the interval $[3, 4]$ to locate 3.7, then magnify $[3.7, 3.8]$ to locate 3.76, and finally magnify $[3.76, 3.77]$ to locate 3.765.

Section D (Long Answer Questions)

1. Construct a square root spiral up to $\sqrt{5}$. Explain how the length of each new segment is determined using the Pythagorean Theorem.

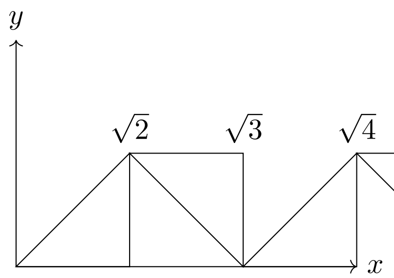
   Solution:

   (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 $\sqrt{4}$ and $\sqrt{5}$.



2. Let $x = 0.\overline{6}$ and $y = 0.4\overline{7}$.

   (a) Express x and y as fractions in simplest form.

   (b) Find $x + y$ and determine if the result is a terminating or non-terminating decimal.

   (c) Find a rational number and an irrational number between x and y.

   Solution:

   (a) Let $x = 0.\overline{6}$. Then,

   $$10x = 6.\overline{6} \implies 9x = 6 \implies x = \frac{2}{3}$$

   Let $y = 0.4\overline{7}$. Then,

   $$10y = 4.\overline{7} \implies 90y = 43 \implies y = \frac{43}{90}$$

   (b) $x + y = \frac{2}{3} + \frac{43}{90} = \frac{60+43}{90} = \frac{103}{90} = 1.144...$, which is non-terminating.

   (c) Rational number: $\frac{7}{10} = 0.7$ Irrational number: 0.67060060006...

Section E (Case Study Based Question)

1. Which of the following best describes the number $\sqrt{2}$ mentioned by Mr. Sharma?

   (a) A terminating decimal

   (b) A non-terminating recurring decimal

   (c) A non-terminating non-recurring decimal

   (d) A rational number

   Solution: $\sqrt{2}$ is a non-terminating non-recurring decimal. $\boxed{C}$

2. If a digital sensor gives a reading of 0.123123123..., this number is:

   (a) Rational
   (b) Irrational
   (c) Not a real number
   (d) An integer

   Solution: The number 0.123123123... is rational because it is repeating. $\boxed{A}$

3. Mr. Sharma's assistant used 1.41 as an approximation for $\sqrt{2}$. The number 1.41 is:

   (a) Rational
   (b) Irrational
   (c) Not a real number
   (d) A natural number

   Solution: The number 1.41 is rational. $\boxed{A}$

4. The collection of all rational and irrational numbers mentioned in the case study is called:

   (a) Integers
   (b) Natural numbers
   (c) Real numbers
   (d) Whole numbers

   Solution: The collection of all rational and irrational numbers is called real numbers. $\boxed{C}$

5. If the side of the square room was 2 units instead of 1, the diagonal would be $\sqrt{8}$ units. The number $\sqrt{8}$ is:

   (a) Rational
   (b) Irrational
   (c) A whole number
   (d) Terminating

   Solution: $\sqrt{8} = 2\sqrt{2}$ is irrational. $\boxed{B}$