

## Instructions

- Attempt all questions.
- Use suitable methods to justify your answers.
- Maintain clarity in your work.

## Unit I

### Section A: Short Answer Questions

1. Simplify:  $\sqrt{25} + \sqrt{144} - \sqrt{81}$
2. If  $a = 2 + \sqrt{3}$  and  $b = 2 - \sqrt{3}$ , find  $a^2 + b^2$ .
3. Find the remainder when  $2023^{2024}$  is divided by 9 using divisibility rules.
4. Rationalize the denominator of  $\frac{5}{\sqrt{2} + 1}$ .
5. Prove:  $\sqrt[3]{64} + \sqrt[3]{27} = 7$ .
6. If  $x = 2$  and  $y = 3$ , evaluate  $(x^y + y^x)$ .
7. Calculate the number of decimal places in  $\frac{1}{8}$ .
8. Using BODMAS, solve:  $5 + (3 \times 2)^2 - 4$ .
9. If  $a \times b = 36$  and both  $a$  and  $b$  are natural numbers, list all possible pairs of  $(a, b)$ .
10. Simplify:  $2\sqrt{5} \times 3\sqrt{2}$ .
11. If  $x = \frac{1}{2}$ , calculate  $x^2 + 2x + \frac{1}{x}$ .
12. Find the cube root of 729 using prime factorization.
13. Determine the value of  $\frac{16^{\frac{3}{4}}}{8^{\frac{2}{3}}}$ .

## Section B: Long Answer Questions

1. Show that  $\sqrt{3}$  is an irrational number. Provide a detailed proof using contradiction.
2. Given the numbers 12345 and 54321, use BODMAS to simplify  $(12345 + 54321) - (12345 \div 123)$ .
3. Solve for  $x$ :  $\frac{1}{\sqrt{x+3}} = \frac{2}{3}$ .
4. If  $a = \sqrt{50}$  and  $b = \sqrt{18}$ , find  $a - b$  in simplest surd form.
5. Find the least positive integer  $x$  such that  $2x + 3$  is divisible by 7.
6. If  $x^3 - 3x^2 + 3x - 1 = 0$ , show that  $x = 1$  is a root of the equation.
7. Convert  $0.\overline{1234}$  into a fraction and simplify.
8. Evaluate  $\sqrt{(81 \times 16)^{\frac{1}{2}}}$  and express in simplest form.
9. If  $x = \frac{1 + \sqrt{5}}{2}$ , prove that  $x^2 = x + 1$ .
10. Solve:  $\sqrt[3]{27x} = 3$ .
11. Using BODMAS, solve:  $6 + [8 \times (2 + 3)] - 15 \div 5$ .
12. If  $x = \frac{4}{5}$  and  $y = \frac{5}{4}$ , prove that  $xy + yx = 2$ .

### Unit II

## Section A: Short Answer Questions

1. Find the HCF of 252 and 105 using Euclidean algorithm.
2. If the LCM of 15 and 24 is 120, find their HCF.
3. Simplify the ratio  $\frac{72}{108}$  and express in simplest form.
4. If  $a : b = 3 : 4$  and  $b : c = 5 : 6$ , find  $a : c$ .
5. Given an arithmetic progression (AP) with first term  $a = 5$  and common difference  $d = 3$ , find the 10th term.
6. Determine the sum of the first 20 terms of an AP where  $a = 2$  and  $d = 7$ .
7. Find the HCF and LCM of 18, 24, and 36.
8. If  $a : b = 7 : 3$  and  $b : c = 4 : 5$ , find  $a : b : c$ .
9. Identify the missing number in the series: 2, 6, 12, 20, 30, ?
10. A sum of money is divided between A and B in the ratio 4:5. If B's share is 225, find the total sum.
11. Find the 8th term of the geometric progression (GP) where the first term  $a = 2$  and common ratio  $r = 3$ .
12. If  $\text{HCF}(x, 36) = 12$ , list all possible values of  $x$ .
13. Calculate the sum of the first 15 terms of the harmonic series:  $1, \frac{1}{2}, \frac{1}{3}, \dots$
14. Complete the number series: 11, 13, 17, 19, 23, ?
15. If the ratio of ages of A and B is 7:9 and A is 35 years old, find the age of B.

## Section B: Long Answer Questions

1. If three numbers are in the ratio 2:3:4 and their HCF is 6, find the numbers.
2. Solve: The sum of the first  $n$  terms of an AP is given by  $S_n = 3n^2 + 5n$ . Find the common difference and the first term.
3. The sum of three consecutive terms of an arithmetic progression is 27, and their product is 504. Find the terms.
4. If the ratio of the speeds of two trains is 5:9 and the first train covers 300 km in 5 hours, find the speed of the second train.
5. For a geometric progression with  $a = 81$  and  $r = \frac{1}{3}$ , find the sum to infinity.
6. Given a harmonic progression (HP) with terms  $\frac{1}{2}, \frac{1}{4}, \frac{1}{6}, \dots$ , find the 10th term.
7. If a number series follows the pattern 3, 12, 27, 48, 75, ..., derive the formula for the  $n$ -th term and find the 10th term.
8. A sum of 10,000 is to be divided among A, B, and C in the ratio 2:3:5. Calculate the share of each.
9. If the HCF of two numbers is 14 and their product is 1960, find their LCM and the numbers.

### Unit III

## Section A: Short Answer Questions

1. If the price of a product increases from 200 to 250, what is the percentage increase?
2. Calculate the profit percentage if a product is bought for 150 and sold for 180.
3. A shopkeeper marks his goods 20% above the cost price and allows a discount of 10%. Find his profit percentage.
4. In an alligation mixture, how much milk must be added to 60 liters of a 20% milk solution to make it a 50% milk solution?
5. Find the average of the numbers: 45, 67, 89, 34, and 56.
6. If a car covers 150 km at 50 km/hr and then another 150 km at 75 km/hr, find its average speed.
7. How many days are there between March 1, 2023, and April 15, 2023, inclusive?
8. If 30% of a number is 45, find the number.
9. A man loses 20% of his money and then spends 25% of the remaining amount. If he has 600 left, how much did he originally have?
10. A trader mixes two types of rice, one costing 50 per kg and the other costing 70 per kg, in the ratio 3 : 5. Find the price of the mixture per kg.
11. If a person saves 12% of his monthly salary and his savings amount to 3,600, calculate his monthly salary.
12. The average age of 10 students is 15 years. If one new student joins, increasing the average to 16 years, find the age of the new student.
13. Calculate the average speed of a vehicle that covers 240 km in 4 hours and 120 km in 3 hours.
14. If the calendar for 2020 and 2021 are compared, which day of the week will January 1, 2022, fall on?
15. If an article is sold at a 25% discount and the selling price is 600, find the marked price.

**Section B: Long Answer Questions**

1. A man buys two watches for 4,000. He sells one at a profit of 25% and the other at a loss of 10%. If he neither gains nor loses overall, find the cost price of each watch.
2. A mixture contains 80 liters of milk and 20 liters of water. How much milk must be added to make the proportion of milk in the mixture 90%?
3. If a car travels 120 km at 40 km/hr, 60 km at 30 km/hr, and 90 km at 45 km/hr, find the overall average speed of the car.
4. A person invests 15,000 in a business and earns a profit of 3,750. Calculate the percentage profit.
5. If two dates are randomly selected in a leap year, what is the probability that both fall on the same day of the week?
6. A shopkeeper mixes two varieties of pulses costing 60 and 80 per kg, respectively, in the ratio 2 : 3. If he sells the mixture at 75 per kg, find his profit or loss percentage.
7. A man sold an article at a loss of 15%. If he had sold it for 85 more, he would have gained 5%. Find the cost price of the article.
8. If the average of five consecutive odd numbers is 45, find the largest and smallest numbers.
9. A train travels 480 km in 8 hours. If it travels part of the distance at 60 km/hr and the rest at 40 km/hr, find the distance traveled at each speed.
10. If a calendar date falls on a Monday in the year 2000, determine the day of the week for the same date in 2024.

www.mathstudy.in