Number system

1. Introduction to Number System

The **Number System** is a way to represent and work with numbers. All calculations in mathematics are based on different types of numbers.

Types of Numbers:

Type	Example	Description
Natural Numbers (N)	1, 2, 3, ...	Counting numbers (excluding 0)
Whole Numbers (W)	0, 1, 2, 3, ...	Natural numbers + Zero
Integers (Z)	-3, -2, -1, 0, 1, 2, 3	Negative & positive whole numbers
Rational Numbers (Q)	1/2, 3/4, -5	Numbers in the form **p/q** ($q \neq 0$)
Irrational Numbers	√2, π, √3	Cannot be expressed as p/q
Real Numbers (R)	All of the above	All rational and irrational numbers
Imaginary Numbers	√-1 = i	Used in advanced math (not for IPO exam)

2. Important Concepts and Properties

1. **Odd Numbers**: Integers not divisible by 2. Example: 1, 3, 5, 7, ...
2. **Even Numbers**: Integers divisible by 2. Example: 0, 2, 4, 6, ...
3. **Prime Numbers**: Natural numbers greater than 1, divisible only by 1 and themselves. Example: 2, 3, 5, 7, ...
4. **Composite Numbers**: Natural numbers greater than 1, divisible by numbers other than 1 and themselves. Example: 4, 6, 8, 9, ...
5. **Natural Numbers**: Positive integers used for counting. Example: 1, 2, 3, ...
6. **Whole Numbers**: Natural numbers plus 0. Example: 0, 1, 2, 3, ...
7. **Integers**: Whole numbers, both positive and negative, including 0. Example: -2, -1, 0, 1, 2, ...
8. **Rational Numbers**: Numbers that can be expressed as a fraction of two integers. Example: 1/2, −3, 0.75
9. **Irrational Numbers**: Numbers that cannot be expressed as fractions, with non-terminating, non-repeating decimals. Example: π, $\sqrt{2}$
10. **Real Numbers**: All rational and irrational numbers. Example: -2, 0.5, π

2.3 Co-prime Numbers

- Two numbers with **HCF = 1** → e.g., 8 and 15

2.5 Divisibility Rules

Number	Divisibility Rule
2	Last digit is even
3	Sum of digits divisible by 3
4	Last two digits divisible by 4
5	Ends with 0 or 5
6	Divisible by 2 and 3
8	Last three digits divisible by 8
9	Sum of digits divisible by 9
10	Ends with 0
11	Alt. digit sum difference divisible by 11

3. Important Terminologies

3.1 HCF (Highest Common Factor)

- Largest number dividing two or more numbers exactly
- Method: Prime factorization or division method

3.2 LCM (Lowest Common Multiple)

- Smallest number divisible by two or more numbers

Formula:
HCF × LCM = Product of two numbers

4. Sample Tricks

Finding Units Digit:

- Look at last digit only → Units digit of 7^4 is **1** (cycle of 4: 7, 9, 3, 1)
- Look at last digit only → Units digit of 3^n is 7 (cycle of 4: 3, 9, 7, 1)
- Look at last digit only → Units digit of 9^n is 9 (cycle of 2: 9, 1)

Sum of First N Natural Numbers:

- **n(n + 1)/2**

Sum of Squares of First N Natural Numbers:

- **n(n + 1)(2n + 1)/6**

MCQ Practice

1. What is the smallest prime number?
   - a) 0
   - b) 1
   - c) 2
   - d) 3
2. What is the highest common divisor (HCM) of 18 and 24?
   - a) 6
   - b) 12
   - c) 18
   - d) 24
3. What is the least common multiple (LCM) of 3 and 4?
   - a) 12
   - b) 6
   - c) 9
   - d) 15
4. Which of the following is a perfect square?
   - a) 15
   - b) 25
   - c) 45
   - d) 55
5. Which of the following is an odd number?
   - a) 14
   - b) 22
   - c) 31
   - d) 48
6. **Problem:** If x + y = 8 and x - y = 2, what is the value of x?
   - a) 3
   - b) 4
   - c) 5
   - d) 6
7. **Problem:** What is the sum of the first 10 natural numbers?
   - a) 55
   - b) 50
   - c) 45
   - d) 40
8. **Problem:** If a number is divisible by 2, 3, and 5, it is also divisible by:
   - a) 8
   - b) 10
   - c) 15
   - d) 30
9. **Problem:** What is the value of 3^4?
   - a) 12
   - b) 27
   - c) 64
   - d) 81
10. **Problem:** Find the missing number in the sequence: 2, 4, 8, 16, ___, 64.
    - a) 24
    - b) 32
    - c) 48
    - d) 56
11. **Problem:** What is the next number in the Fibonacci sequence: 0, 1, 1, 2, 3, 5, 8, ___?
    - a) 10
    - b) 12
    - c) 13
    - d) 11
12. **Problem:** If the product of two numbers is 36 and one of the numbers is 4, what is the other number?
    - a) 8
    - b) 9
    - c) 12
    - d) 6
13. **Problem:** What is the decimal equivalent of the fraction 3/4?
    - a) 0.5

- b) 0.6
- c) 0.75
- d) 0.8

14. If x=3, what is x^2 + 2x?
    - a) 9
    - b) 12
    - c) 15
    - d) 21
15. **Problem:** If 3x = 12, what is the value of x?
    - a) 2
    - b) 3
    - c) 4
    - d) 5
16. **Problem:** What is the square root of 49?
    - a) 6
    - b) 7
    - c) 8
    - d) 9
17. **Problem:** Which of the following numbers is a multiple of both 2 and 3?
    - a) 4
    - b) 6
    - c) 9
    - d) 12
18. Which of the following is a composite number?
    - a) 7
    - b) 13
    - c) 21
    - d) 29
19. $\sqrt{12}$ x$\sqrt{15}$ is equal to
    - a) $5\sqrt{6}$
    - b) $6\sqrt{5}$
    - c) $10\sqrt{5}$
    - d) $\sqrt{25}$
20. What is the value of 5×6−3?
    - a) 27
    - b) 28
    - c) 29
    - d) 30
21. What is the remainder when 123 is divided by 5?
    - a) 1
    - b) 2
    - c) 3
    - d) 4
22. If 7x = 49, what is the value of x?
    - a) 5
    - b) 6
    - c) 7
    - d) 8
23. What is the value of (5 + 3)^2?
    - a) 49
    - b) 64
    - c) 81
    - d) 100
24. If a number is divisible by both 4 and 5, it is also divisible by:
    - a) 8
    - b) 10
    - c) 15
    - d) 20
25. What is the value of 7^3?
    - a) 216
    - b) 343
    - c) 729
    - d) 1000

Answers

1. c) 2
2. a) 6
3. a) 12
4. b) 25
5. c)31
6. c) 5
7. a) 55
8. d) 30
9. d) 81
10. b) 32
11. c) 13
12. d) 9
13. c) 0.75
14. c) 15
15. c) 4
16. b) 7
17. b) 6
18. c) 21
19. b) $6\sqrt{5}$
20. a) 27
21. c) 3
22. c) 7
23. b) 64
24. d) 20
25. b) 343

Decimal & Fraction.

◇ 1. Fractions – Basic Concepts

Definition:

A **fraction** represents a part of a whole. It is written in the form:

a/b

Where:

- **a** = numerator (number of parts taken)
- **b** = denominator (total number of equal parts)

Types of Fractions:

Type	Example	Description
Proper Fraction	3/4	Numerator < Denominator
Improper Fraction	9/4	Numerator > Denominator

2. Decimals – Basic Concepts

Definition:

A **decimal** is a number that includes a **decimal point** to represent values less than one.

Example:
0.5, 3.75, 2.03

🔁 Conversion between Fractions and Decimals:

Fraction	Decimal
1/2	0.5
1/4	0.25
3/5	0.6
7/8	0.875
5/2	2.5

✏️ Rule:Divide numerator by denominator.

➕➖ Adding/Subtracting Decimals:

Rule: Align decimal points before calculating.

Example:
2.53 + 0.87 = 3.40
3.6 – 1.47 = 2.13

✖➗ Multiplying/Dividing Decimals:

Multiplication:

- Multiply normally.
- Count total digits after decimal and place accordingly.

Example:
1.2 × 0.3 = 0.36 (since 1 digit + 1 digit = 2 digits after decimal)

Division:

- Shift decimal to make divisor a whole number.

Example:
1.26 ÷ 0.3 = (126 ÷ 3 × 0.01) = 4.2

Questions

1. Convert 0.75 to a fraction.
   - a) 3/4
   - b) 1/2
   - c) 2/3
   - d) 4/5
2. Convert 1/5to a decimal.
   - a) 0.5
   - b) 0.2
   - c) 0.25
   - d) 0.75
3. What is 3.5 as a fraction?
   - a) 7/2
   - b) 5/2
   - c) 4/3
   - d) 6/5
4. Simplify 8/24
   - a) 1/3
   - b) 1/2
   - c) 2/3
   - d) 1/4

5. What is 1.25 as a fraction?
    - a) 5/4
    - b) 6/5
    - c) 5/3
    - d) 4/3

6. **Problem:** Convert 0.875 to a fraction.
    - a) 7/8
    - b) 3/4
    - c) 9/10
    - d) 5/6
7. **Problem:** What is 3/8 as a decimal?
    - a) 0.3
    - b) 0.375
    - c) 0.35
    - d) 0.4
8. **Problem:** Simplify 10/25
    - a) 4/5
    - b) 2/5
    - c) 3/5
    - d) 1/5
9. **Problem:** Convert 2.75 to a fraction.
    - a) 11/4
    - b) 5/4
    - c) 7/4
    - d) 9/4
10. **Problem:** What is 1/3 as a decimal?
    - a) 0.3
    - b) 0.333
    - c) 0.3333
    - d) 0.33333
11. **Problem:** Convert 0.6 to a fraction.
    - a) 2/3
    - b) 3/5
    - c) 3/4
    - d) 1/2
12. **Problem:** Simplify 18/24
    - a) 5/6
    - b) 3/5
    - c) 2/3
    - d) 3/4
13. **Problem:** What is 5/6 as a decimal?
    - a) 0.85
    - b) 0.75
    - c) 0.833
    - d) 0.666
14. **Problem:** Convert 4.5 to a fraction.
    - a) 9/2
    - b) 10/3
    - c) 8/3
    - d) 7/2
15. **Problem:** Simplify 16/20
    - a) 4/5
    - b) 3/5
    - c) 2/5
    - d) 1/4

16. Convert 2/ 5 to a decimal.
    - a) 0.2
    - b) 0.4
    - c) 0.6
    - d) 0.8
17. What is 7.25 as a fraction?
    - a) 29/4
    - b) 28/5
    - c) 30/4
    - d) 27/5
18. Simplify 15/45
    - a) 1/2
    - b) 2/3
    - c) 1/3
    - d) 3/4
19. What is 7/10 as a decimal?
    - a) 0.5
    - b) 0.6
    - c) 0.7
    - d) 0.8
20. Convert 1.75 to a fraction.
    - a) 5/4
    - b) 7/4
    - c) 8/5
    - d) 9/5
21. What is 0.45 as a fraction?
    - a) 9/20
    - b) 7/20
    - c) 9/25
    - d) 7/25
22. Simplify 6/9
    - a) 2/5
    - b) 1/3
    - c) 2/3
    - d) 4/5
23. Convert 3.25 to a fraction.
    - a) 13/4
    - b) 12/5
    - c) 11/4
    - d) 10/5
24. What is 8/9 as a decimal?
    - a) 0.75
    - b) 0.85

- c) 0.8
- d) 0.888

25. 20+09+4/100 is equal to
    - a) 29.04
    - b) 29.40
    - c) 2940
    - d) 0.2940

Answers

1. a) 3/4
2. b) 0.2
3. a) 7/2
4. a) 1/3
5. a) 5/4
6. a) 7/8
7. b) 0.375
8. a) 2/5
9. a) 11/4
10. d) 0.33333
11. b) 3/5
12. d) 3/4
13. c) 0.833
14. a) 9/2
15. a) 4/5
16. b) 0.4
17. a) 29/4
18. c) 1/3
19. c) 0.7
20. b) 7/4
21. a) 9/20
22. c) 2/3
23. a) 13/4
24. d) 0.888
25. a) 29.04

Simple Equation

1. What is a Simple Equation?

A **Simple Equation** is a **mathematical statement** where two expressions are **equal**, and it usually contains **one variable (like x or y)**.

🧠 Example:
x + 5 = 9
This means: "x plus 5 equals 9".

2.Common Types of Simple Equations

◇ Type 1: Linear Equation in One Variable

📝 Form:
ax + b = c

📌 Solve by:

- Moving constants to one side
- Keeping variable on one side

🧠 Example:
2x + 3 = 11
⇒ 2x = 11 - 3 = 8
⇒ x = 8 / 2 = **4**

◇ Type 2: Equation with Variable on Both Sides

📝 Form:
ax + b = cx + d

📌 Solve by:

- Bringing variables to one side
- Constants to the other

🧠 Example:
3x + 2 = 2x + 9
⇒ 3x - 2x = 9 - 2
⇒ x = 7

◇ Type 3: Using Brackets

📝 Expand brackets before solving

🧠 Example:
2(x + 3) = 14
⇒ 2x + 6 = 14
⇒ 2x = 14 - 6 = 8
⇒ x = 4

◇ Type 4: Fractions in Equations

📌 Clear fractions by multiplying both sides with the **LCM** of denominators.

🧠 Example:
(x/2) + 1 = 5
⇒ (x/2) = 4
⇒ x = 8

◇ Type 5: Word Problems into Equations

Convert statements into algebraic expressions.

🧠 Example:
"**5 added to a number gives 12. Find the number.**"
Let the number be x:
x + 5 = 12 ⇒ x = 7

3.Common MCQ Question Patterns

Type	Example	Trick
Direct Solve	x + 7 = 12	Subtract both sides
Variable on both sides	4x + 2 = 2x + 8	Bring like terms together
Brackets	3(x - 2) = 9	Expand first
Fractions	(x/5) = 3	Multiply both sides by 5
Word Problems	"Twice a number is 14"	Form x×2 = 14

Questions

1. If 3x+2=11, what is the value of x?
   - a) 4
   - b) 3
   - c) 2
   - d) 1
2. Solve for y: 2y - 5 = 9
   - a) 2
   - b) 5
   - c) 7
   - d) 14
3. What is the solution to 5x - 4 = 21?
   - a) 3
   - b) 4
   - c) 5
   - d) 6
4. Find the value of z if 7z + 3 = 31.
   - a) 3
   - b) 4
   - c) 5
   - d) 6
5. If 2x/3=10, what is the value of xx?
   - a) 10
   - b) 15
   - c) 20
   - d) 25
6. **Problem:** Solve for x in the equation 4x - 7 = 9.
   - a) 4
   - b) 3
   - c) 2
   - d) 1
7. **Problem:** If 5a+2=17, what is the value of a?
   - a) 4
   - b) 3
   - c) 2
   - d) 1
8. **Problem:** Solve for y: 3y - 4 = 11.
   - a) 2
   - b) 4
   - c) 5
   - d) 6
9. **Problem:** Find the value of k if 2 k + 5 = 17.
   - a) 5
   - b) 6
   - c) 7
   - d) 8
10. **Problem:** If 6x−3=15 what is the value of x?
    - a) 3
    - b) 2
    - c) 4
    - d) 5
11. **Problem:** Solve for m: 4m + 6 = 18.
    - a) 1
    - b) 2
    - c) 3
    - d) 4
12. **Problem:** If 7n - 2 = 19, what is the value of n?
    - a) 2
    - b) 3
    - c) 4
    - d) 5
13. **Problem:** Solve for p: 2p + 3 = 11.
    - a) 2
    - b) 3
    - c) 4
    - d) 5
14. **Problem:** If 8q - 5 = 19, what is the value of q?
    - a) 2
    - b) 3
    - c) 4
    - d) 5
15. **Problem:** Solve for r: 9r + 2 = 29.
    - a) 2
    - b) 3
    - c) 4
    - d) 5
16. If x + 7 = 15, what is x?
    - a) 6
    - b) 7
    - c) 8
    - d) 9
17. Solve for t: 6t - 4 = 14.
    - a) 3
    - b) 2
    - c) 4
    - d) 5
18. If 5y + 3 = 23, what is y?
    - a) 4
    - b) 5
    - c) 6
    - d) 7

19. Solve for u: 7u - 6 = 22.
    - a) 4
    - b) 5
    - c) 6
    - d) 7
20. If 8v + 5 = 37, what is v?
    - a) 3
    - b) 4
    - c) 5
    - d) 6
21. Solve for w: 9w−4=32.
    - a) 3
    - b) 4
    - c) 5
    - d) 6
22. If 3x + 6 = 21, what is x?
    - a) 4
    - b) 5
    - c) 6
    - d) 7
23. Solve 5f+2=3f+14 for f.
    - a) 4
    - b) 5
    - c) 6
    - d) 7
24. Find the value of Y

    $5\frac{1}{2} - 3\frac{4}{9} + Y = \frac{7}{3} \times 4\frac{1}{6}$

    - a) 6.67
    - b) 9.67
    - c) 7.67
    - d) 8.67
25. Determine bb in the equation 3b - 4 = 2b + 8.
    - a) 8
    - b) 10
    - c) 12
    - d) 14

Answers

1. b) 3
2. c) 7
3. c) 5
4. b) 4
5. b) 15
6. a) 4
7. b) 3
8. c) 5
9. b) 6
10. a) 3
11. b) 3
12. b) 3
13. b) 4
14. b) 3
15. b) 3
16. b) 8
17. b) 3
18. b) 4
19. a) 4
20. b) 4
21. b) 4
22. b) 5
23. c) 6
24. c) 7.67
25. c) 12

▧ Ratio- Proportion

1. Basic Definitions

◇ Ratio

- A ratio is a **comparison** of two quantities of the **same kind** by division.
- It is expressed as **a : b** or **a/b**, where **b ≠ 0**.

🧠 Example:
If A = 20 kg and B = 40 kg, then the ratio A to B is
20 : 40 = 1 : 2

◇ Proportion

- A proportion shows that **two ratios are equal**.

🧠 Example:
2 : 3 = 4 : 6 is a **proportion** because
2/3 = 4/6

2.Common Types of Questions (MCQ Style)

◇ Type 1: Find the ratio between two quantities

Example: 30 apples and 50 apples → Ratio = 3 : 5

◇ Type 2: Simplifying ratios

Example: 42 : 56 = ?
HCF of 42 and 56 = 14 → Answer = 3 : 4

◇ Type 3: Check whether numbers are in proportion

Example: 4, 8, 6, 12 → 4 : 8 = 1 : 2 and 6 : 12 = 1 : 2 → Proportion ☑

◇ Type 4: Find missing term in proportion

Example: 6 : x = 18 : 36 → Cross multiply: 6 × 36 = 18 × x → x = 12

◇ Type 5: Divide a number in a given ratio

Example: Divide 60 in ratio 2 : 3
Total parts = 2 + 3 = 5
⇒ First part = (2/5) × 60 = 24
⇒ Second part = (3/5) × 60 = 36

Questions

1. The ratio of A to B is 3:5. If A is 60, what is B?
   - a) 80
   - b) 100
   - c) 90
   - d) 75
2. If 5x = 6y, what is the ratio of x to y?
   - a) 6:5
   - b) 5:6
   - c) 1:1
   - d) 2:3
3. A sum of money is divided among A, B, and C in the ratio 2:3:5. If C gets ₹1000, what is the total sum?
   - a) ₹2000
   - b) ₹1500
   - c) ₹2500
   - d) ₹5000
4. If a:b = 4:7 and b:c = 7:9, then a:c is:
   - a) 4:9
   - b) 4:15
   - c) 7:15
   - d) 4:21
5. The numbers 6, 8, 12 are in:
   - a) Arithmetic progression
   - b) Geometric progression
   - c) Harmonic progression
   - d) Proportional variation
6. The ratio of the ages of two friends is 3:4 and the sum of their ages is 28 years. The age of the younger friend is:
   - a) 16

    - b) 12
    - c) 10
    - d) 8
7. If a car travels 100 km in 2 hours, the speed of the car is:
    - a) 25 km/hr
    - b) 50 km/hr
    - c) 75 km/hr
    - d) 100 km/hr
8. What is the fourth proportional to 2, 4, and 8?
    - a) 16
    - b) 12
    - c) 10
    - d) 14
9. The ratio of boys to girls in a class is 7:9. If there are 63 boys, how many girls are there?
    - a) 72
    - b) 81
    - c) 90
    - d) 99
10. The ratio of 2.5 to 0.5 is:
    - a) 5:1
    - b) 1:5
    - c) 1:10
    - d) 10:1
11. If 9x = 3y, then x:y is:
    - a) 3:1
    - b) 1:3
    - c) 3:2
    - d) 2:3
12. If the ratio of two quantities is 3:4 and their product is 48, what are the quantities?
    - a) 4, 12
    - b) 6, 8
    - c) 12, 4
    - d) 9, 5
13. The compounded ratio of 2:3 and 5:7 is:
    - a) 1:2
    - b) 10:21
    - c) 10:14
    - d) 5:21
14. If a number is divided into the ratio 2:3, the smaller part is 50. Find the larger part.
    - a) 75
    - b) 100
    - c) 80
    - d) 90
15. In a mixture of 60 liters, the ratio of milk to water is 2:3. How much milk is there in the mixture?
    - a) 24 liters
    - b) 30 liters
    - c) 36 liters
    - d) 40 liters

16. **Problem:** If two numbers are in the ratio 3:7 and the difference between them is 20, what are the numbers?

- a) 35, 20
- b) 20, 15
- c) 15, 35
- d) 35, 15

17. **Problem:** A recipe requires ingredients in the ratio 5:3:2. If you use 200 grams of the first ingredient, how much of the second ingredient do you need?

- a) 120 grams
- b) 100 grams
- c) 150 grams
- d) 80 grams

18. **Problem:** The ratio of boys to girls in a class is 3:5. If there are 30 boys, how many girls are there?

- a) 40
- b) 45
- c) 50
- d) 60

19. **Problem:** If a car's fuel efficiency varies inversely with the weight it carries, and it gets 20 km/litre with 100 kg, how much will it get with 200 kg?

- a) 10 km/litre
- b) 15 km/litre
- c) 25 km/litre
- d) 30 km/litre

20. **Problem:** If 4/5=16/x , what is the value of x?

- a) 10
- b) 15
- c) 20
- d) 25

21. **Problem:** A metal alloy contains copper and tin in the ratio 3:2. If there is 300 grams of tin, how much copper is there?

- a) 450 grams
- b) 500 grams
- c) 600 grams
- d) 700 grams

22. **Problem:** Two numbers are in the ratio 4:5. If their sum is 54, what are the numbers?

- a) 24, 30
- b) 18, 36
- c) 20, 34
- d) 22, 32

23. **Problem:** The ratio of the length to the width of a rectangle is 5:2. If the width is 6 cm, what is the length?

- a) 12 cm
- b) 15 cm
- c) 18 cm
- d) 20 cm

24. **Problem:** If the ratio of apples to oranges in a basket is 7:3 and there are 21 apples, how many oranges are there?

- a) 9
- b) 10
- c) 11
- d) 12

25. **Problem:** A man divides his property among his three sons in the ratio 5:3:2. If the youngest son gets ₹20,000, what is the total value of the property?

- a) ₹100,000
- b) ₹120,000
- c) ₹150,000
- d) ₹200,000

Answers

1. b) 100
2. a) 6:5
3. c) ₹2500
4. a) 4:9
5. d) Proportional variation
6. b) 12
7. b) 50 km/hr
8. b) 81
9. a) 4
10. a) 5:1
11. b) 1:3
12. b) 6, 8
13. b) 10:21
14. a) 75
15. a) 24 liters
16. c) 15, 35
17. a) 120 grams
18. c) 50
19. a) 10 km/litre
20. c) 20
21. a) 450 grams
22. a) 24, 30
23. b) 15 cm
24. a) 09
25. a) ₹100,000

Percentage

1. What is Percentage?

- **Percentage** means "**per hundred**".
- It shows **how many parts out of 100**.
- Symbol: **%**

🧠 Example:
40% means **40 out of 100** or **40/100 = 0.4**

2.Types of Percentage Questions (in MCQ Exams)

◇ Type 1: Find a percentage of a number

Q: What is 25% of 800?
A: (25/100) × 800 = **200**

◇ Type 2: Convert % to fraction or decimal

Q: Convert 80% to decimal → 0.8
Q: Convert 60% to fraction → 3/5

◇ Type 3: Percentage Increase/Decrease

Q: Price increased from ₹200 to ₹250. What is the % increase?
A: ((250–200)/200) × 100 = 25%

◇ Type 4: What % is A of B?

Q: What % is 30 of 120?
A: (30/120) × 100 = 25%

◇ Type 5: Successive percentage changes

Q: Increase by 10%, then by 20% → Total increase?
A: 10 + 20 + (10×20)/100 = **32%**

◇ Type 6: Reverse percentage

Q: 40 is 25% of what number?
A: (40×100)/25 = **160**

Practice Question.

1. A store is offering a discount of 25% on all items. If the original price of a jacket is ₹2000, what is the discounted price?
   - a) ₹1500
   - b) ₹1600
   - c) ₹1700
   - d) ₹1800
2. A student scored 85% on a test of 200 marks. How many marks did the student score?
   - a) 170
   - b) 160
   - c) 180
   - d) 175
3. The price of a laptop increased by 15% to ₹23,000. What was the original price?
   - a) ₹19,000
   - b) ₹20,000
   - c) ₹21,000
   - d) ₹22,000
4. In a class of 40 students, 60% are boys. How many boys are there in the class?
   - a) 20
   - b) 24
   - c) 26
   - d) 28
5. A book is marked at ₹600. If it is sold at a discount of 30%, what is the selling price?
   - a) ₹420
   - b) ₹450
   - c) ₹480
   - d) ₹500
6. A car's value depreciates by 10% every year. If the current value is ₹5,00,000, what will be its value after one year?
   - a) ₹4,50,000
   - b) ₹4,60,000
   - c) ₹4,70,000
   - d) ₹4,80,000

7. A company made a profit of 20% on a sale of ₹50,000. What was the profit amount?
    - a) ₹8,000
    - b) ₹9,000
    - c) ₹10,000
    - d) ₹11,000
8. A person saved 15% of his salary every month. If he saved ₹9,000 in one month, what is his monthly salary?
    - a) ₹50,000
    - b) ₹60,000
    - c) ₹70,000
    - d) ₹80,000
9. A fruit seller sold 120 oranges, which is 80% of the total oranges he had. How many oranges did he have in total?
    - a) 130
    - b) 140
    - c) 150
    - d) 160
10. A bottle of juice contains 12% sugar. If the bottle holds 500 ml of juice, how many ml of sugar does it contain?
    - a) 50 ml
    - b) 55 ml
    - c) 60 ml
    - d) 65 ml
11. A population of a town increased by 25% over a year. If the population at the start was 40,000, what is the population now?
    - a) 45,000
    - b) 48,000
    - c) 50,000
    - d) 52,000
12. The price of a shirt after a discount of 20% is ₹800. What was the original price?
    - a) ₹900
    - b) ₹1000
    - c) ₹1050
    - d) ₹1100
13. A man spent 75% of his monthly salary and saved ₹10,000. What is his monthly salary?
    - a) ₹30,000
    - b) ₹35,000
    - c) ₹40,000
    - d) ₹45,000
14. A school's enrollment increased by 30% this year, bringing the total to 1,300 students. How many students were enrolled last year?
    - a) 1,000
    - b) 1,100
    - c) 1,150
    - d) 1,200
15. A garden has 200 plants, 40% of which are roses. How many rose plants are there in the garden?
    - a) 70
    - b) 80
    - c) 90
    - d) 100
16. What is 20% of 150?
    - a) 30
    - b) 25
    - c) 35
    - d) 20
17. If 40% of a number is 80, what is the number?
    - a) 200
    - b) 100
    - c) 150
    - d) 250
18. Increase 80 by 25%.
    - a) 100
    - b) 90
    - c) 85
    - d) 105
19. What is 75% of 200?
    - a) 140
    - b) 160
    - c) 150
    - d) 175
20. Decrease 90 by 10%.
    - a) 81
    - b) 72
    - c) 99
    - d) 78
21. If 35% of a number is 70, what is the number?
    - a) 250
    - b) 150
    - c) 200
    - d) 300
22. What percentage is 45 of 60?
    - a) 60%
    - b) 75%

- c) 80%
- d) 90%

23. What is 50% of 240?
    - a) 100
    - b) 110
    - c) 120
    - d) 130
24. Increase 150 by 40%.
    - a) 200
    - b) 210
    - c) 220
    - d) 230
25. What is 80% of 350?
    - a) 270
    - b) 280
    - c) 300
    - d) 320

Answers

1. a) ₹1500
2. a) 170
3. c) ₹20,000
4. b) 24
5. a) ₹420
6. a) ₹4,50,000
7. c) ₹10,000
8. b) ₹60,000
9. c) 150
10. c) 60 ml
11. b) 50,000
12. b) ₹1000
13. c) ₹40,000
14. a) 1,000
15. b) 80
16. a) 30
17. a) 200
18. a) 100
19. b) 150
20. a) 81
21. c) 200
22. b) 75%
23. c) 120
24. b) 210
25. b) 280

Profit & Loss

1. Basic Definitions

Term	Meaning
Cost Price (CP)	The price at which an article is purchased
Selling Price (SP)	The price at which an article is sold
Profit (Gain)	SP > CP → Profit = SP – CP
Loss	CP > SP → Loss = CP – SP
Marked Price (MP)	The price printed on the article (before discount)
Discount	Reduction given on the marked price

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2. Important Formulas

Concept	Formula
Profit	Profit = SP – CP
Loss	Loss = CP – SP
Profit %	(Profit / CP) × 100
Loss %	(Loss / CP) × 100
SP (in profit case)	SP = CP × (1 + Profit%)
SP (in loss case)	SP = CP × (1 – Loss%)
CP (in profit case)	CP = SP / (1 + Profit%)
CP (in loss case)	CP = SP / (1 – Loss%)
Discount	Discount = MP – SP
Discount %	(Discount / MP) × 100

3. Types of Questions (MCQ Style)

◇ Type 1: Find Profit or Loss

Q: CP = ₹100, SP = ₹120
A: Profit = ₹20, Profit % = 20%

◇ Type 2: Find SP or CP

Q: CP = ₹150, Profit = 10%
A: SP = 150 × (1 + 10/100) = ₹165

Q: SP = ₹180, Loss = 10%
A: CP = 180 / (1 – 10/100) = ₹200

◇ Type 3: Profit or Loss % from given CP & SP

Q: CP = ₹250, SP = ₹200
A: Loss = ₹50, Loss % = (50/250)×100 = 20%

◇ Type 4: Find Discount and Discount %

Q: MP = ₹500, SP = ₹450
A: Discount = ₹50, Discount % = 10%

◇ Type 5: Word problems

Q: A man buys an article for ₹400 and sells it for ₹460. What is the profit %?
A: Profit = ₹60; Profit % = (60/400) × 100 = **15%**

Questions

1. A man bought a TV for ₹20,000 and sold it for ₹25,000. What is his profit percentage?
   - a) 20%
   - b) 25%
   - c) 30%
   - d) 35%
2. A shopkeeper sells an item for ₹600 at a loss of 10%. What was the cost price?
   - a) ₹660
   - b) ₹700
   - c) ₹720
   - d) ₹650
3. If the cost price of 15 items is equal to the selling price of 12 items, find the profit percentage.
   - a) 15%
   - b) 20%
   - c) 25%
   - d) 30%
4. An article was bought for ₹800 and sold at a profit of 15%. Find the selling price.
   - a) ₹920
   - b) ₹960

    - c) ₹880
    - d) ₹860
5. A trader bought goods worth ₹15,000 and sold them for ₹18,000. Find the profit percentage.
    - a) 18%
    - b) 20%
    - c) 25%
    - d) 30%
6. If the selling price of an article is ₹1,200 and the cost price is ₹1,000, find the profit percentage.
    - a) 15%
    - b) 20%
    - c) 25%
    - d) 30%
7. A shopkeeper bought a table for ₹1,500 and sold it at a loss of 10%. Find the selling price.
    - a) ₹1,350
    - b) ₹1,400
    - c) ₹1,300
    - d) ₹1,200
8. The cost price of 20 items is equal to the selling price of 16 items. Find the profit percentage.
    - a) 20%
    - b) 25%
    - c) 30%
    - d) 35%
9. If the selling price of an item is ₹750 and the loss incurred is 25%, what is the cost price?
    - a) ₹1,000
    - b) ₹950
    - c) ₹900
    - d) ₹800
10. An article was sold for ₹2,500 at a profit of 25%. What was the cost price?
    - a) ₹2,000
    - b) ₹2,100
    - c) ₹2,200
    - d) ₹2,300
11. A man bought a car for ₹4,00,000 and sold it for ₹4,50,000. Calculate the profit percentage.
    - a) 10%
    - b) 12.5%
    - c) 15%
    - d) 20%
12. A trader bought 50 bags of rice at ₹1,000 each. He sold all the bags at a profit of 5%. Find the selling price of each bag.
    - a) ₹1,050
    - b) ₹1,080
    - c) ₹1,100
    - d) ₹1,120
13. If a man sold an article for ₹3,000 at a loss of 20%, what was the cost price?
    - a) ₹3,750
    - b) ₹3,800
    - c) ₹4,000
    - d) ₹4,200
14. A shopkeeper bought a refrigerator for ₹12,000 and sold it at a loss of 15%. Find the selling price.
    - a) ₹10,500
    - b) ₹10,200
    - c) ₹9,800
    - d) ₹10,800
15. An item is sold at a profit of 25%. If the cost price is ₹320, what is the selling price?
    - a) ₹380
    - b) ₹400
    - c) ₹420
    - d) ₹440

16. **Problem:** A bicycle was bought for ₹2,000 and sold for ₹2,400. Find the profit percentage.

- a) 18%
- b) 20%
- c) 22%
- d) 25%

17. **Problem:** A man bought a computer for ₹30,000 and sold it for ₹27,000. Find the loss percentage.

- a) 8%
- b) 9%
- c) 10%
- d) 11%

18. **Problem:** The selling price of an article is ₹500 and the cost price is ₹450. Find the profit percentage.

- a) 10%
- b) 11.11%
- c) 12%
- d) 13.33%

19. **Problem:** A shirt was bought for ₹750 and sold at a loss of 5%. What was the selling price?

- a) ₹700
- b) ₹712.50
- c) ₹720
- d) ₹725

20. **Problem:** A man sold a watch for ₹1,500, making a profit of 25%. Find the cost price.

- a) ₹1,100
- b) ₹1,200
- c) ₹1,250
- d) ₹1,300

21. **Problem:** The cost price of a table is ₹2,000 and the selling price is ₹1,800. Find the loss percentage.

- a) 9%
- b) 10%
- c) 11%
- d) 12%

22. **Problem:** A woman bought a dress for ₹1,200 and sold it for ₹1,440. Find the profit percentage.

- a) 18%
- b) 20%
- c) 22%
- d) 25%

23. **Problem:** A book was sold for ₹600 at a loss of 10%. Find the cost price.

- a) ₹640
- b) ₹660
- c) ₹680
- d) ₹700

24. **Problem:** If the cost price of an article is ₹500 and the selling price is ₹575, what is the profit percentage?

- a) 12%
- b) 15%
- c) 14%
- d) 16%

25. **Problem:** A person bought a bag for ₹1,500 and sold it for ₹1,275. Find the loss percentage.

- a) 10%
- b) 12%
- c) 15%
- d) 18%

Answers

1. b) 25%
2. b) ₹660
3. c) 25%
4. b) ₹920
5. b) 20%
6. b) 20%
7. a) ₹1,350
8. b) 25%
9. a) ₹1,000
10. a) ₹2,000
11. b) 12.5%
12. a) ₹1,050
13. c) ₹3,750
14. b) ₹10,200
15. b) ₹400
16. d) 20%
17. c) 10%
18. b) 11.11%
19. b) ₹712.50
20. c) ₹1,200
21. b) 10%
22. d) 20%
23. b) ₹660
24. b) 15%
25. b) 15%

▧ Simple Interest and Compound Interest.

1. Basic Definitions

◇ Simple Interest (SI):

- Interest calculated only on the **original principal** for the entire period.

🧠 Example:
If you invest ₹1000 at 10% per annum for 2 years, you get ₹100 each year = ₹200 total interest.

◇ Compound Interest (CI):

- Interest is calculated on the **principal + accumulated interest** of previous periods.
- Interest is **compounded** (usually yearly, half-yearly, quarterly).

🧠 Example:
₹1000 at 10% for 2 years →
Year 1: ₹100 interest
Year 2: ₹110 interest
Total CI = ₹210

Types of Questions (MCQ-Oriented)

◇ Type 1: Find SI

Q: Find SI on ₹4000 for 2 years at 5% p.a.
A: SI = (4000×5×2)/100 = ₹400

◇ Type 2: Find Principal / Rate / Time

Q: SI = ₹500, R = 10%, T = 5 years. Find P.
A: P = (SI × 100) / (R × T) = (500×100)/(10×5) = ₹1000

◇ Type 3: Find CI (Compounded Annually)

Q: Find CI on ₹2000 at 10% for 2 years.
A = $2000(1 + 10/100)^2 = 2000(1.1)^2 = 2000 \times 1.21 = ₹2420$
CI = 2420 – 2000 = ₹420

◇ Type 4: Difference between CI and SI

Applicable mostly for **2 years**

Difference = P × (R^2 / 100^2) (Approximate for 2 years)

Formula

Simple Interest

$$SI = \frac{P \times R \times T}{100}$$

Compound Interest

$$A = P\left(1 + \frac{R}{100}\right)^T$$

Where: (P= Principle, R= rate of interest, T= Time)

Question.

1. If you invest ₹5,000 at an annual interest rate of 5% for 3 years, what is the simple interest?
   - a) ₹750
   - b) ₹800
   - c) ₹700
   - d) ₹850
2. What is the simple interest on ₹12,000 for 4 years at an interest rate of 6% per annum?
   - a) ₹2,880
   - b) ₹3,000

- c) ₹2,400
- d) ₹2,700

3. A sum of ₹10,000 earns a simple interest of ₹2,500 in 5 years. What is the annual rate of interest?
   - a) 4%
   - b) 5%
   - c) 6%
   - d) 7%
4. What is the simple interest on ₹15,000 for 2 years at an interest rate of 4% per annum?
   - a) ₹1,000
   - b) ₹1,200
   - c) ₹1,500
   - d) ₹1,800
5. If the simple interest on a sum of money at 6% per annum for 4 years is ₹720, what is the principal amount?
   - a) ₹2,800
   - b) ₹3,000
   - c) ₹3,200
   - d) ₹3,600

6. If you invest ₹8,000 at an annual interest rate of 5% for 2 years, what is the simple interest?
   - a) ₹700
   - b) ₹800
   - c) ₹600
   - d) ₹900
7. **Problem:** A sum of ₹7,500 earns a simple interest of ₹1,125 in 3 years. What is the annual rate of interest?
   - a) 4%
   - b) 5%
   - c) 6%
   - d) 7%
8. **Problem:** What is the simple interest on ₹10,000 for 2 years at an interest rate of 3% per annum?
   - a) ₹500
   - b) ₹600
   - c) ₹700
   - d) ₹800
9. **Problem:** If the simple interest on a sum of money at 5% per annum for 5 years is ₹1,250, what is the principal amount?
   - a) ₹5,000
   - b) ₹4,500
   - c) ₹4,000
   - d) ₹3,500
10. **Problem:** Calculate the simple interest on ₹9,000 for 3 years at an interest rate of 4% per annum.
    - a) ₹960
    - b) ₹1,080
    - c) ₹1,200
    - d) ₹1,350
11. **Problem:** A sum of ₹12,000 earns a simple interest of ₹1680 2 years. What is the annual rate of interest?
    - a) 6%
    - b) 7%
    - c) 8%
    - d) 9%

12. If you invest ₹10,000 at an annual interest rate of 5% compounded annually for 2 years, what will be the amount?
    - a) ₹11,000
    - b) ₹11,025
    - c) ₹10,500
    - d) ₹10,250
13. What is the compound interest on ₹8,000 for 3 years at an interest rate of 10% per annum compounded annually?
    - a) ₹2,648
    - b) ₹2,420
    - c) ₹2,400
    - d) ₹2,250
14. A sum of ₹12,000 is invested at an annual interest rate of 5% compounded annually for 2 years. What will be the amount?
    - a) ₹13,248
    - b) ₹13,632
    - c) ₹13,230
    - d) ₹14,000
15. What is the compound interest on ₹5,000 for 2 years at an interest rate of 6% per annum compounded annually?
    - a) ₹630
    - b) ₹618
    - c) ₹600
    - d) ₹620

16. **Problem:** If you invest ₹15,000 at an annual interest rate of 7% compounded