

# Commercial Arithmetic

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# Simple and Compound Interest

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# Definition

- **Simple Interest:** Interest calculated only on the initial principal.
- **Compound Interest:** Interest calculated on both the initial principal and the accumulated interest from previous periods.

# Introduction

- Simple Interest is straightforward and is based only on the original amount of money.
- Compound Interest, on the other hand, takes into account the interest that accumulates over time.

# Where it is Used in Real Life

- **Simple Interest:** Bank savings accounts, loans.
- **Compound Interest:** Investments, credit cards, mortgages.

# Worked Out Problems

## Simple Interest:

If  $P$  is the principal amount,  $r$  is the rate of interest, and  $t$  is the time (in years), then the simple interest ( $SI$ ) is given by the formula:

$$SI = P \cdot r \cdot t$$

## Compound Interest:

The compound interest ( $CI$ ) can be calculated using the formula:

$$CI = P \left(1 + \frac{r}{n}\right)^{nt} - P$$

# Step-by-Step Solution for Simple Interest Problem

**Problem:** Calculate the simple interest for a principal amount of 5000, an interest rate of 8%, and a time period of 3 years.

**Solution:**

- 1 **Given:**  $P = 5000$ ,  $r = 0.08$ ,  $t = 3$  years.
- 2 **Formula:** Use the simple interest formula  $SI = P \cdot r \cdot t$ .
- 3 **Substitute:**  $SI = 5000 \cdot 0.08 \cdot 3$ .
- 4 **Calculate:**  $SI = 1200$ .

## Reasoning for Simple Interest Solution

- The formula  $SI = P \cdot r \cdot t$  represents the calculation for simple interest.
- Substitute the given values into the formula to find the result.
- In this case, the principal amount is 5000, the interest rate is 8%, and the time is 3 years.
- Substituting these values gives  $SI = 5000 \cdot 0.08 \cdot 3 = 1200$ .
- Therefore, the simple interest for the given scenario is 1200.



## Exercise for Students

- 1 Calculate the simple interest for a principal amount of 5000, an interest rate of 8%, and a time period of 3 years.
- 2 Find the compound interest for a principal amount of 2000 at an annual interest rate of 6% compounded annually for 4 years.
- 3 Discuss a real-life scenario where understanding simple or compound interest is important.

# Definition

- **Profit:** The financial gain made in a transaction.
- **Loss:** The financial deficit incurred in a transaction.

# Introduction

- Profit and loss are essential concepts in business and everyday transactions.
- Understanding these concepts helps in making informed financial decisions.

# Where it is Used in Real Life

- **Profit:** Business transactions, investments, selling goods.
- **Loss:** Business losses, investments with negative returns, selling goods at a loss.

# Worked Out Problems

**Problem 1:** A person buys a product for \$50 and sells it for \$80. Calculate the profit.

**Solution:**

- ➊ **Given:** Cost Price (CP) = 50, Selling Price (SP) = 80.
- ➋ **Formula:** Profit ( $P$ ) is calculated as  $P = SP - CP$ .
- ➌ **Substitute:**  $P = 80 - 50$ .
- ➍ **Calculate:**  $P = 30$ .

## Exercise for Students

- ① Calculate the profit if an item is bought for \$120 and sold for \$150.
- ② Determine the loss if an article is purchased for \$90 and sold for \$80.
- ③ Discuss a real-life scenario where understanding profit and loss is important.

# Percentage

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# Definition

- **Percentage:** A proportion or ratio expressed as a fraction of 100.



# Introduction

- Percentage is a common way to express a part of a whole in terms of 100.
- It is used in various real-life situations for comparisons and calculations.

# Where it is Used in Real Life

- **Discounts:** Percentage off on retail prices.
- **Interest Rates:** Mortgage rates, credit card interest rates.
- **Grades:** Academic scores are often presented as percentages.

## Worked Out Problems

**Problem 1:** If a shirt originally costs \$40 and is discounted by 20%, find the discounted price.

**Solution:**

- ① **Given:** Original Price = \$40, Discount Rate = 20%.
- ② **Formula:** Discounted Price ( $DP$ ) is calculated as  
$$DP = \text{Original Price} - (\text{Original Price} \times \text{Discount Rate}).$$
- ③ **Substitute:**  $DP = 40 - (40 \times 0.2).$
- ④ **Calculate:**  $DP = 40 - 8 = 32.$

## Exercise for Students

- 1 Calculate 15% of \$120.
- 2 A student scored 85% on a test. If the total marks were 200, how many marks did the student score?
- 3 Discuss a real-life scenario where understanding percentages is important.

# Partnership

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# Definition

- **Partnership:** A business structure where two or more individuals manage and operate a business in accordance with the terms and objectives set out in a Partnership Deed.

# Introduction

- Partnership is a form of business organization that allows multiple individuals to share responsibilities and profits.
- Partnerships are governed by a legal agreement known as the Partnership Deed.

# Where it is Used in Real Life

- **Small Businesses:** Many small businesses, such as law firms, medical practices, and consulting firms, operate as partnerships.
- **Professional Services:** Partnerships are common in professional services where expertise and collaboration are essential.



## Worked Out Problems

**Problem 1:** In a partnership, John invests \$5000 and Peter invests \$7000. If the total profit at the end of the year is \$6000, how much does each partner receive?

**Solution:**

- ① **Given:** John's investment = \$5000, Peter's investment = \$7000,  
Total profit = \$6000.
- ② **Formula:** Share of each partner is calculated as their investment divided by the total investment, multiplied by the total profit.
- ③ **John's Share:**  $\frac{5000}{5000+7000} \times 6000$ .
- ④ **Peter's Share:**  $\frac{7000}{5000+7000} \times 6000$ .

# Reasoning for Partnership Solution

- In a partnership, the distribution of profits is based on the proportion of each partner's investment.
- John's share is calculated as  $\frac{5000}{5000+7000} \times 6000$ , and Peter's share is calculated as  $\frac{7000}{5000+7000} \times 6000$ .
- The total profit is distributed among the partners according to their investments.

## Exercise for Students

- 1 If two partners, A and B, invest \$8000 and \$12000 respectively in a business, and the annual profit is \$5000, calculate the share of each partner.
- 2 Discuss a real-life scenario where forming a partnership would be beneficial for a business.

# Ratio and Proportion

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# Definition

- **Ratio:** A comparison of two quantities by division.
- **Proportion:** An equation stating that two ratios are equal.

# Introduction

- Ratios and proportions are fundamental mathematical concepts used for comparing quantities and solving various problems.
- They are applicable in a wide range of scenarios, from everyday life to complex mathematical problem-solving.

## Where it is Used in Real Life

- **Cooking:** Ratios are often used in recipes to determine ingredient quantities.
- **Finance:** Proportions are used in financial calculations, such as interest rates and investment returns.
- **Scale Models:** Architects and model builders use ratios to create accurate scale models.

## Worked Out Problems

**Problem 1:** If the ratio of boys to girls in a class is 3 : 2, and there are 30 students in total, how many boys and girls are there?

**Solution:**

- ➊ **Given:** Ratio of boys to girls = 3 : 2, Total students = 30.
- ➋ **Formula:** Use the ratio to find the individual quantities. Let the number of boys be  $3x$  and girls be  $2x$ .
- ➌ **Equation:**  $3x + 2x = 30$ .
- ➍ **Calculate:** Solve for  $x$  and find the number of boys and girls.



# Reasoning for Ratio and Proportion Solution

- The ratio 3 : 2 implies that for every 3 boys, there are 2 girls.
- Assuming the number of boys is  $3x$  and girls is  $2x$ , the total becomes  $3x + 2x = 30$ .
- Solve for  $x$  to find the multiplier, and then determine the number of boys and girls accordingly.

## Exercise for Students

- ① In a mixture, the ratio of sugar to salt is  $5 : 2$ . If there are 35 units of sugar, how much salt is there in the mixture?
- ② A recipe for a cake requires a ratio of  $2 : 3$  for flour to sugar. If you have 400 grams of flour, how much sugar is needed?
- ③ Discuss a real-life scenario where understanding ratios and proportions is important.

# Surface Area

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# Definition

- **Surface Area:** The total area of the surface of a three-dimensional object.

# Introduction

- Surface area is a crucial measure in geometry and is used to quantify the extent of the outer layer of three-dimensional shapes.
- Understanding surface area is essential for various applications, such as construction, packaging, and manufacturing.

## Where it is Used in Real Life

- **Packaging:** Determining the amount of material needed for packaging.
- **Construction:** Calculating the amount of paint or other materials required to cover surfaces.
- **Manufacturing:** Designing products with optimized surface area for efficiency.

# Worked Out Problems

**Problem 1:** Find the surface area of a rectangular prism with dimensions *length* = 4, *width* = 3, and *height* = 5.

**Solution:**

- 1 **Formula:** The surface area of a rectangular prism is given by  $2lw + 2lh + 2wh$ .
- 2 **Substitute:** Surface area =  $2(4 \times 3) + 2(4 \times 5) + 2(3 \times 5)$ .
- 3 **Calculate:** Surface area =  $24 + 40 + 30 = 94$ .

# Reasoning for Surface Area Solution

- The formula for the surface area of a rectangular prism is  $2lw + 2lh + 2wh$ .
- Substitute the given dimensions into the formula and calculate each term separately.
- Summing up the individual areas gives the total surface area of the rectangular prism.



## Exercise for Students

- 1 Find the surface area of a cube with a side length of 6 units.
- 2 Calculate the surface area of a cylinder with a radius of 4 units and a height of 8 units.
- 3 Discuss a real-life scenario where understanding surface area is crucial.

# Volume

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# Definition

- **Volume:** The amount of space occupied by a three-dimensional object.

# Introduction

- Volume is a key measurement in geometry, representing the capacity or size of three-dimensional objects.
- Understanding volume is crucial in various fields, including architecture, engineering, and manufacturing.

# Where it is Used in Real Life

- **Packaging:** Determining the capacity of containers and boxes.
- **Construction:** Calculating the amount of material needed for a structure.
- **Fluid Dynamics:** Understanding the volume of liquids and gases in engineering applications.

# Worked Out Problems

**Problem 1:** Find the volume of a rectangular prism with dimensions *length* = 4, *width* = 3, and *height* = 5.

**Solution:**

- ① **Formula:** The volume of a rectangular prism is given by  $V = lwh$ .
- ② **Substitute:** Volume =  $4 \times 3 \times 5$ .
- ③ **Calculate:** Volume = 60 cubic units.

# Reasoning for Volume Solution

- The formula for the volume of a rectangular prism is  $V = lwh$ .
- Substitute the given dimensions into the formula and multiply to find the volume.
- The resulting value represents the space occupied by the rectangular prism.

## Exercise for Students

- 1 Calculate the volume of a cube with a side length of 6 units.
- 2 Find the volume of a cylinder with a radius of 4 units and a height of 8 units.
- 3 Discuss a real-life scenario where understanding volume is essential.



# Average

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# Definition

- **Average:** A measure of central tendency that represents the typical value of a set of numbers.

# Introduction

- The average is commonly used to represent the central value of a set of data points.
- It provides a single value that summarizes the data and is often used for comparison and analysis.

# Where it is Used in Real Life

- **Grades:** Average scores in academic assessments.
- **Finance:** Average returns on investments.
- **Sports:** Average performance statistics for athletes.

# Worked Out Problems

**Problem 1:** The scores of a student in five subjects are 85, 90, 88, 92, and 87. Calculate the average score.

**Solution:**

- ① **Given:** Scores = 85, 90, 88, 92, 87.
- ② **Formula:** The average is calculated as  $\frac{\text{Sum of Scores}}{\text{Number of Scores}}$ .
- ③ **Calculate:** Average =  $\frac{85+90+88+92+87}{5}$ .

# Reasoning for Average Solution

- The average is found by summing up all the scores and dividing by the number of scores.
- For the given problem, the average score is  $\frac{85+90+88+92+87}{5}$ .
- This provides a single value that represents the typical score of the student.

## Exercise for Students

- 1 Find the average of 12, 15, 18, 20, and 25.
- 2 A car travels at speeds of 50, 60, 55, 65, and 70 mph. Calculate the average speed.
- 3 Discuss a real-life scenario where understanding averages is important.

# Linear Equations

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# Definition

- **Linear Equation:** An equation that represents a straight line when graphed on a coordinate plane.

# Introduction

- Linear equations are fundamental in algebra and represent relationships between variables that result in a straight-line graph.
- They are used to model various real-world situations and are crucial in problem-solving.

# Where it is Used in Real Life

- **Finance:** Budgeting and financial planning often involve linear relationships.
- **Physics:** Formulas describing motion or energy can be represented by linear equations.
- **Engineering:** Many engineering problems are modeled using linear equations.

# Worked Out Problems

**Problem 1:** Solve the equation  $2x + 3 = 7$ .

**Solution:**

- 1 **Equation:**  $2x + 3 = 7$ .
- 2 **Isolate Variable:** Subtract 3 from both sides to get  $2x = 4$ .
- 3 **Solve for  $x$ :** Divide both sides by 2 to find  $x = 2$ .

# Reasoning for Linear Equation Solution

- To solve a linear equation, perform operations to isolate the variable on one side of the equation.
- For the given problem, start by subtracting 3 from both sides, resulting in  $2x = 4$ .
- Then, divide both sides by 2 to find  $x = 2$ .

## Exercise for Students

- 1 Solve the equation  $3y - 5 = 10$ .
- 2 Write a linear equation to represent the statement: "Twice a number increased by 7 is equal to 15."
- 3 Discuss a real-life scenario where understanding linear equations is important.

# Quadratic Equations

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# Definition

- **Quadratic Equation:** A second-degree polynomial equation in a single variable with the form  $ax^2 + bx + c = 0$ , where  $a$ ,  $b$ , and  $c$  are constants.



# Introduction

- Quadratic equations are an essential part of algebra and are widely used to model various real-world phenomena.
- They describe the shape of a parabola and have applications in physics, engineering, and other fields.

## Where it is Used in Real Life

- **Physics:** Projectile motion can be modeled using quadratic equations.
- **Engineering:** Quadratic equations describe the behavior of certain mechanical systems.
- **Finance:** Quadratic equations are used in financial modeling.

# Worked Out Problems

**Problem 1:** Solve the quadratic equation  $x^2 - 4x + 4 = 0$ .

**Solution:**

- ① **Equation:**  $x^2 - 4x + 4 = 0$ .
- ② **Factor:** The equation can be factored into  $(x - 2)^2 = 0$ .
- ③ **Solve for  $x$ :** Set  $x - 2 = 0$ , leading to  $x = 2$ .

# Reasoning for Quadratic Equation Solution

- To solve a quadratic equation, factor it and set each factor equal to zero.
- For the given problem, the quadratic equation  $x^2 - 4x + 4 = 0$  can be factored into  $(x - 2)^2 = 0$ .
- Set  $x - 2 = 0$  to find the solution  $x = 2$ .

## Exercise for Students

- 1 Solve the quadratic equation  $2x^2 - 5x + 2 = 0$ .
- 2 Write a quadratic equation given the roots  $x = 3$  and  $x = -2$ .
- 3 Discuss a real-life scenario where understanding quadratic equations is important.