ALGEBRA

Algebra is a branch of mathematics that deals with mathematical symbols and the rules for manipulating these symbols. It involves the study of mathematical operations and relationships between variables, often using letters to represent unknown or variable quantities. Here's an overview of key concepts in algebra:

1. **Basic Operations:**

- **Addition and Subtraction:** Combining or removing quantities.

- **Multiplication and Division:** Repeated addition and partitioning, respectively.

2. **Expressions and Equations:**

- **Expressions:** Mathematical phrases containing numbers, variables, and operations (e.g., \(2x + 5\)).

- **Equations:** Mathematical statements asserting equality between two expressions (e.g., \(2x + 5 = 11\)).

3. **Variables:**

- **Symbols representing numbers:** Commonly denoted by letters (e.g., \(x, y, a, b\)).

- **Unknowns:** Used to solve equations and express relationships.

4. **Polynomials:**

- **Polynomial:** An expression consisting of variables and coefficients, involving only addition, subtraction, and multiplication by constants. Examples include \(3x^2 + 2x - 1\) and \(a^3 - 5a^2 + 2a - 7\).

5. **Factoring:**

- **Factoring:** Expressing a polynomial as a product of its factors. For example, \(x^2 - 4\) can be factored as \((x + 2)(x - 2)\).

6. **Linear Equations and Inequalities:**

- **Linear Equation:** An equation of degree 1, represented as $ax + b = 0$.

- **Inequality:** Expresses a relationship between two expressions using symbols like $<$, $>$, $\leq$, or $\geq$.

7. **Quadratic Equations:**

- **Quadratic Equation:** An equation of degree 2, represented as $ax^2 + bx + c = 0$.

- **Quadratic Formula:** $x = \frac{{-b \pm \sqrt{{b^2 - 4ac}}}}{{2a}}$.

8. **Systems of Equations:**

- **System of Equations:** A set of two or more equations with the same variables.

- **Solution of a System:** Values of the variables that satisfy all equations in the system.

9. **Functions:**

- **Function:** A relation between a set of inputs (domain) and a set of possible outputs (range), often represented by an equation or a graph.

- **Domain and Range:** The set of possible input values and output values, respectively.

10. **Exponents and Radicals:**

- **Exponents:** Represent repeated multiplication (e.g., $a^n = a \times a \times \ldots \times a$).

- **Radicals:** Inverse operation to exponentiation (e.g., $\sqrt{a}$).

11. **Logarithms:**

- **Logarithm:** The inverse operation to exponentiation. If $b^x = a$, then $\log_b(a) = x$.

12. **Matrices:**

- **Matrix:** A rectangular array of numbers, symbols, or expressions.

- **Matrix Operations:** Addition, subtraction, and multiplication of matrices.

Algebra provides a foundation for more advanced mathematical topics and is widely used in various fields such as physics, engineering, computer science, economics, and many others. It serves as a powerful tool for solving real-world problems and expressing relationships between quantities.