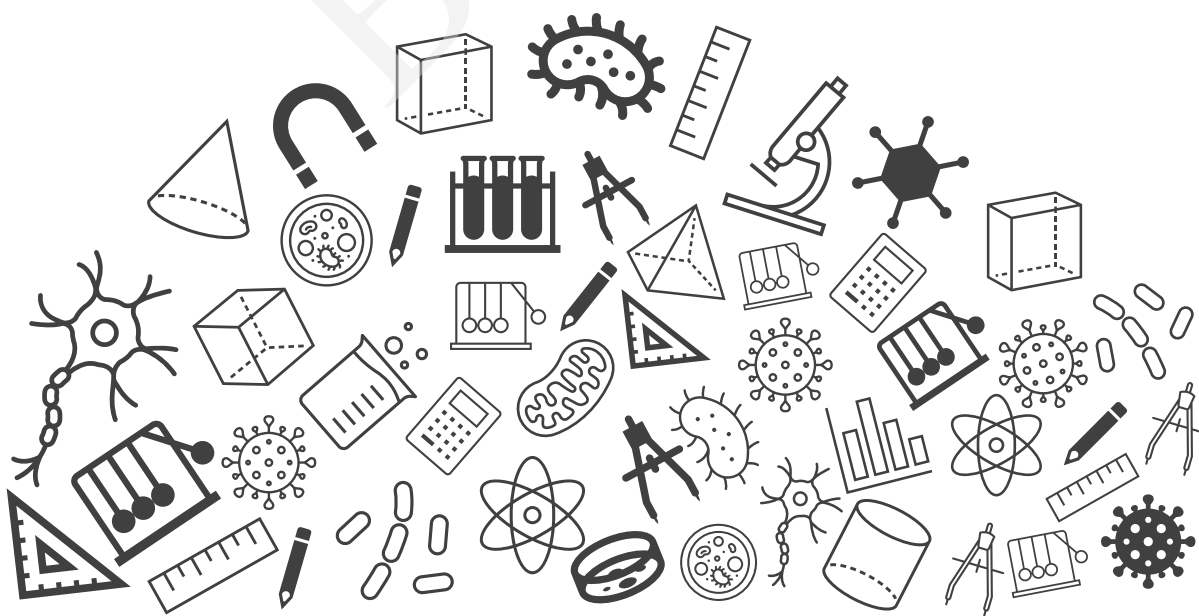




Grade 09

Mathematics Chapter Notes

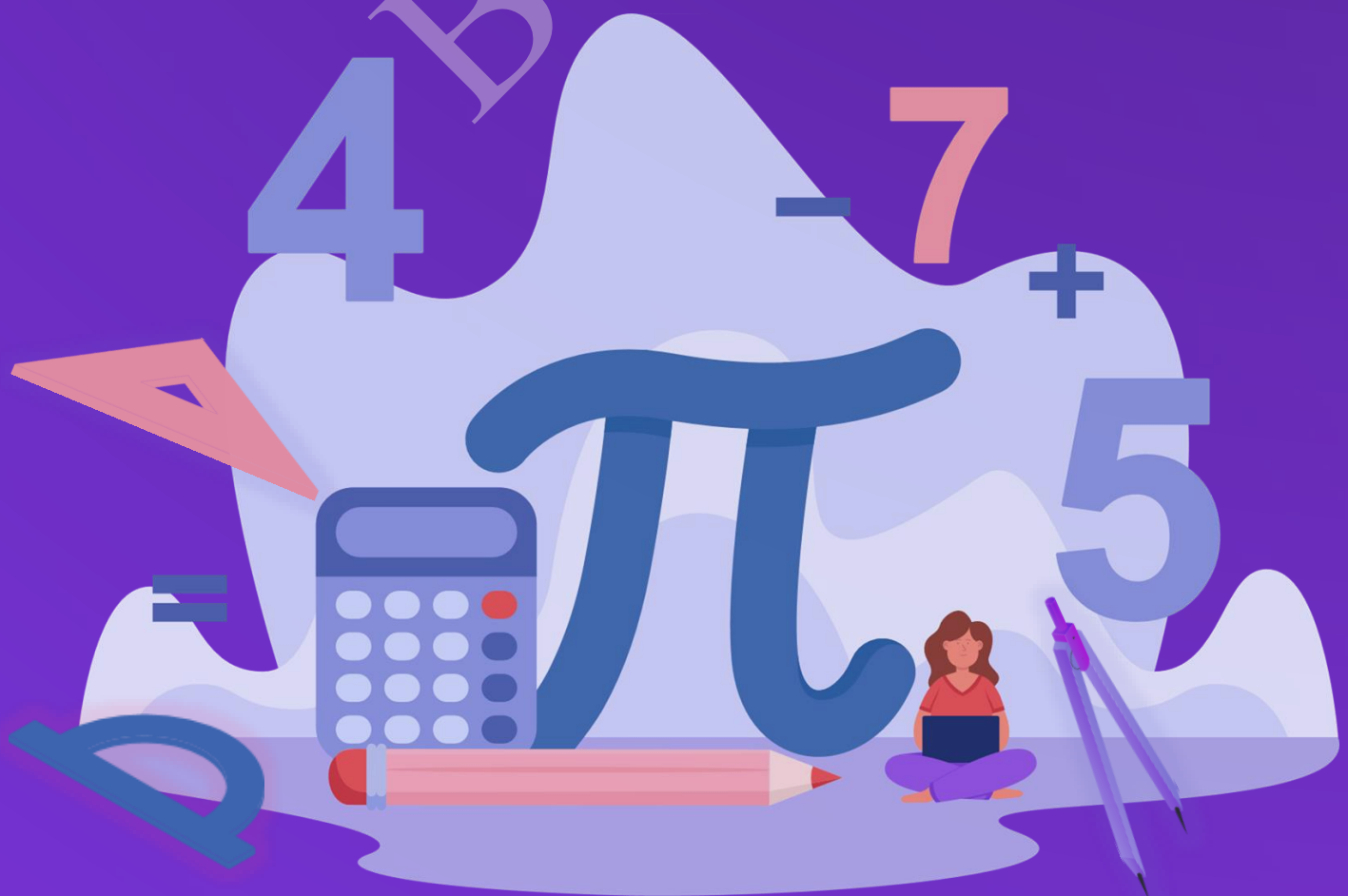


BYJU'S Classes

Chapter Notes

Polynomials

Grade 09



Topics to be Covered

1. Introduction to Polynomials

- 1.1. Polynomial in One Variable.
- 1.2. Type of Polynomials.
- 1.3. Degree of a Polynomial.
- 1.4 Classification of Polynomial: based on the degree.

2. Zeroes of a Polynomial

3. Division of Polynomials

- 3.1 Factor Theorem.

4 .Factorisation of Polynomials

5. Algebraic Identities

1. Introduction to Polynomials

1.1 Polynomial in One Variable

A polynomial $p(x)$ in one variable x is an algebraic expression in x of the form:

$$p(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_2 x^2 + a_1 x + a_0$$

where $a_0, a_1, a_2, \dots, a_n$ are constants and $a_n \neq 0$.

$a_0, a_1, a_2, \dots, a_n$ are respectively the co-efficients of $x_0, x_1, x_2, \dots, x_n$ and n is called the degree of the polynomial.

Each of $a_n x^n, a_{n-1} x^{n-1}, \dots, a_0$ with $a_n \neq 0$ is called the term of the polynomial $p(x)$.

For example:

$$4x^3 - 3x^2 + \frac{x}{4} + 6$$

Diagram illustrating the components of the polynomial $4x^3 - 3x^2 + \frac{x}{4} + 6$:

- Coefficient:** Can be any real number (points to 4, -3, and $\frac{1}{4}$).
- Variable:** No limit on number of variables (points to x).
- Exponent:** Must be a whole number (points to 3, 2, and 1).
- Operator:** (points to $-$ and $+$).
- Constant:** (points to 6).

1.2 Type of Polynomials

Monomial

Single non-zero term

Ex: $5x, 3, 6a^4, -3xy$

Binomial

Exactly two unlike terms

Ex: $-5x + 3, 6a^4 + 17x$

Trinomial

Exactly three unlike terms

Ex: $-8a^4 + 2x + 7$

1. Introduction to Polynomials

1.3 Degree of a Polynomial

The degree of a polynomial is the highest power of the variable in the polynomial.

For example:

$$4x^3 - 3x^2 + \frac{x^1}{4} + 6x^0$$

The degree of the above polynomial is 3.

1.4 Classification of Polynomial: based on Degree

Linear Polynomial: A polynomial of degree one is called a linear polynomial. For example: $x - 12$.

Quadratic Polynomial: A polynomial of degree two is called a quadratic polynomial. For example: $2x^2 - 3x + 5$.

Cubic Polynomial: A polynomial of degree three is called a cubic polynomial. For example: $4a^3 - 100a^2 + a - 6$.

2. Zeroes of a Polynomial

For a polynomial, there could be some values of the variable for which the polynomial will be **zero**. These values are called **zeros of a polynomial**. Sometimes, they are also referred to as **roots** of the polynomials. In general, we find the zeros of quadratic equations, to get the solutions for the given equation.

If the value of the polynomial $p(x)$ becomes equal to 0 when we substitute $x = a$, then a is a zero of the polynomial $p(x)$, and vice-versa.

$$p(x = a) = 0$$

a is a zero of $p(x)$

3. Division of Polynomials

	Divisor	Quotient	
	$\uparrow g(x)$	$\uparrow q(x)$	
$3x^2 + x - 1$	$x - 1$	$\times$	$3x + 4$
$=$			$+$
			3
$\downarrow p(x)$			$\downarrow r(x)$
Dividend			Remainder

3. Division of Polynomials

$$p(x) = q(x) \times g(x) + r(x)$$

where,

$p(x)$ is the dividend

$g(x)$ is the divisor

$q(x)$ is the quotient

$r(x)$ is the remainder

3.1 Factor Theorem

According to factor theorem, if $f(x)$ is a polynomial of degree $n \geq 1$ and 'a' is any real number, then, $(x-a)$ is a factor of $f(x)$, if $f(a)=0$.

Factor theorem is commonly used for factoring a polynomial and finding the roots of the polynomial. It is a special case of a polynomial remainder theorem.

4. Factorisation of Polynomials

Factorisation of polynomials is the process of expressing the polynomials as the product of two or more polynomials.

For example, the polynomial $x^2 - x - 6$ can be factorised as $(x - 3)(x + 2)$.

5. Algebraic Identities

The algebraic identities are the algebraic equations, which are valid for all values. The important algebraic identities are:

$$(x + y)^2 = x^2 + 2xy + y^2$$

$$(x - y)^2 = x^2 - 2xy + y^2$$

$$x^2 - y^2 = (x + y)(x - y)$$

$$(x + a)(x + b) = x^2 + (a + b)x + ab$$

$$(x + y)^3 = x^3 + y^3 + 3xy(x + y)$$

$$(x - y)^3 = x^3 - y^3 - 3xy(x - y)$$

Mind Map

Ex: $5x$, 3 , $6a^4$, $-3xy$

Ex: $-5x + 3$, $6a^4 + 17x$

Ex: $-8a^4 + 2x + 7$

Monomial

Binomial

Trinomial

Types of Polynomial

Remainder
Theorem

Factorisation

Division

Polynomials

Algebraic
Identities

Factor
Theorem

Classification of Polynomial

Linear

Quadratic

Cubic

Degree 1

Degree 2

Degree 3