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POLYNOMIALS

Complete Study Material for CBSE Class 10

🌟 INTERESTING MATHEMATICAL FACTS

Did You Know?

🎯 **The word "Polynomial"** comes from Greek: "poly" means "many" and "nomial" means "terms". So polynomial literally means "many terms"!

📐 **Parabolas are everywhere!** The path of a thrown ball, satellite dish shapes, car headlight reflectors, and even the cables of suspension bridges follow parabolic curves described by quadratic polynomials.

🚀 **NASA uses polynomials** to calculate spacecraft trajectories. The path of rockets and satellites is predicted using polynomial equations!

> 💡 **The quadratic formula** was known to ancient Babylonians around 2000 BC, but the general form we use today was developed by Indian mathematician Brahmagupta in 628 AD!
>
> 🎨 **Computer graphics and animation** rely heavily on polynomial equations. Every curve you see in video games and movies is created using polynomial mathematics!

📋 CHAPTER OVERVIEW

Chapter	Polynomials
Weightage	4 Marks (as per CBSE marking scheme)
1 Mark Questions	1
3 Mark Questions	1

Topics Covered:

1. Types of Polynomials (Linear, Quadratic, Cubic)
2. Zeroes of Polynomials
3. Geometrical Meaning of Zeroes with Graphs
4. Relationship between Zeroes and Coefficients
5. Formation of Polynomials from Given Zeroes

🎯 SECTION 1: TYPES OF POLYNOMIALS

Key Definitions:

Polynomial: An algebraic expression of the form $a_0 + a_1x + a_2x^2 + ... + a_nx^n$ where a_0, a_1, a_2, ..., a_n are real numbers and n is a non-negative integer.

Type	Degree	General Form	Example
Linear	1	$ax + b$ ($a \neq 0$)	$2x + 3$, $5x - 7$
Quadratic	2	$ax^2 + bx + c$ ($a \neq 0$)	$x^2 - 5x + 6$
Cubic	3	$ax^3 + bx^2 + cx + d$ ($a \neq 0$)	$2x^3 - 3x^2 + x - 5$

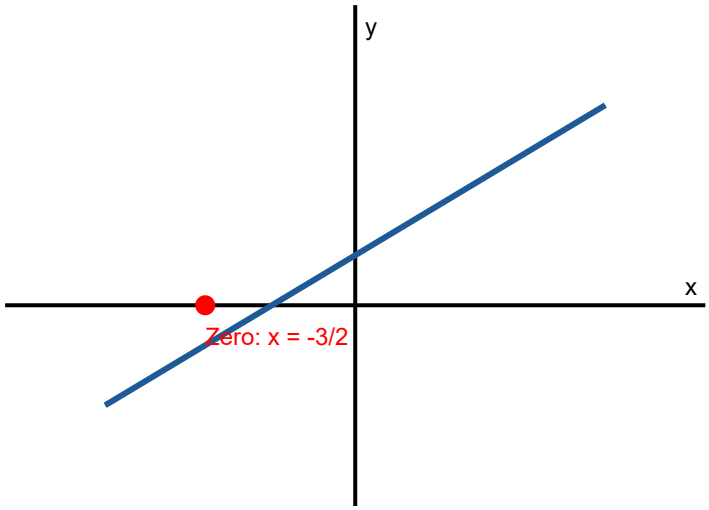
🎯 SECTION 2: GEOMETRICAL MEANING OF ZEROES

Zero of a Polynomial: A real number 'k' is called a zero of polynomial p(x) if p(k) = 0

Geometric Meaning: Zeroes are x-coordinates where graph intersects x-axis

Linear Polynomial: y = 2x + 3

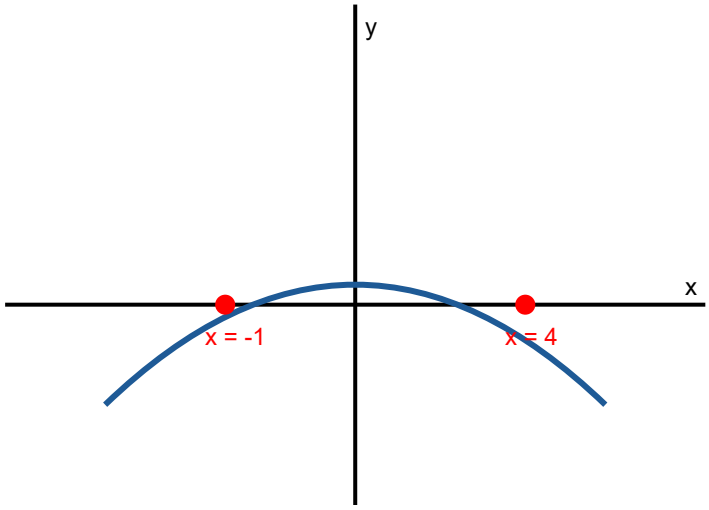
Graph of Linear Polynomial y = 2x + 3



One zero: The line intersects x-axis at exactly one point

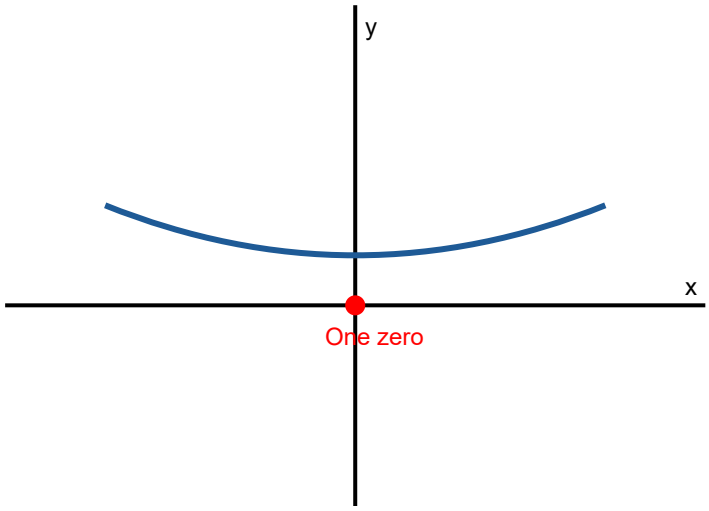
Quadratic Polynomial: Three Cases

Case 1: Two Distinct Zeroes ($y = x^2 - 3x - 4$)



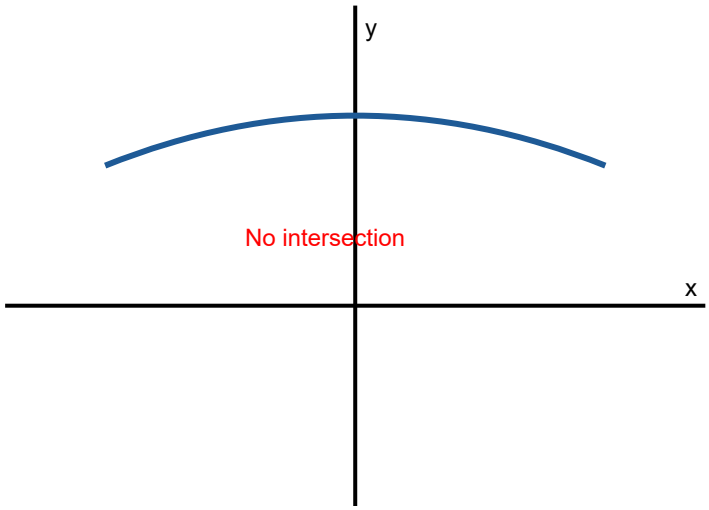
Two distinct zeroes: Parabola cuts x-axis at two points

Case 2: One Zero (Two Equal Zeroes)



One zero (repeated): Parabola touches x-axis at one point

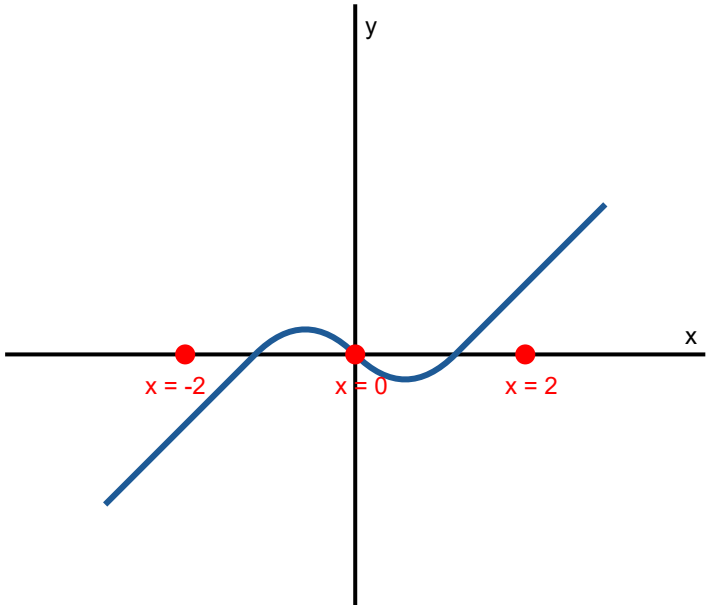
Case 3: No Real Zeroes



No real zeroes: Parabola doesn't touch x-axis

Cubic Polynomial: $y = x^3 - 4x$

Graph of Cubic Polynomial $y = x^3 - 4x$



Three zeroes: Cubic polynomial can have up to 3 zeroes

🎯 SECTION 3: RELATIONSHIP BETWEEN ZEROES AND COEFFICIENTS

For Quadratic Polynomials:

If α and β are zeroes of $ax^2 + bx + c$, then:

Sum of zeroes: $\alpha + \beta = -b/a$

Product of zeroes: $\alpha\beta = c/a$

Example: Find zeroes of $x^2 + 7x + 10$ and verify

$x^2 + 7x + 10 = (x + 2)(x + 5)$
Zeroes: $x = -2$ and $x = -5$

Verification:
Sum = $-2 + (-5) = -7 = -7/1$ ✓
Product = $(-2)(-5) = 10 = 10/1$ ✓

Formation of Quadratic Polynomial:

If α and β are required zeroes:

Polynomial = $x^2 - (\alpha + \beta)x + \alpha\beta$

Or = x^2 - (Sum)x + (Product)

💡 TIPS & TRICKS

✓ **Quick Sum:** Sum = -(middle coefficient)/(first coefficient)

✓ **Quick Product:** Product = (constant term)/(first coefficient)

✓ **Sign Check:**

- Both zeroes positive → sum > 0, product > 0
- Both zeroes negative → sum < 0, product > 0
- Opposite signs → product < 0

For Cubic Polynomials:

If α, β, γ are zeroes of $ax^3 + bx^2 + cx + d$:

$$\alpha + \beta + \gamma = -b/a$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = c/a$$

$$\alpha\beta\gamma = -d/a$$

⚠️ COMMON MISTAKES

❌ **Mistake 1:** Forgetting negative signs in formulas

❌ **Mistake 2:** Using wrong coefficients (always identify a, b, c correctly)

❌ **Mistake 3:** Confusing sum and product formulas

📄 PREVIOUS YEARS' BOARD QUESTIONS

Q1. [1 Mark] If one zero of $x^2 + 3x + k$ is 2, find k. (2023)

Solution:

```
p(2) = 0
4 + 6 + k = 0
k = -10
```

Q2. [3 Marks] Find zeroes of $6x^2 - 3 - 7x$ and verify relationship. (2024)

Solution:

```
Rearrange: 6x² - 7x - 3
= 6x² - 9x + 2x - 3
= 3x(2x - 3) + 1(2x - 3)
= (3x + 1)(2x - 3)

Zeroes: x = -1/3 and x = 3/2

Verification: a = 6, b = -7, c = -3
Sum = -1/3 + 3/2 = 7/6 = -(-7)/6 ✓
Product = (-1/3)(3/2) = -1/2 = -3/6 ✓
```

📚 IMPORTANT FORMULAS - QUICK REFERENCE

1. For Linear: ax + b, Zero = -b/a

2. For Quadratic: $ax^2 + bx + c$

- Sum of zeroes = -b/a
- Product of zeroes = c/a
- Polynomial from zeroes = x^2 - (sum)x + (product)

3. For Cubic: $ax^3 + bx^2 + cx + d$

- $\alpha + \beta + \gamma = -b/a$
- $\alpha\beta + \beta\gamma + \gamma\alpha = c/a$
- $\alpha\beta\gamma = -d/a$

🚀 LAST MINUTE REVISION CHECKLIST

Theory:

- ☐ Types of polynomials (Linear, Quadratic, Cubic)
- ☐ Definition of zero of polynomial
- ☐ Geometrical meaning - graph intersection
- ☐ Number of zeroes = degree of polynomial (maximum)

Formulas:

- ☐ Sum and product formulas for quadratic
- ☐ Formation of polynomial from given zeroes
- ☐ Three formulas for cubic polynomial

Common Questions:

- ☐ Find zeroes and verify relationship
- ☐ Form polynomial from given sum and product
- ☐ Find value of k using given zero
- ☐ Identify number of zeroes from graph

📞 NEED HELP?

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💪 MOTIVATIONAL MESSAGE

"Mathematics is not about numbers, equations, or algorithms. It's about understanding patterns and solving problems."

Polynomials might seem abstract, but they're the foundation of so much in our world - from the trajectory of a ball to the design of roller coasters, from computer graphics to NASA's space missions!

Every mathematician started exactly where you are. The difference between those who mastered math and those who struggled wasn't talent - it was **consistent practice and never giving up**.

Your Success Mantra:

- ✨ **Practice Daily:** Solve at least 5 polynomial problems every day
- ✨ **Master Graphs:** Visualize the curves - it makes understanding easier
- ✨ **Memorize Formulas:** Write them 10 times daily until they're automatic
- ✨ **Learn from Mistakes:** Every wrong answer teaches you something new
- ✨ **Ask Questions:** No question is stupid - confusion cleared is knowledge gained

"Success is the sum of small efforts repeated day in and day out."

You've got this! Keep practicing, stay curious, and success will follow.

Team Math Love 💙

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