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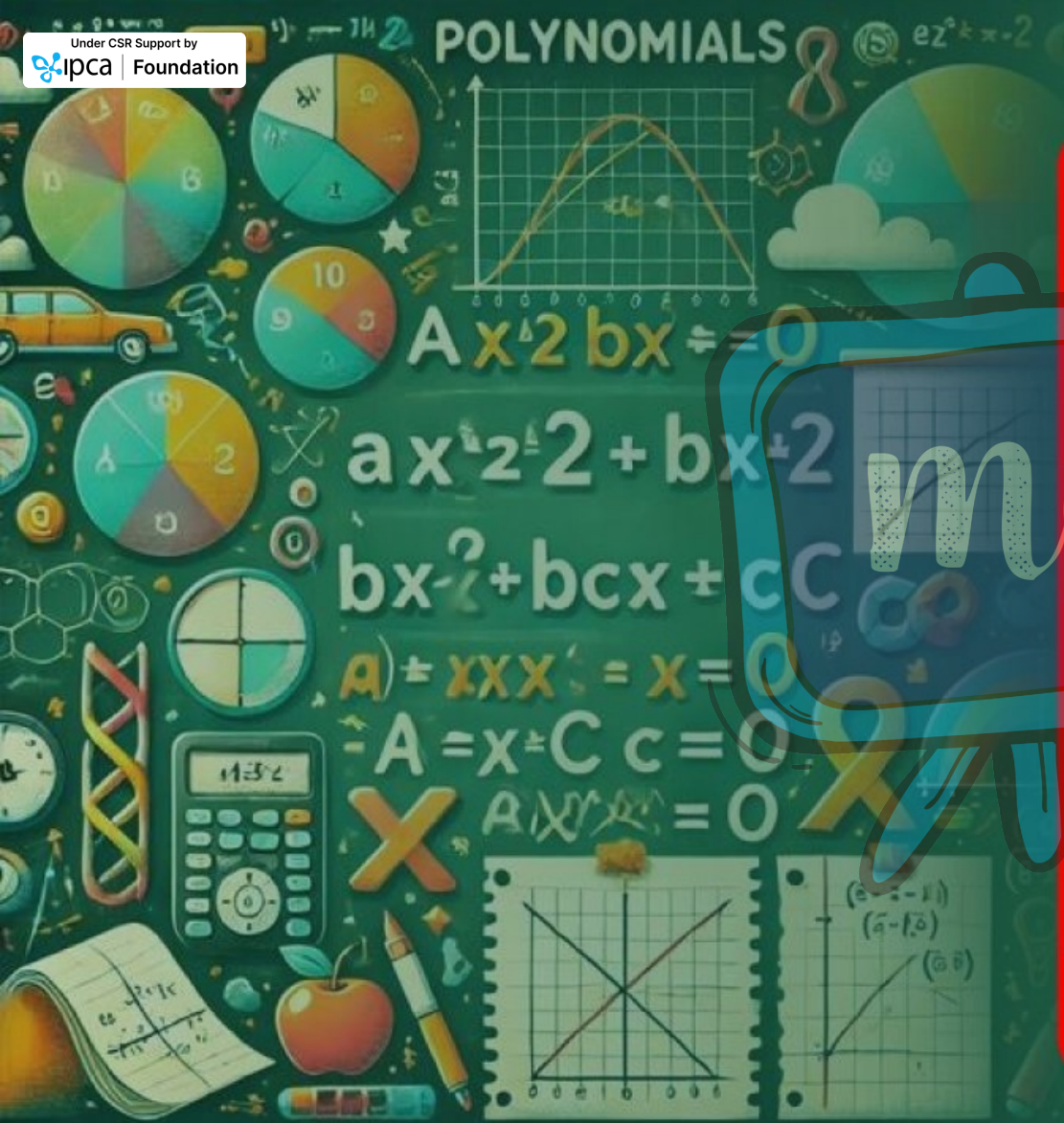

CLASS – 9

MATHS

Chapter - 2

Polynomials

Part – 4

Zeros of Polynomials

Vikas Saini

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OVERVIEW

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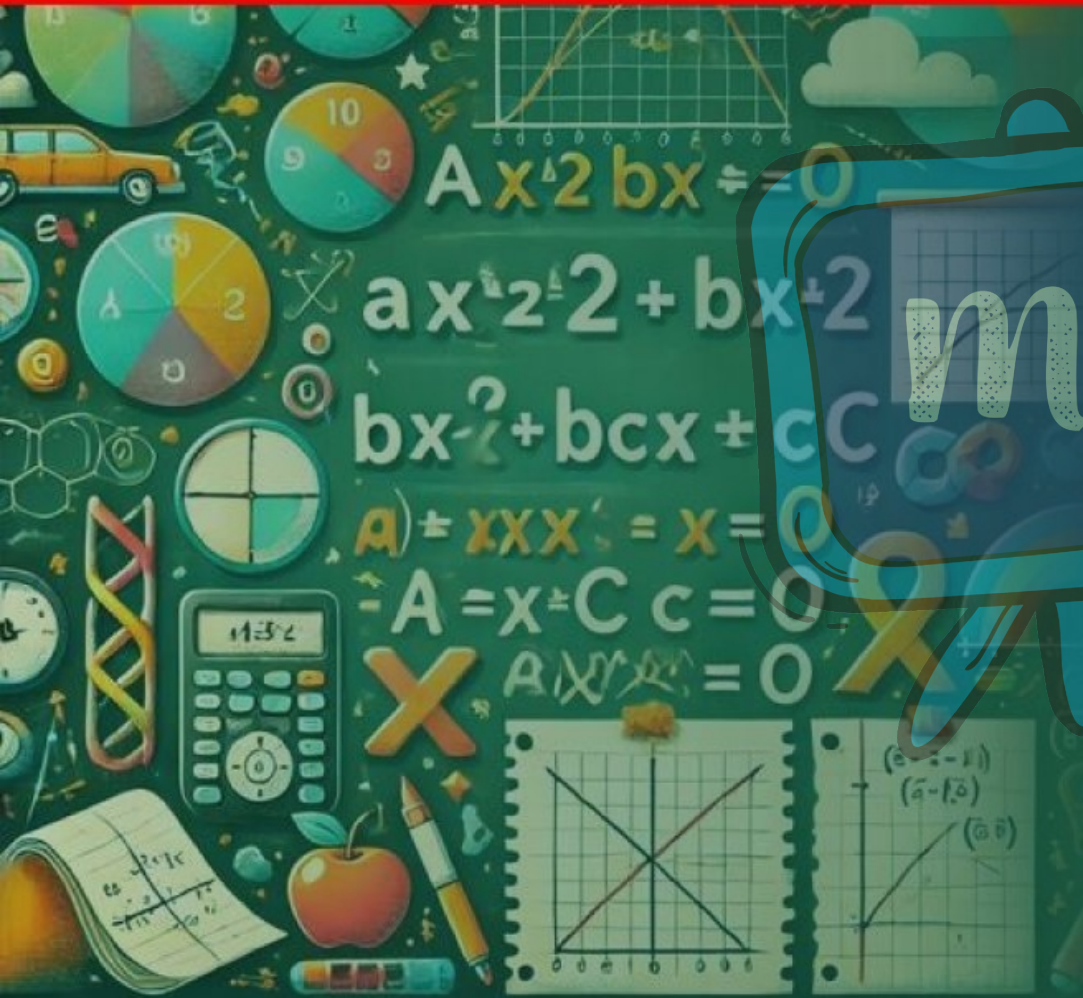

1. Introduction to Polynomials
2. Zeroes of Polynomials
3. Factorisation of Polynomials
4. Algebraic Identities

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VALUE OF POLYNOMIAL

The value of polynomial is the value it takes when the variables are replaced with a number.

$P(x) = ax^2 + b$

ax (variable)$^2 + b$

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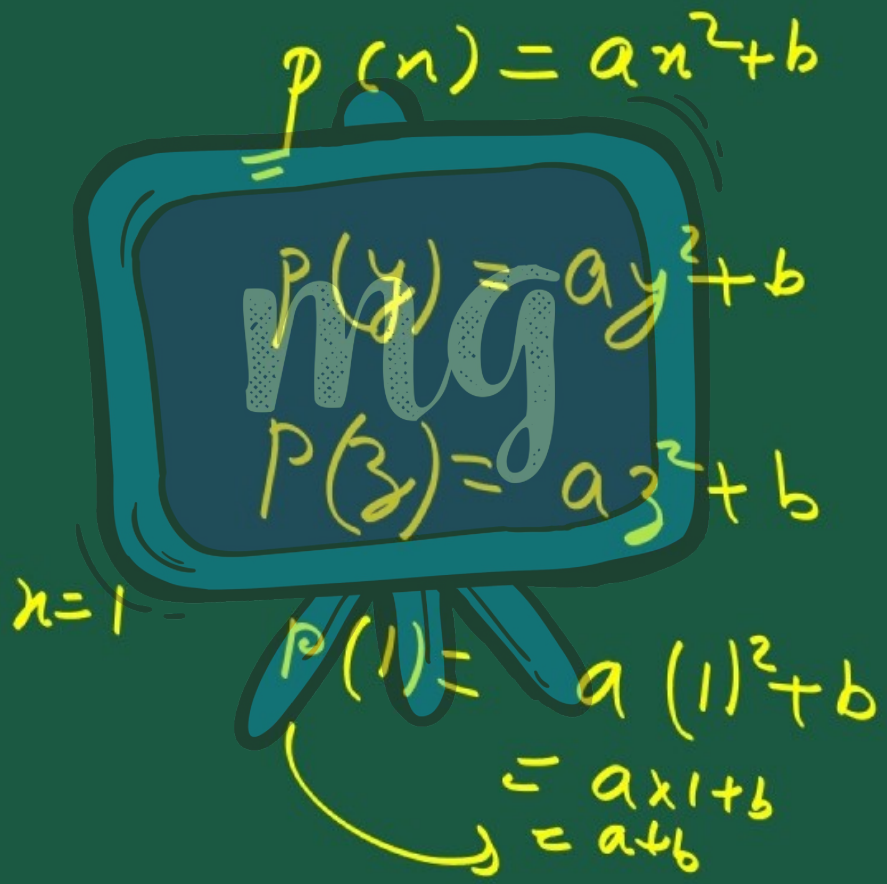

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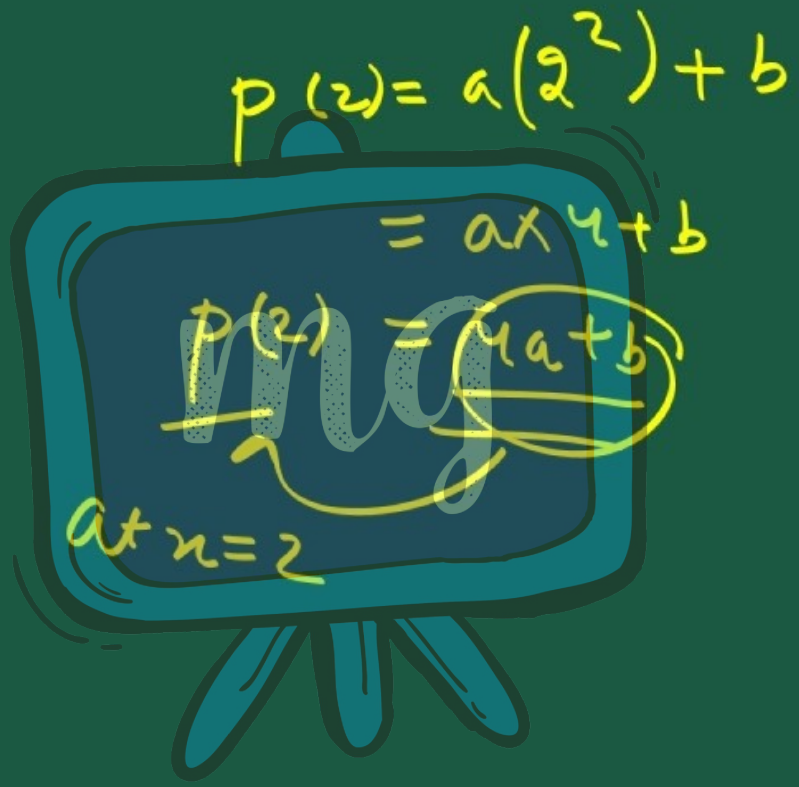

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Example :

Let $p(x) = x^3 - 3x - 4$ be a polynomial

and by replacing x by 2 in

polynomial p(x) we get

$p(2) = 8 - 6 - 4 = -2$

where p(2) is value of polynomial at

$x = 2$

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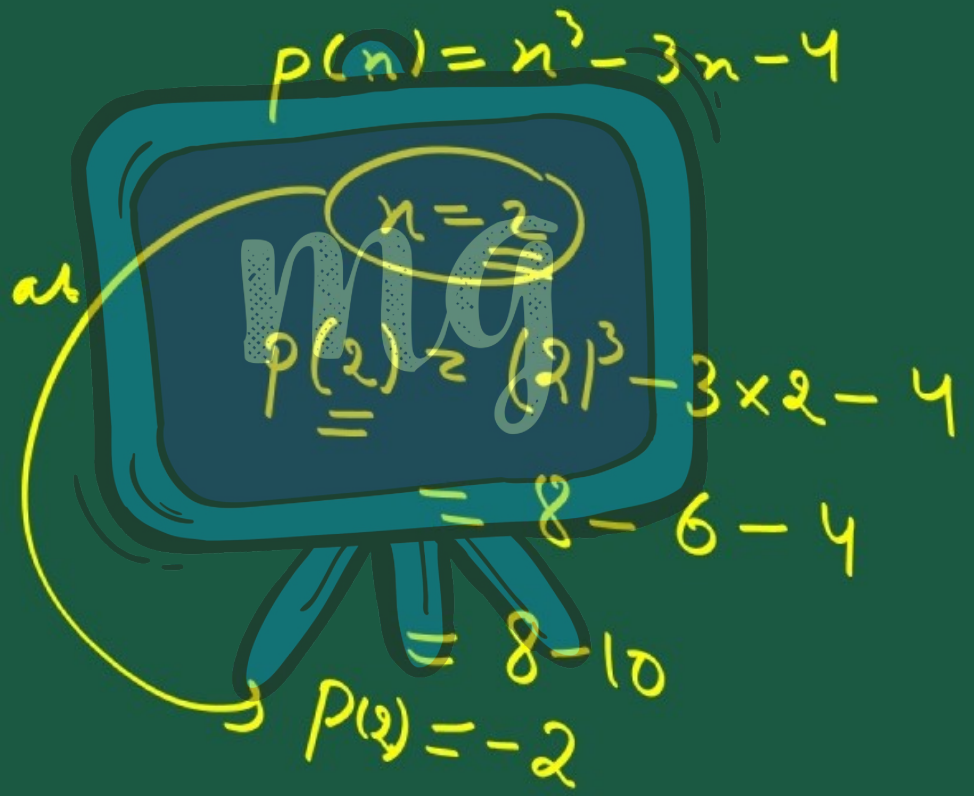

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$P(x) = x^3 - 3x - 4$



$P \rightarrow (\text{variable})^3 - 3 \times (\text{variable}) - 4$

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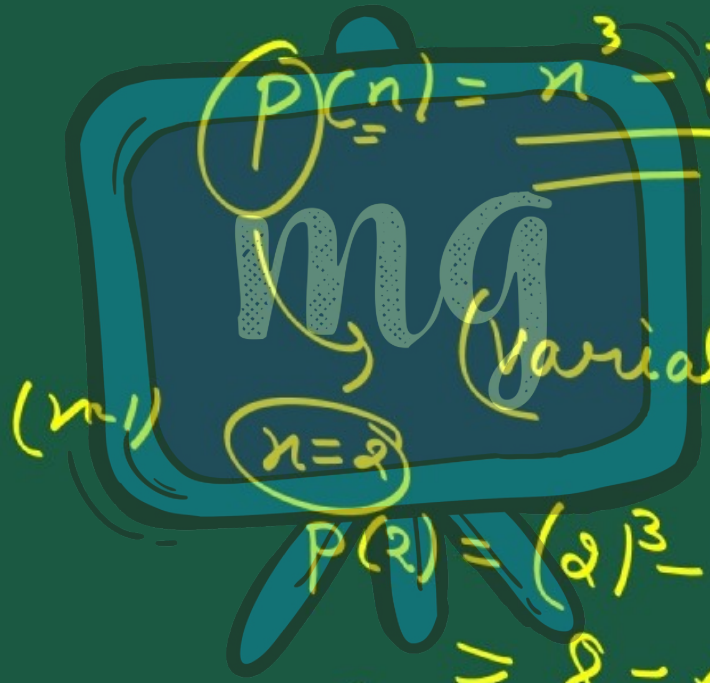

$P(n) = n^3 - 3n$

$y = (\text{variable})^3 - 3\times(\text{variable})$

$(n-1)$ $\quad n=2$

$P(2) = (2)^3 - 3\times 2$

$P(2) = 8 - 6$

$P(2) = 2$

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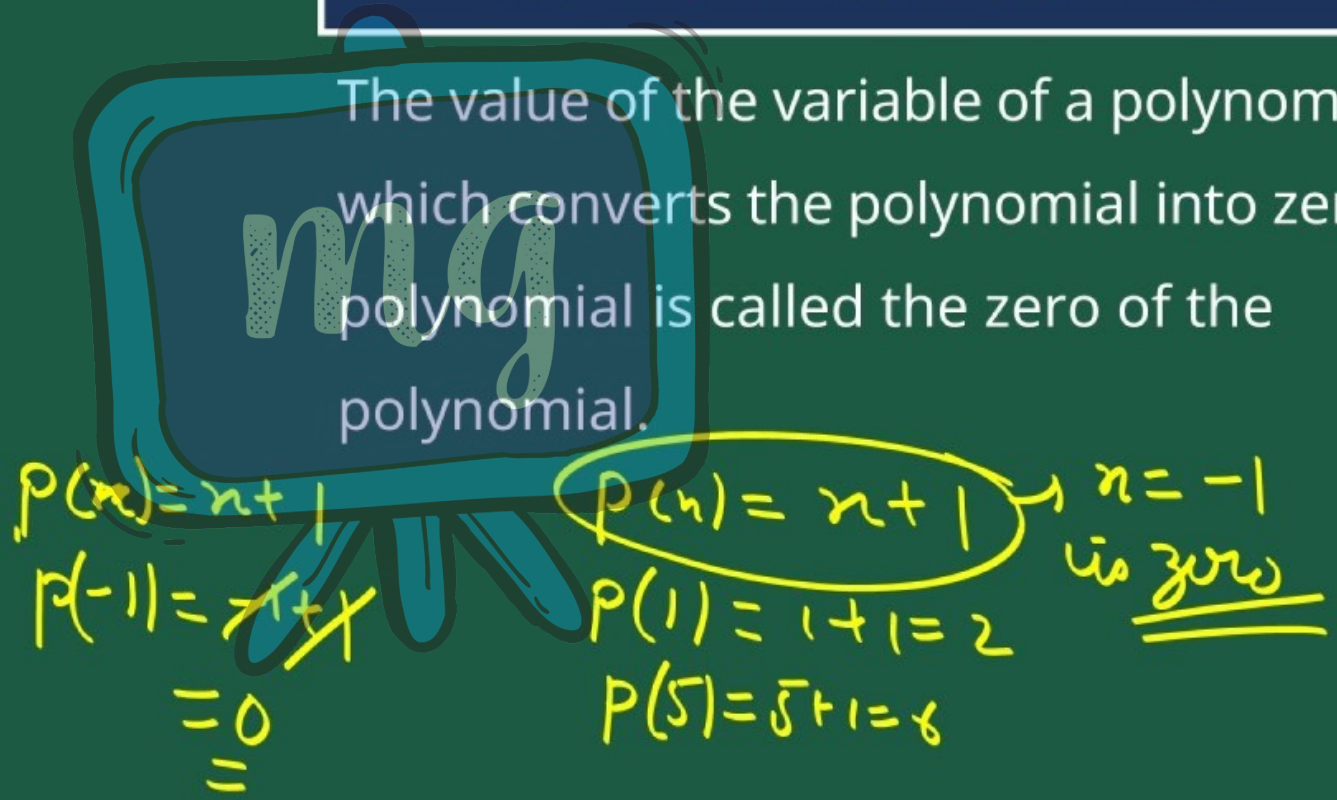
ZERO OF POLYNOMIAL

The value of the variable of a polynomial which converts the polynomial into zero polynomial is called the zero of the polynomial.



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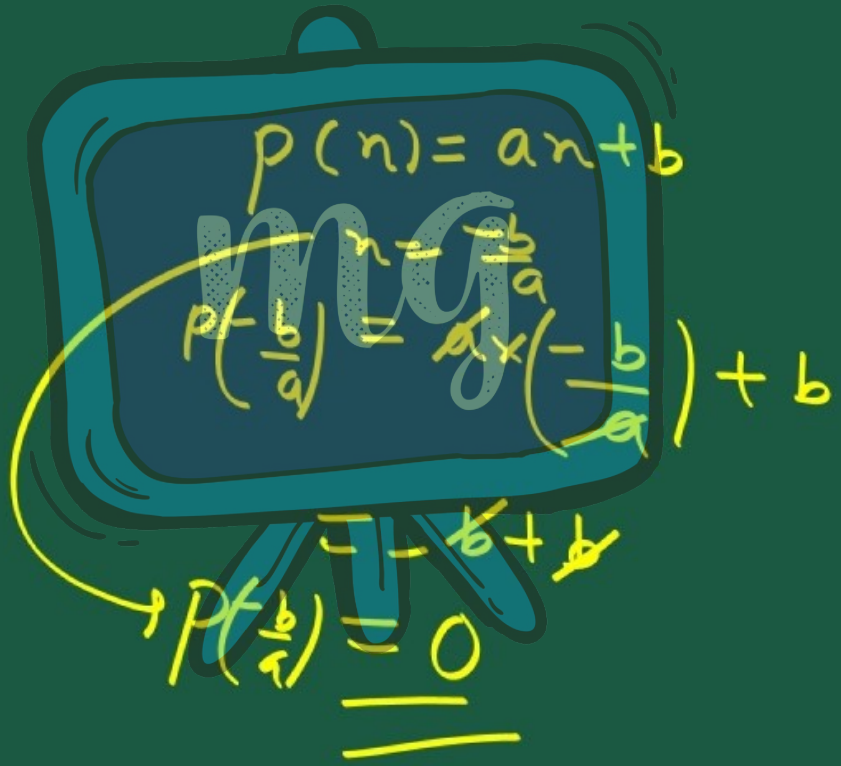

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$P(x) = x^2 - 4x + 3$

at $x = 1$

$P(1) = 1 - 4 + 3$

$P(1) = 0$

Hence $x = 1$ is the zero of the polynomial $P(x)$.

$(1^3 - 4 \times 1 + 3$

$x - x$

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Note

A polynomial of degree n can have at most n zeroes. The zeroes of a polynomial is a real number.

- A linear polynomial has one zero.
- A quadratic polynomial has at most two zeroes.
- A cubic polynomial has at most three zeroes.

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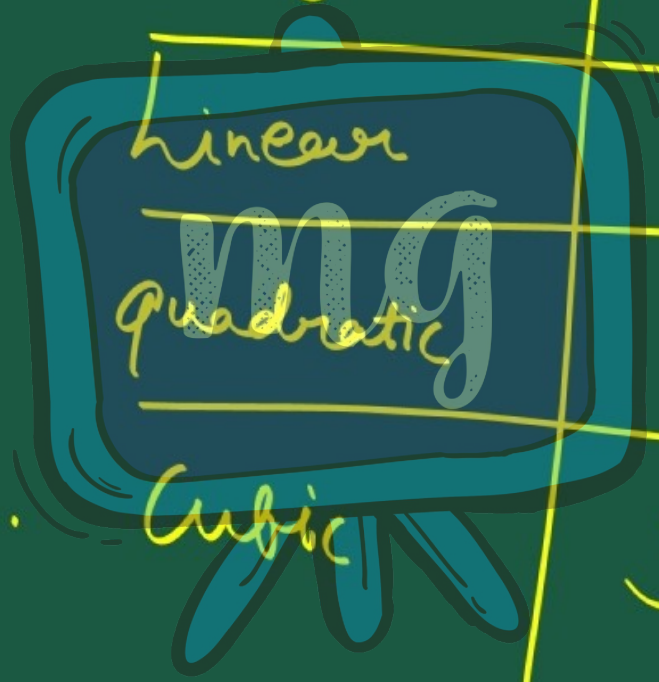
Polynomial	degree	Number of zeros
linear	1	1
quadratic	2	2
cubic	3	3
...		



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degree of polynomial

=

number of zeroes of polynomial

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$-2x - 2 = +4$

$p(x) = x^2 - 4 \rightarrow 2, -2$ are zeroes of polynomial

at $(x = -2)$

$p(-2) = (-2)^2 - 4$

$= 4 - 4$

$p(-2) = 0$

x at 2

$p(2) = (2)^2 - 4$

$= 4 - 4$

$p(4) = 0$

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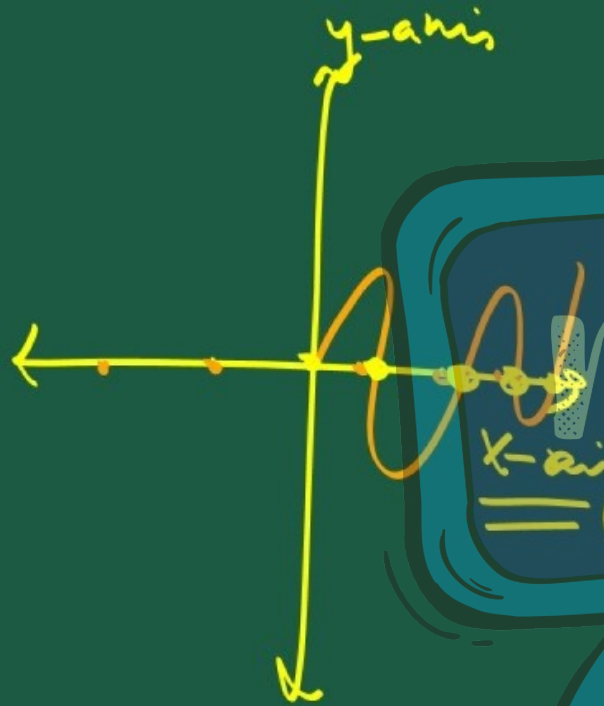
GEOMETRIC MEANING OF THE ZERO OF A POLYNOMIAL



Geometrically, zeroes of a polynomial are the points rare its graph cuts the x-axis.

$y = p(x)$

$x = a$

$p(x) = 0$

$y = 0$

$p(a) = 0$

$y = 0$

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Example : 2

Find the value of each of the following polynomials at the indicated value of variables:

(i) $p(x) = 5x^2 - 3x + 7$ at $x = 1$.

$5 \times (\text{variable})^2$

$-3\,(\text{variable})$

$+7$

at $x = 1$

$\Rightarrow g = p(1)$

$p(1) = 5 \times (1)^2 - 3 \times 1 + 7$

$= 5 \times 1 - 3 + 7$

$= 5 - 3 + 7$

$= 2 + 7 = 9$

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(ii) $q(y) = 3y^3 - 4y + \sqrt{11}$ at $y = 2$.

at $y = 2$

$q(2) = 3(2)^3 - 4 \times 2 + \sqrt{11}$

$= 3 \times 8 - 8 + \sqrt{11}$

$= 24 - 8 + \sqrt{11}$

$q(2) = 16 + \sqrt{11}$

$16 + \sqrt{11}$

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(iii) $p(t) = 4t^4 + 5t^3 - t^2 + 6$ at $t = a$.

at $t = a$

$p(a) = 4 \times a^4 + 5 \times a^3 - a^2 + 6$

$p(a) = 4a^4 + 5a^3 - a^2 + 6$

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Example : 3

Check whether −2 and 2 are zeroes of the polynomial x + 2.

$p(x) = x + 2$

at $x = 2$

$p(2) = 2 + 2$

$p(2) = 4$

at $x = -2$

$p(-2) = -2 + 2$

$p(-2) = 0$

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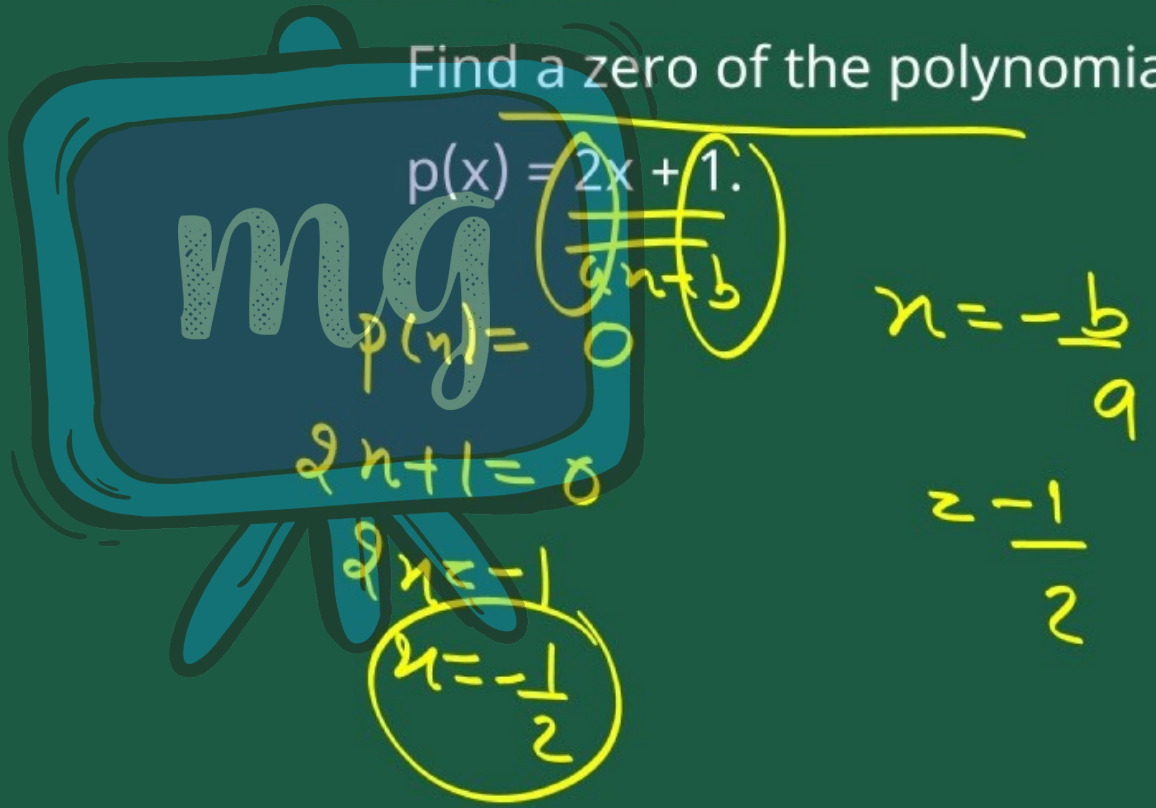
Example : 4

Find a zero of the polynomial

$p(x) = 2x + 1$.



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$p(n) = an + b$

$a, b \rightarrow$ Real No

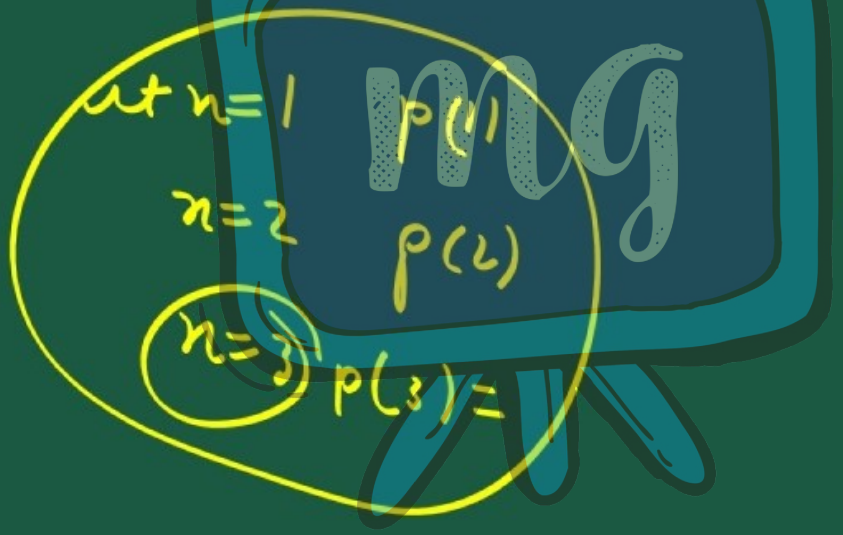
$a \neq 0$

$p(n) = 0$

$an + b = 0$

$an = -b$

$n = \frac{-b}{a}$



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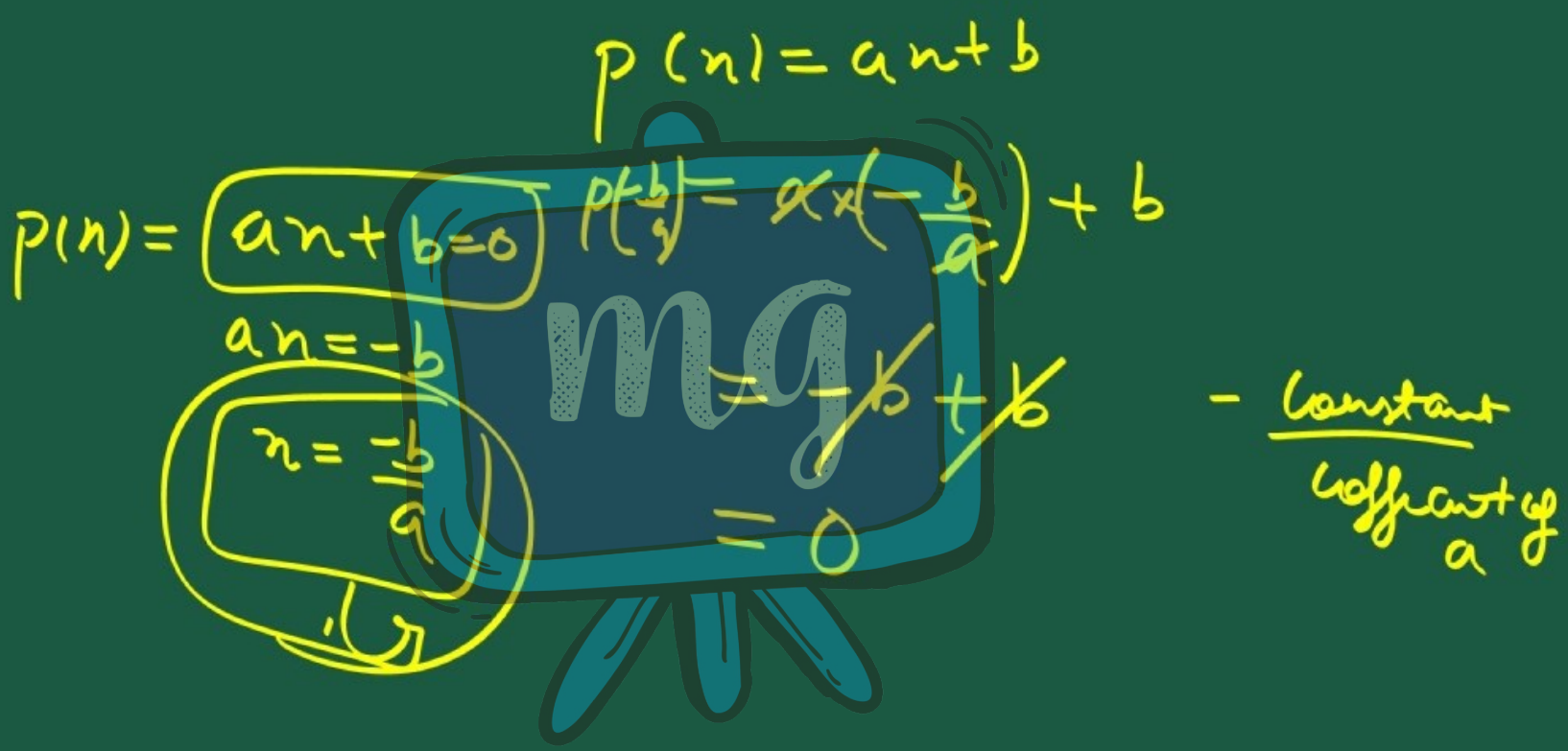

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Example : 5

Verify whether 2 and 0 are zeroes of the polynomial $x^2 - 2x$.

$P(x) = x^2 - 2x$

$x = 2$, $x = 0$

$P(2) = (2)^2 - 2 \times 2$

$= 4 - 2 \times 2$

$= 4 - 4$

$P(2) = 0$

$P(0) = (0)^2 - 2 \times 0$

$= 0^2 - 0$

$= 0 - 0$

$= 0$

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LEARNING OUTCOMES

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1. Zeroes of polynomial
2. To verify if the given value is a zero of a polynomial.
3. Geometric meaning of zeroes of polynomial

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ASSESSMENT

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1 The zeroes of the polynomial $x^2 + 3x + 2$ are:

A. −1, 2

B. 1, 2

C. −1, −2

D. 1, −2

$p(n) = n^2 + 3n + 2$

$p(1) = (1)^2 + 3 \times 1 + 2$

$= 1 + 3 + 2$

$p(1) = 6$

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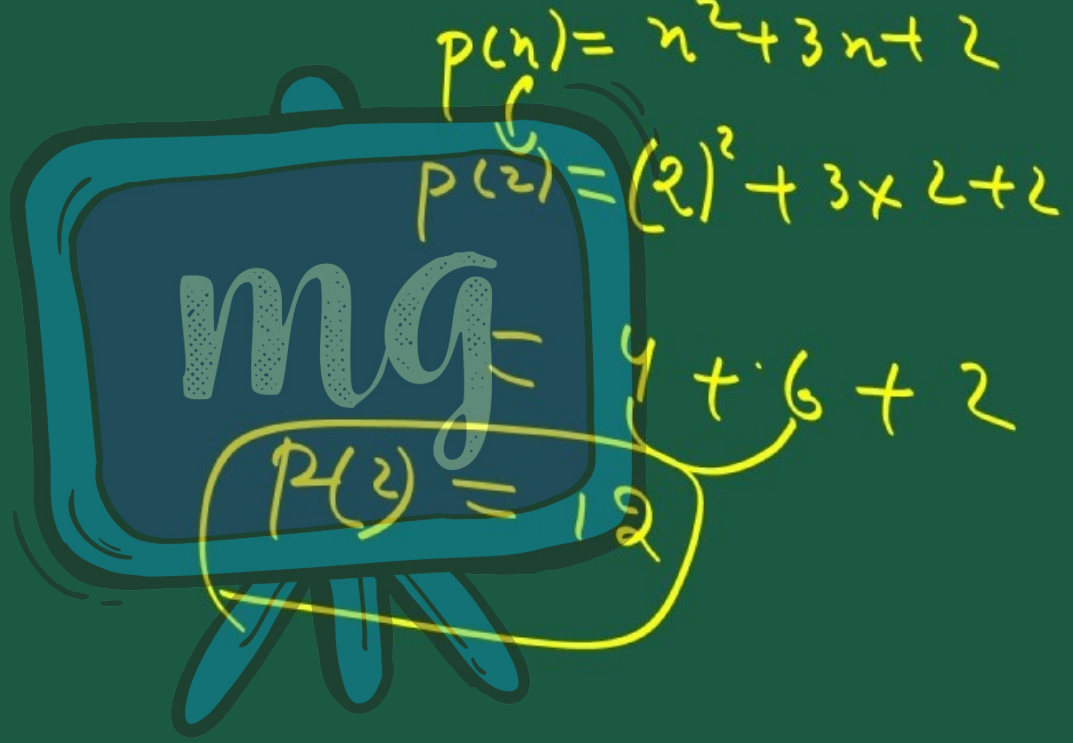

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ASSESSMENT

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2 The number of zeroes of the polynomial $x^2 - 2x + 1$ is:

A 3

B 1

C 0

D 2

$x^2 - 2x + 1$

degree = 2

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ASSESSMENT

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3 $x = 2$ is the zero of which polynomial:

A $x^2 - x + 1$

B $x^2 - 4$

C $x^2 + 4$

D $x + 2$