ST. LAWRENCE HIGH SCHOOL

TOPIC-POLYNOMIAL

Sub: Mathematics **Class-9**

STUDY MATERIAL -4 **Date: 7.5.2020**

DEFINITION :

1.Algebraic expression in which the index of the variable is whole number is called a polynomial.

For example : 2x+3 is a linear polynomial because the index of x is 1(whole number).
$2x^{1/2}$ -2 is not a polynomial because the index of x is ½ (fraction).

2.In a polynomial, the index of the highest power is called the **degree of the polynomial**.

For example : x^2 +x +1 is a polynomial whose degree =2.

3. One power polynomial is **called linear polynomial.**

For example: ax +b , 3x+2 etc.

4. The polynomial in which only one term is present is **called a monomial.**

For example : 3x, 7y, 2x etc.

5. The polynomial in which two terms are present is **called a binomial.**

For example : x+5, x^2 +3x, etc.

6. The polynomial in which three terms are present is **called a trinomial.**

For example: x^2 +2x+4 etc.

Notation:
Polynomials are denoted by f(x); f(y); g(x); p(x) etc. according to the variable.

7**. REMAINDER THEOREM.**

If a polynomial f(x) is divided by (x-a) to give q(x) as quotient and R as remainder then,
f(x) = (x-a).q(x) + R.
Since it is an identity therefore putting x = a on both sides we get,
f(a) = (a-a).q(x) +R
= 0 +R
=R
Therefore remainder =R =f(a).
This means that if a polynomial f(x) is divided by (x-a), then the remainder will be f(a).

8. If the polynomial is completely divisible by (x-a) then the remainder R =0

Therefore f(a) =0.

9**. FACTOR THEOREM :**

If f(x) is a polynomial and f(a) =0, then (x-a) is a factor of f(x).
Conversely, if (x-a) is a factor of f(x) then f(a) =0.
Again, if (x+a) is a factor of f(x) then f(-a) =0.

10. If at x = a, the polynomial f(x) becomes equal to zero, then x = a is called the zero of the polynomial f(x).
That means, a will be called the zero of the polynomial f(x) if f(a) =0.

For example : Let f(x) = x □ 2.
Therefore f(2) =2 □ 2 =0.
Hence, 2 is the zero of the polynomial f(x).

11. f(x) =0 is called **the equation of the polynomial f(x).**

12. If f(a) =0 then x = 0 is **the zero of the polynomial f(x).**

For example : let f(x) = x-2
Since f(2) = 2-2=0, therefore 2 is the zero of the polynomial f(x).

13. x = a is **called the root of the polynomial equation** f(x) = 0.

For example : let f(x) =2x+4
Since f(-2) = 0, therefore -2 is a root of the equation f(x) = 0.

S0LVED SUMS :

1. Which of the following are the polynomials?
   i) X^2 +2x
   ii) x+ 1/x -3
   iii) 4

Ans : i) It is a polynomial.

ii) It is not a polynomial.

iii)It is a polynomial.

2. If f(x) = 2x +3 then find the value of f(x) + f(-x).

Ans : f(x) =2x +3
Therefore, f(-x) = 2(-x) +3
= -2x + 3

Hence, f(x) + f(-x) = 2x + 3 -2x +3
= 6.

3. What will be the remainder if the polynomial $x^4 +4x^3 +6x^2 +4x +4$ is divided by (x+2) ?

Ans : $f(x) = x^4 + 4x^3 + 6x^2 + 4x + 4$

Therefore ,$f(-2) = (-2)^4 + 4(-2)^3 + 6(-2)^2 + 4(-2) + 4$
$= 16 - 32 + 24 - 8 + 4 = 4.$

4. If the polynomial $x^4 + 2x^3 - 3x^2 + ax \square b$ is divided by (x-1) and (x+1), the remainders are 5 and -13. Find the values of a and b .

Ans : let $f(x) = x^4 + 2x^3 - 3x^2 + ax - b$.

If f(x) is divided by (x-1) and (x+1), the remainders will be f(1) and f(-1) respectively.
Now $f(1) = 1^4 + 2.1^3 - 3.1^2 + a.1 - b$
$= 1+2-3+a-b = a-b$
B.T.P. $f(1) = 5$ or $a-b = 5$------(i)

Again, $f(-1) = (-1)^4\ 2.(-1)^3 - 3.(-1)^2\ a(-1) - b$
$= 1 - 2 - 3 \square a \square b = -4-a-b$
B.T.P. $f(-1) = -13$ or $-4-a-b = -13$ or $a+b = 9$------(ii)

By solving equation (i) and (ii) we get , a=7 and b=2.

5. For what values of k the polynomial $k+4x-3x^2 \square x^3$ will be completely divisible by (x+3)?

Ans : Let $f(x) = k+4x-3x^2 \square x^3$.

Since f(x) is divisible by (x+3) therefore f(-3) =0.

Now, $f(-3) = k + 4(-3) - 3(-3)^2 \square (-3)^3$
$= k - 12 - 27 + 27$
$= k - 12$

B.T.P. $k - 12 = 0$ or $k = 12$.

6. What will be the remainder if $x^3 + 4x^2 + 4x - 3$ is divided by x ?

Ans : Let $f(x) = x^3 + 4x^2 + 4x - 3$

When f(x) is divided by x-0 then the remainder will be f(0).

Therefore the required remainder is
$= f(0) = (0)^3 + 4(0)^2 + 4(0) - 3$
$= -3.$

Debjani Das