WELCOME

Lecture# 3

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Example:
The tree grows 20 cm every year, so the height of the tree is related to its age using the function h.

Answer:
h(age) = age × 20 or h(year) = 20 ×year
So, if the age is 10 years, the height is
 h(10) = 20 × 10 = 200 cm
h( ) is the function.
"year" could be called the "argument" or the "variable"
a fixed value like "20" can be called a parameter.

Domain & range of a functon

For $f: X \rightarrow Y$, the permissible values which x can take from the set X is called the domain of f which is denoted by D_f, while the set of corresponding values of $y \in$ Y is called the range of f, which is denoted by R_f.

Co-domain

The whole set Y is called Co domain

$$\therefore Range \subseteq Co-domain$$

Graphical representation

Classification of functions:

Any given function is either Algebraic or Transcendental

Algebraic function

A function is said to be an algebraic function which consists of a definite number of terms involving only the operations of addition, subtraction, multiplication, multiplication, root extraction and raising to powers of one or more variables.

Examples are:

$$\text{i) } y = x^3 + 3x^2 + x + 5$$

$$\text{ii) } y = \frac{2x+1}{3x-1}$$

$$\text{iii) } y = \sqrt{x + 3}$$

$$\text{iv) } y = x + 5$$

There are two types of Algebraic functions.

i) Polynomial functions

ii) Rational functions

Polynomial functions:

A function of the type $f(x) = a_n x^n + a_{n-1} x^{n-1} + \ldots\ldots + a_2 x^2 + a_1 x + a_0$, where $a_0, a_1, a_2, \ldots\ldots\ldots, a_n$ are all constants and n is a positive integer, is called a polynomials in x of degree n.

Examples:

$$f(x) = x^3 + 3x^2 + x + 5$$
$$f(x) = 4x^4 - 6x^2 + 3x$$

But $f(x) = 4x^3 + 3x^{-2} + 4x - 5$ is not a polynomial function

A constant function is zero degree $f(x) = a$

A linear function is first degree $f(x) = a\, x + b$ or $y = a\, x + b$

Examples: $y = 2x + 3, y = 8x - 9, f(x) = 2x - \sqrt{2}$

A quadratic function is second degree $f(x) = ax^2 + bx + c$

Example: $f(x) = 3x^2 + 5x - 2$

A cubic function is third degree $f(x) = ax^3 + bx^2 + cx + d$

Example: $f(x) = x^3 + 2x^2 + x + 1$

A quatric function is fourth degree $f(x) = ax^4 + bx^3 + cx^2 + dx + e$

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

Rational functions:

If P(x) and Q(x) be two polynomials, the ratio $y = \frac{P(x)}{Q(x)}$, where P(x) and Q(x) have no

Common factor, is said to be a rational function

$$f(x) = \frac{a_n x^n + a_{n-1} x^{n-1} + \,\ldots\ldots + a_2 x^2 + a_1 x + a_0}{b_m x^m + b_{m-1} x^{m-1} + \,\ldots\ldots + b_2 x^2 + b_1 x + b_0}$$

Examples: $f(x) = \frac{2x^2 + x + 1}{x - 3}$ $f(x) = x^{-1}$

$$f(x) = \frac{x^3 + 4x + 1}{x^3 + 5x^2 + 6x + 8}$$

Irrational functions:

A function which is an algebraic function of x when it involves root
Extraction of terms involving x.

Examples: $f(x) = \sqrt{x + 2}$ $f(x) = \sqrt{x^2 + 4} + 3$