# Functions :

Functions are relations where each input has a particular output. It is a relation between a set of inputs and a set of permissible outputs with the property that each input is related to exactly one input.

Types :

(1) Constant Functions :

A function whose range consists of only one element is called a constant functions.

Ex :- $Y = f(x) = 7$.

In the coordinate plane. Such function will appear as a horizontal straight line.

In national-income models, which investment (I) is exogenously determined, we may have an investment function of the form I = \$100 million, or $I = I_0$ which exemplifies the constant function.

(2) polynomial Functions :

The constant function is actually a 'degenerate' case of what are known as polynomial functions. The word 'polynomial' means 'multiterm' and a polynomial function of a single variable $x$ has the general form

$$Y = a_0 + a_1 x + a_2 x^2 + \cdots + a_n x^n$$

in which each term contains a coefficient as well as a nonnegative-integer power of the variable $x$.

Depending on the value of the integer $n$, ~~the~~ we have several subclasses of polynomial functions:

case of $n = 0$ : $Y = a_0$ [constant function]

case of $n = 1$ : $Y = a_0 + a_1 x$ [Linear function]

case of $n = 2$ : $Y = a_0 + a_1 x + a_2 x^2$ [Quadratic function]

case of $n = 3$ : $Y = a_0 + a_1 x + a_2 x^2 + a_3 x^3$ [cubic Function]

The superscript indicators of the powers of $x$ are called exponents. The highest power involved, i.e the value of $n$, is often called the degree of the polynomial function.

(3) Rational Functions :
A function in which $Y$ is expressed as a ratio of two polynomials in the variable $x$, is known as a rational function.

$$Y = \frac{x-1}{x^2+2x+4}$$

According to this definition, any polynomial function must itself be a rational function, because it can always be expressed as a ratio to 1, which is a constant function.

(4) Nonalgebric Functions :
Any function expressed in terms of polynomials and/or roots of polynomials is an algebraic function.

$$Y = \sqrt{x^2+3}$$

Exponential functions such as $Y = b^x$, in which the independent variable appears in the exponent are nonalgebraic. The closely related logarithmic functions, such as $Y = \log_b x$ are also nonalgebraic.