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# Basic Functions

## Types of basic functions

The types of basic functions that can be expressed in terms of operations of functions are

- Exponential functions in terms of constant base
- Linear functions
- Exponential functions in terms of variable base
- Logarithmic functions
- Special Functions

## Nature of exponential functions

- A exponential function has a constant base.
- The power of an exponential function is variable.
- The expression for exponential function is expressed as
- $$f(x) = a^x$$

## Nature of linear functions

- A linear function has a term on $x$ .
- The term in $x$ of a linear function is in the power of $1$ .
- The expression for linear function is expressed as
- $$f(x) = kx$$

## Nature of exponential functions in terms of a variable base

- A exponential function in terms of a variable base has a constant power.
- The expression for exponential functions in terms of variable base is expressed as
- $$f(x) = x^n$$

## Nature of logarithmic function

- A logarithmic function is an inverse function.
- The function of which the logarithmic function is a inverse of is exponential function.
- The expression for logarithmic function is
- $$f(x) = \log_a(x)$$

## Nature of special functions

- A special function in operation of basic function is a special case.
- The expression for special function in operations of basic function is

$$f(x) = \begin{cases} 1 + x^n \\ 1 - x^n \end{cases}$$

## Derivation on Operations on exponential functions in terms of constant base

$$\begin{aligned} f(x) &= a^x \\ f(y) &= a^y \\ f(x+y) &= a^{x+y} \\ f(x+y) &= a^x \times a^y \end{aligned}$$

## Expression for Operations on exponential functions in terms of constant base

- A expression for the operation with a function satisfying relation in terms of a constant base is
- $$f(x+y) = f(x)f(y) \implies f(x) = a^x$$

## Derivation on Operations on linear functions

$$\begin{aligned} f(x) &= kx \\ f(y) &= ky \\ f(x+y) &= k(x+y) \\ f(x+y) &= kx+ky \end{aligned}$$

## Expression for Operations on linear functions

- The expression for the operation with a function satisfying relation in terms of linear function is
- $$f(x+y) = f(x) + f(y) \implies f(x) = kx$$

## Derivation on Operations on exponential functions in terms of variable base

$$\begin{aligned} f(x) &= x^n \\ f(y) &= y^n \\ f(xy) &= (xy)^n \\ f(x+y) &= x^n \times y^n \end{aligned}$$

## Expression for Operations on exponential functions in terms of variable base

- The expression for the operation with a function satisfying relation in terms of exponential function with variable base is
- $$f(xy) = f(x) \times f(y) \implies f(x) = x^n$$

## Derivation on Operations of logarithmic functions

$$\begin{aligned} f(x) &= \log_a(x) \\ f(y) &= \log_a(y) \\ f(xy) &= \log_a(xy) \\ f(xy) &= \log_a(x) + \log_a(y) \end{aligned}$$

## Expression for Operations of logarithmic functions

- The expression for the operation with a function satisfying the relation in terms of logarithmic functions is
- $$f(xy) = f(x) + f(y) \implies f(x) = \log_a(x)$$

## Expression for Special functions

- The expression for special functions is

$$f(x) \times f(\frac{1}{x}) = f(x) + f(\frac{1}{x}) \implies f(x) = \begin{cases} 1 + x^n \\ 1 - x^n \end{cases}$$