**Derivative**

**Definition**

The function defined on an open interval and is said to be differentiable at

exists.

**Table of Differentiation formula**

Example

**Quotient rule:**

Example

***[ Note by -Jannatul Ferdous Umama(Bristy)]***

**Chain rule:**

**If , then**

Example1

**Implicit Differentiation**

* + - * Differentiate the equation with respect to x.
      * Collect all the on one side.
      * Solve for .

Example:Given Find

or,

or, or,

**Parametric differentiation**

If and then

Example

**Logarithmic Differentiation:**

The derivatives of complicated functions involving products, quotients or power can often be simplified by taking logarithms.

**Properties of logarithmic functions:**

Example1 ,

Differentiating w.r.t ,

Example2

Differentiating w.r.t

**Derivative of inverse Trigonometric function:**  ,

**Hyperbolic functions**

**Derivatives of** **Hyperbolic functions**

**Application of Differentiation**

* + - The equation of the tangent to the curve at

* + - The equation of the normal at

provided .

**Exercise** Find the equation of the tangent and normal to the curve at the point (2, 1).

Solution

Now putting

The equation of the tangent

and the normal

**Example**- Determine the equation of the tangent and normal to the curve given by at .

**Solution**: Given  **.** Putting  **,**

Therefore the tangent to the curve passes through the point . Let us find out .

Now

Therefore the slope of the tangent to the curve at the point is .

The equation of the tangent at is

The equation of the normal at is

**Linear Approximation**: The equation of the tangent line to the curve at is

The approximation

is called the linear approximation of at .

The linear function whose graph is the tangent line, that is,

Is called the **linearization** of at .

***[ Note by -Jannatul Ferdous Umama(Bristy)]***

**Example** Find the linearization of the function and use it to approximate the number .

**Solution:** Given  **.** Then and .

Now the linearization is

The corresponding linear approximation is

Now

**Taylor and Maclaurin series**

The function has derivatives of all orders at

* + - The Taylor series of about
    - The Maclaurin series of [i.e. The Taylor series of at 0]

**Exercise**

Find the Taylor series for the function 1 using first three nonzero terms.

Solution, ,

,

The Taylor series

**Exercise**

Find the Maclaurin series for the function using first three nonzero terms.

1, 0,

,

The Maclaurin series

***[ Note by -Jannatul Ferdous Umama(Bristy)]***