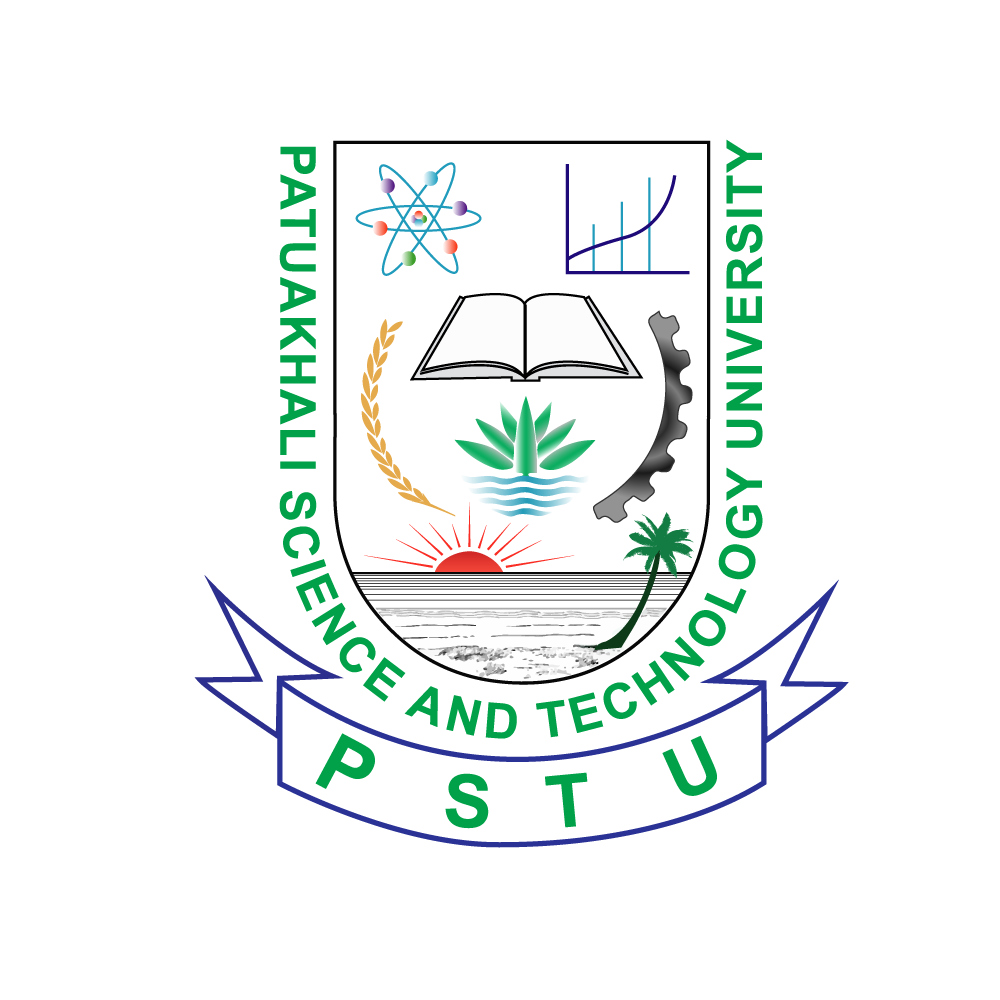
**PATUAKHALI SCIENCE**

**AND TECHNOLOGY UNIVERSITY**



Assignment : Successive Derivative

Course Code- MAT111

Date Submission: 11-04-2023

SUBMITTED TO:

**Muhammad Masudur Rahman**

Associate professor of Mathematics Department

Faculty of Computer Science and Engineering

SUBMITTED BY:

**Aishwariya Sarder-------------2102012**

**Mahedi Hasan Nazmul-------2102013**

**Sadia Homayra Nowshin----2102014**

**Md Riadul Islam Mahi-------2102015**

Faculty of Computer Science and Engineering

**SUCCESSIVE DIFFERENTIATION**

**Definiton:**Successive differentiation refers to the process of finding higher-order derivatives of a function by differentiating it multiple times.

if f(x) = + 2 - 3x + 1 is a differentiable function then we can get its first derivative f '(x) by differentiating it with respect to x:

f′(x)=3x2+4x-3

if f′(x) is a differentiable function then we can get its second derivative f ′'(x) by differentiating it with respect to x:

f''(x) = 6x+4

f'''(x) = 6

nth derivative of f(x) is denoted by =

**Example of n-th derivatives:**

**1.y=**

we have the function f(x) = , where n is a positive integer. We can use the power rule of differentiation to find its n-th derivative:

f'(x) = n

f''(x) = n(n-1)

f'''(x) = n(n-1)(n-2)

f''''(x) = n(n-1) (n-2) (n-3)

(x)= n(n-1)(n-2)…..(n-(n-1)) = n!

**2. y=**

y' = ma

y'' = m(m-1)

y''' = m(m-1)(m-2)

= m(m-1)(m-2)….(m-n+1)

**If m be appositive integer greater than n,**

**Since (m-1)(m-2)….(m-n+1)=**

=

**3.y=**

=a

=

=

**4.y=**

=

=

=

=

**5. y=sin(ax+b)**

=acos(ax+b)=asin(ax+b)

=cos(ax+b)=sin(ax+b)

=cos(ax+b)=sin(ax+b)

=sin(ax+b)

**The n-th derivatives of rotational algebraic function**

The n-th derivative of a fraction whose numerator and denominator are both rational integral algebraic functions may be conveniently obtained by resolving the fraction into partial fractions.

**Illustrative example**

**1.y= ,find**

We know, sin3x=3sinx - 4

y==(3sinx-sin3x)

={3sin( n+x)-sin( n+3x)}

**2. y =sin3x.cos2x**

**y =** .2 sin3x cos2x= (sin5x+sinx)

={3sin( n+5x)+sin( n+x)}

**3.,find**

=+b cosbx)

Let,

a=rcos,b= rsin

=+)

similarly

=+)++)}

=+)

In a similar way,

=etc. and generally

=

=

**• Find yn in the following cases:**

(i)

*y =(a-bx)m*

*y1=m(a-bx)m-1(-b)*

*y2=m(m-1) (a-bx)m-2(-b)(-b)*

*=m(m-1)(-b)2(a-bx)m-2*

*y3=m(m-1)(m-2)(a-bx)m-3 (-b)(-b)2*

*= m(m-1)(m-2)(-b)3(a-bx)m-3*

*y4= m(m-1)(m-2)(m-3) (a-bx)m-4(-b)(-b)3*

*= m(m-1)(m-2)(m-4+1)(-b)4(a-bx)m-4*

by the method of induction,

*yn= m(m-1)(m-2)(m-n+1)(-b)n(a-bx)m-n*

*=(-1)nm(m-1)(m-2)….(m-n+1)bn(a-bx)m-n*

***(ii)***

*y=1/((ax+b) )*

*=(ax+b)-m*

*y1=-m(ax+b)-m-1. a*

*y2=-m(-m-1) (ax+b)-m-1. a. a*

*=(-m) (-m-1) a2 (ax+b)-m-2*

*y3=(-m) (-m-1) (-m-2) (ax+b)-m-3 .a.a2*

*=(-m) (-m-1) (-m-2) (ax+b)-m-3 .a3*

*y4=(-m) (-m-1) (-m-2) (-m-3) (ax+b)-m-4.a3.a*

*=(-m) (-m-1) (-m-2) (-m-3) (ax+b)-m- 4.a4*

∴by the method of induction,

*yn=(-m) (-m-1) (-m-2) …(-m-n+1) an(ax+b)-m-n*

*=(-1)nm(m+1)(m+2)…(m+n-1)an(ax+b)-m-n*

*=*

***(iii)***

*y=*

*y1= (-1) (a-x)-1-1(-1)*

*y2= (-1) (-1-1) (a-x)-1-2(-1) (-1)*

*= (-1) (-1-1) (-1)2(a-x)-1-2*

*y3= (-1) (-1-1) (-1-2) (a-x)-1-3(-1). (-1)2*

*= (-1) (-1-1) (-1-2) (a-x)-1-3(-1)3*

*y4= (-1) (-1-1) (-1-2) (-1-3) (a-x)-1-4(-1). (-1)3*

*= (-1) (-1-1) (-1-2) (-1-4+1) (-1)4(a-x)-1-4*

∴by the method of induction,

*yn= (-1) (-1-1) (-1-2) …(-1-n+1) (-1) n (a-x)-1-m*

*=(-1)n1.2…n(-1)n*

*=*

*=*

***(iv)***

*y= log(ax+b)p =p log(ax+b)*

*∴y1= = p(ax+b)-1a*

*y2= p (-1)(ax+b)-2 a.a*

*y3= p (-1)(-2) (ax+b)-3 a.a2*

*y4= p(-1)(-2)(-3) (ax+b)-4 a.a3*

*=p(-1)(-2)(-4+1)(ax+b)-4 a4*

∴by the method of induction,

*yn= p(-1)(-2)…(-n+1)(ax+b)-n an*

*= p*

*=*

***(v)***

*log- log(a+x)*

*= u-v, where u = log(a-x), v = log(a+x)*

*∴ yn = un* – *vn*

*Now, u = log{a+(-1)x}*

*u1 = (-1) = (a-x)-1 (-1)*

*u2 = (-1) (a-x)-1-1 (-1)(-1) = (-1) (a-x)-1-1 (-1)2*

*u3 = (-1)(-1-1)(a-x)-1-2 (-1)(-1)2*

*= (-1)(-1-1)(a-x)-3 (-1)3*

*u4 = (-1)(-1-1)(-1-2)(a-x)-1-3 (-1)(-1)3*

*= (-1)(-2)(-4+1)(a-x)-4 (-1)4*

*by the method of induction,*

*un = (-1)(-2)…(-n+1)(a-x)-n (-1)n*

*= (-1)n-1 1.2…(n-1)(a-x)-n(-1)n*

*= (-1)n-1 (n-1)! (-1)n*

*similarly, putting 1 for (-1) in the coefficient of x in the above, we get*

*vn = (-1)n-1 1.2…(n-1)(a-x)-n(1)n*

*= (-1)n-1*

*∴yn = (-1)n-1 (-1)n– (-1)n-1*

*= (n-1)!*

*= (n-1)!*

***THANK YOU***