ENGINEERING MATHEMATICS-I
MATLAB

Department of Science and Humanities

Finding partial derivative of a function:

Find the partial derivative of the following functions:

a) If $\mathrm{f} = \sin(x) + y^3 + x^{10} - y^2 + \log(x)$, then find f_x & f_y.

b) If $\mathrm{f} = x^2 + 2 * y^2 - 22$, then find ${f_x}^2$ & ${f_y}^2$.

c) If $\mathrm{f} = xy^3 + tanx + cos\sqrt{logx}$, then find f_x.

d) If $\mathrm{f} = {}^{\mathrm{xy}^3}/_{\mathrm{x+y}}$, then find $\mathrm{f_x}$; $\mathrm{f_y}$; ${\mathrm{f_x}}^2$; $\mathrm{f}_{\mathrm{x}y}$; $\mathrm{f_{yx}}$.

Finding partial derivative of a function, Continued…

If $f = \sin(x) + y^3 + x^{10} - y^2 + \log(x)$, then find f_x & f_y.

```
>> syms x y
>> f=sin(x)+y^3+x^10-y^2+log(x);
>> diff(f,x)
>> diff(f,y)
```

Out put: f =log(x) + sin(x) + x^10 - y^2 + y^3

ans =cos(x) + 1/x + 10*x^9

ans =3*y^2 - 2*y

Finding partial derivative of a function, Continued…

If f $= x^2 + 2 * y^2 - 22,$ then find f_{xx} & f_{yy}.

```
>> syms x y
>> f=x^2+2*y^2-22
>> diff(f,x,2)
>> diff(f,y,2)
```

Out put: f = x^2 + 2*y^2 – 22

ans =2

ans=4

Finding partial derivative of a function, Continued…

If $f = xy^3 + tanx + cos\sqrt{logx}$, then find f_x.

```
>> syms x y;
>> f=x*y^3+tan(x)+cos(sqrt(log(x)))
>> diff(f,x)
```

Out put:

```
f = cos(log(x)^(1/2)) + tan(x) + x*y^3
ans =tan(x)^2 + y^3 - sin(log(x)^(1/2))/(2*x*log(x)^(1/2)) + 1
```

Finding partial derivative of a function, Continued…

If $f = {}^{xy^3}/_{x+y}$, then find f_x; f_y; ${f_x}^2$; f_{xy}; f_{yx}.

```
>> syms x y
>> f=(x*y^3)/(x+y)
>> diff(f,x)
>> diff(f,y)
>> diff(f,x,2)
>> diff(f, x, y)
>> diff(f, y, x)
```

Out put: f = (x*y^3)/(x + y); ans = y^3/(x + y) - (x*y^3)/(x + y)^2

Finding partial derivative of a function, Continued…

ans =(3*x*y^2)/(x + y) - (x*y^3)/(x + y)^2

ans =(2*x*y^3)/(x + y)^3 - (2*y^3)/(x + y)^2

ans =

(3*y^2)/(x + y) - y^3/(x + y)^2 - (3*x*y^2)/(x + y)^2 + (2*x*y^3)/(x + y)^3

ans =

(3*y^2)/(x + y) - y^3/(x + y)^2 - (3*x*y^2)/(x + y)^2 + (2*x*y^3)/(x + y)^3

Note that $f_{xy} = f_{yx}$.

Taylor’s and Macluarin’s series expansion of a function of single variable:

Expand f(x)=e^{xsinx} about the point $\mathrm{x} = 2$ up to third degree terms.

```
>> syms x

>> f = exp(x*sin(x));

>> t= taylor(f, 'ExpansionPoint', 2, 'Order', 3)
```

Out put:

t=exp(2*sin(2)) + exp(2*sin(2))*(2*cos(2) + sin(2))*(x - 2) + exp(2*sin(2))*(x - 2)^2*(cos(2) - sin(2) + (2*cos(2) + sin(2))*(cos(2) + sin(2)/2))

Taylor’s and Macluarin’s series expansion of a function of single variable:

Expand f(x)=log(cosx) about the point $x = \frac{\pi}{3}$ up to fifth degree terms.

```
>> syms x

>> f = log(cos(x));

>> t= taylor(f, 'ExpansionPoint', pi/3, 'Order', 5)
```

Out put:

```
t = - log(2) - 3^(1/2)*(x - pi/3) - (4*3^(1/2)*(x - pi/3)^3)/3 - 2*(x - pi/3)^2 - (10*(x -
pi/3)^4)/3
```

Taylor’s and Macluarin’s series expansion of a function of single variable:

Expand f(x)=log(secx) about the origin up to six degree terms.

```
>> syms x

>> f = log(sec(x));

>> T= taylor(f, 'Order', 7)
```

Out put:

```
T = x^6/45 + x^4/12 + x^2/2
```

Taylor’s and Macluarin’s series expansion of a function of single variable:

Expand f(x)=sin(log(x^2+2x+1)) about the origin up to six degree terms.

```
>> syms x

>> f = sin(log(x^2+2*x+1));

>> T= taylor(f, 'Order', 7)
```

Out put:

```
T= (3*x^6)/2 - (5*x^5)/3 + (3*x^4)/2 - (2*x^3)/3 - x^2 + 2*x
```

Taylor's and Macluarin's series expansion of a function of single variable:

Plot the graph of the following:

1. sinx:

```
>> t = [0:0.1:2*pi]
>> a = sin(t);
>> plot(t,a)
```

2. cosx:

```
>> t = [0:0.1:2*pi]
>> a = cos(t);
>> plot(t,a)
```

Taylor’s and Macluarin’s series expansion of a function of two variables:

Expand $\mathrm{f(x,y)} = \mathrm{e^x} cosy$ about the point $x = 1, y = \frac{\pi}{4}$ up to three degree terms.

```
>> syms x y
>> f=exp(x)*cos(y);
>> t = taylor(f, [x, y], [1, pi/4], 'Order', 3)
```

Out put:

```
T = (2^(1/2)*exp(1))/2 - (2^(1/2)*exp(1)*(y - pi/4)^2)/4 + (2^(1/2)*exp(1)*(x - 1)^2)/4 - (2^(1/2)*exp(1)*(y - pi/4))/2 + (2^(1/2)*exp(1)*(x - 1))/2 - (2^(1/2)*exp(1)*(y - pi/4)*(x - 1))/2
```

Taylor's and Macluarin's series expansion of a function of two variables:

Expand $\mathrm{f}(\mathrm{x},\mathrm{y}) = x^3 + y^3 + xy^2$ about $x = 1, y = 2$ up to fourth degree terms.

```
>> syms x y

>> f=x^3+y^3+x*y^2;

>> t = taylor(f, [x, y], [1, 2], 'Order', 4)
```

Out put:

t=7*x + 16*y + 4*(x - 1)*(y - 2) + 3*(x - 1)^2 + (x - 1)^3 + 7*(y - 2)^2 + (y - 2)^3 + (x - 1)*(y - 2)^2 - 26

Taylor's and Macluarin's series expansion of a function of two variables:

Expand $f(x, y) = e^{y}\log(1+x)$ about the origin up to fourth degree terms.

```
>> syms x y

>> f=exp(y)*log(1+x);

>> T= taylor(f, [x, y], 'Order', 4)
```

Out put:

```
T= x^3/3 - (x^2*y)/2 - x^2/2 + (x*y^2)/2 + x*y + x
```

Taylor’s and Macluarin’s series expansion of a function of two variables:

Expand $f(x, y) = e^{x}\tan y$ about the origin up to fifth degree

terms.

```
>> syms x y

>> f=exp(x)*tan(y);

>> T= taylor(f, [x, y], 'Order', 5)
```

Out put:

```
T =(x^3*y)/6 + (x^2*y)/2 + (x*y^3)/3 + x*y + y^3/3 + y
```

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THANK YOU