

SNS COLLEGE OF ENGINEERING Kurumbapalayam (Po), Coimbatore – 641 107



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TOPIC: 4.4- TAYLOR SERIES FOR FUNCTIONS OF TWO VARIABLES.

Taylor's series for functions of two variables

$$f(x,y) = f(a,b) + \frac{1}{1!} \left[h f_{x}(a,b) + k f_{y}(a,b) \right] + \frac{1}{a!} \left[h^{2} f_{xx}(a,b) + 2hk f_{xy}(a,b) + k^{2} f_{yy}(a,b) \right] + \frac{1}{3!} \left[h^{3} f_{xxx}(a,b) + 3h^{2}k f_{xxy}(a,b) + k^{3} f_{yy}(a,b) + 3hk^{2} f_{xyy}(a,b) + k^{3} f_{yy}(a,b) + k$$



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(2) Expand e log (1+y) in powers of x and y upto terms of third degree.

Function	value at (0,0)
$f(x,y) = e^x \log(1+y)$	f = 0
$f_x = e^x \log (1+y)$ $f_y = e^x \frac{1}{1+y}$	$f_x = 0$ $f_y = 1$
$f_{xx} = e^x \log (14y)$ $f_{xy} = e^x \cdot \frac{1}{1+y}$	$f_{xx} = 0$ $f_{xy} = 1$
$f_{xy} = \frac{e^{7}}{(1+y)^{2}}$	$f_{yy} = -1$



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$$f_{xxy} = e^{x} \log (1+y)$$

$$f_{xxy} = \frac{e^{x}}{1+y}$$

$$f_{xxy} = -\frac{e^{x}}{(1+y)^{2}}$$

$$f_{yyy} = +\frac{2e^{x}}{(1+y)^{3}}$$

$$f_{yyy} = 2$$

Here
$$a = 0$$
, $b = 0$, $h = x$ and $k = y$.

$$f(x,y) = 0 + \frac{1}{1!} \left[x(0) + y(1) \right] + \frac{1}{2!} \left[x^{2}(0) + 2xy(1) + y(1) + y(1) \right] + \frac{1}{3!} \left[x^{3}(0) + 3x^{3}y(1) + 3xy^{2}(-1) + y^{3}(2) \right] + \frac{1}{3!} \left[x^{3}(0) + 3x^{3}y(1) + 3xy^{2}(-1) + y^{3}(2) \right] + \frac{1}{2!} \left[2xy - y^{2} \right] + \frac{1}{3!} \left[3x^{2}y - 3xy^{2} + 2y^{3} \right] = y + \frac{1}{2!} \left[2xy - y^{2} \right] + \frac{1}{3!} \left[3x^{2}y - 3xy^{2} + 2y^{3} \right]$$