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

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Topic: 4.5 – TAYLOR SERIES FOR FUNCTIONS OF TWO VARIABLES

③ Expand $\sin(xy)$ inpowers of $x-1$ and $y-\frac{\pi}{2}$ upto second degree terms.

Function	Value at $(1, \frac{\pi}{2})$
$f(x,y) = \sin(xy)$	$f = 1$
$f_x = y\cos(xy)$ $f_y = x\cos(xy)$	$f_x = 0$ $f_y = 0$
$f_{xx} = -y^2\sin(xy)$ $f_{xy} = -xy\sin(xy) + \cos xy$ $f_{yy} = -x^2\sin(xy)$	$f_{xx} = -\frac{\pi^2}{4}$ $f_{xy} = -\frac{\pi}{2}$ $f_{yy} = -1$

Here $a = 1$, $b = \frac{\pi}{2}$, $h = x-1$ and $K = y-\frac{\pi}{2}$

$$f(x,y) = 1 + \left[(x-1)\,0 + (y-\frac{\pi}{2})0\right] + \frac{1}{2!}\left[(x-1)^2\left(-\frac{\pi^2}{4}\right)\right.$$
$$\left. + 2(x-1)(y-\frac{\pi}{2})\left(-\frac{\pi}{2}\right) + (y-\frac{\pi}{2})^2(-1)\right] + \cdots$$

$$= 1 + \frac{1}{2}\left[-\frac{\pi^2}{4}(x-1)^2 - \pi(x-1)(y-\frac{\pi}{2}) - (y-\frac{\pi}{2})^2\right] + \cdots$$

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④ Find the Taylor's series expansion of $x^2y^2 + 2x^2y + 3xy^2$ in powers of $(x+2)$ and $(y-1)$ upto third degree terms.

Function	value at $(-2, 1)$
$f(x,y) = x^2y^2 + 2x^2y + 3xy^2$	$f = 6$
$f_x = 2xy^2 + 4xy + 3y^2$	$f_x = -9$
$f_y = 2x^2y + 2x^2 + 6xy$	$f_y = 4$
$f_{xx} = 2y^2 + 4y$	$f_{xx} = 6$
$f_{xy} = 4xy + 4x + 6y$	$f_{xy} = -10$
$f_{yy} = 2x^2 + 6x$	$f_{yy} = -4$

$f_{xx} = 2y^2 + 4y$	$f_{xx} = 6$
$f_{xy} = 4xy + 4x + 6y$	$f_{xy} = -10$
$f_{yy} = 2x^2 + 6x$	$f_{yy} = -4$
$f_{xxx} = 0$	$f_{xxx} = 0$
$f_{xxy} = 4y + 4$	$f_{xxy} = 8$
$f_{xyy} = 4x + 6$	$f_{xyy} = -2$
$f_{yyy} = 0$	$f_{yyy} = 0$

$$f(x,y) = 6 + \frac{1}{1!}\left[-9(x+2) + 4(y-1)\right] + \frac{1}{2!}\left[6(x+2)^2 - 20(x+2)(y-1)\right.$$
$$\left. -4(y-1)^2\right] + \frac{1}{3!}\left[24(x+2)^2(y-1) - 6(x+2)(y-1)^2\right] + \frac{1}{}$$

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