SIIT MAS 117 SUMMER 2006 QUIZ 2 SECTION 1

SOLUTION

Prob. 1	Prob. 2	Prob. 3	Prob. 4
1	1	1	1
2	**2**	2	2
3	3	**3**	3
4	4	4	4
5	5	**5**	**5**

Problem 1. Calculate $\lim_{(x,y)\to(1,1)} \frac{x^2 - xy}{\sqrt{x} - \sqrt{y}}$

1. 1/2 **2.** 2 3. 0 4. ∞ 5. None of the above

Multiplying by the conjugate

$$\lim_{(x,y)\to(1,1)} \frac{x^2 - xy}{\sqrt{x} - \sqrt{y}} = \lim_{(x,y)\to(1,1)} \frac{(x^2 - xy)(\sqrt{x} + \sqrt{y})}{(\sqrt{x} - \sqrt{y})(\sqrt{x} + \sqrt{y})} =$$

$$\lim_{(x,y)\to(1,1)} \frac{x(x - y)(\sqrt{x} + \sqrt{y})}{x - y} = 2$$

Problem 2. Let $f(x, y) = x\sin xy$. Evaluate $\dfrac{\partial^2 f}{\partial x \partial y}(0,1)$

1. 2   2. –1   3. $\pi/3$ 4. $\pi/4$ 5. None of the above

$f_y = x^2 \cos xy$. Hence, $f_{xy} = 2x \cos xy - x^2 y \sin xy$. Therefore $f_{xy}(0,1) = 0$

Problem 3. Given the function $f(x, y) = x^2 + xy - 2y + 2x + 1$. It has

1. Relative minimum at (-1, -1)
2. Relative maximum at (0, 1)
3. Saddle point at (2, -2)
4. No relative maximum, no relative minimum and no saddle points.
5. None of the above

$f_x = 2x + y + 2 = 0$ The solution of the system is the critical point (2, -6)
$f_y = x - 2 = 0$

$f_{xx} = 2$
$f_{xy} = 1$ Therefore, $D = f_{xx} f_{yy} - f^2_{xy} = 0 - 1 < 0$ therefore it is saddle point at (2, -6)
$f_{yy} = 0$

Problem 4. Calculate the directional derivative of $f(x,y) = x^2 + 2xy^2 - 3$ at the point $P(1, -1)$ in the direction of $\mathbf{u} = 3\mathbf{i} - 4\mathbf{j}$.

1. 0 2. –11/3 3. $7/\sqrt{5}$ 4. 28/5 (5.) None of the above

$f_x = 2x + 2y^2$ $f_x(1, -1) = 4$
$f_y = 4xy$ $f_y(1, -1) = -4$
$\|\mathbf{u}\| = 5$

Then $D_{\mathbf{u}} = (4)(3/5) + (-4)(-4/5) = 28/5$