

## MCS 108,HW8

**Q1.** Find  $f_x$  and  $f_y$  in the following:

- a)  $f(x, y) = \ln(x^2 + 3y)$
- b)  $f(x, y) = e^{xy} \ln(x^3 + y)$
- c)  $f(x, y) = (2x - 5y)^3$

**Q2.** Find  $f_x$ ,  $f_y$  and  $f_z$  in the following:

- a)  $f(x, y, z) = \ln(x + 2y - 3z)$
- b)  $f(x, y, z) = yz \ln(xy)$
- c)  $f(x, y, z) = e^{x^2+y^2+z^2}$

**Q3.** Find  $z_x$  and  $z_y$  at the point  $(1, 1, 1)$  in the following:

- a)  $xy + z^3x - 2yz = 0$
- b)  $xz + y \ln x - x^2 + 4$
- c)  $x^2 + xy + y^2 - 7 = 0$

**Q4.** Find  $w_t$  if  $w = xy + z, x = \frac{1}{t}, y = e^t, z = t$

**Q5.** Find  $w_r$  and  $w_s$  if  $w = 7x + 2y + z^2, x = \frac{r}{s}, y = r^2 + \ln s, z = 2r$

**Q6.** Find  $w_r$  and  $w_s$  if  $w = x^3 + y^3, x = r + 5s, y = 7r - 3s$

**Q7.** If  $f(u, v, w)$  is differentiable and  $u = x - y, v = y - z, w = z - x$ , show that

$$f_x + f_y + f_z = 0$$

**Q8.** Find the local extreme values of the function  $f(x, y) = xy - x^2 - y^2 - 2x - 2y + 4$

**Q9.** Find and classify all critical points of the functions

- a)  $f(x, y) = 5xy - 7x^2 + 3x - 6y + 2$
- b)  $f(x, y) = x^2 - 4xy + y^2 + 6y + 2$
- c)  $f(x, y) = 2x^2 + 3xy + 4y^2 - 5x + 2y$
- d)  $f(x, y) = x^2 - y^2 - 2x + 4y + 6$
- e)  $f(x, y) = x^2 + 2xy$

**Q10.** Find  $z_x$  and  $z_y$  if  $2xy - z + e^{x+y} - z^2 = 0$  at point  $P(0, \ln 2, 1)$ .

**Q11.** Find and classify all critical points of the function  $f(x, y) = 2x^3 + 3xy + 2y^3$ .

**Q12.** Find and classify all critical points of the function  $f(x, y) = x^3 + 3x^2y + y^3 - 15y^2 + 2$ .

**Q13.** Given  $x + yz - xz^2 = 0$ , evaluate  $\frac{\partial z}{\partial x}$ .

**Q14.** Let  $w = w(u, v)$ ,  $u = xy$ ,  $v = x - y$ .

Suppose  $w_u(1, 2) = 1$ ,  $w_v(1, 2) = 3$ ,  $w(2, -1) = 5$ ,  $x = 1$ ,  $y = 2$ , find  $w_x(1, 2)$  and  $w_y(1, 2)$ .