

MATH 213 - QUIZ 7 - SOLUTIONS

1. $f(x, y, z) = xy^2/z^3 \quad (3, 2, 1)$

$$f_x = y^2/z^3 \quad f_y = 2xy/z^3 \quad f_z = -3xy^2/z^4$$

$$f_x(3, 2, 1) = 4 \quad f_y(3, 2, 1) = 12 \quad f_z(3, 2, 1) = -36$$

$$f(3, 2, 1) = 12 \quad \therefore$$

$$\therefore L(x, y, z) = 12 + 4(x-3) + 12(y-2) - 36(z-1)$$

$$= 4x + 12y - 36z + 12 //$$

2. (a) $V = \pi r^2 h \quad dV = \frac{\partial V}{\partial r} dr + \frac{\partial V}{\partial h} dh$

$$= 2\pi r h dr + \pi r^2 dh //$$

(b) $r = 5 \quad h = 25 \quad dr = .1 \quad dh = .2$

$$dV = 2\pi(5)(25)(.1) + \pi(5)^2(.2)$$

$$= 30\pi \approx 94.2 \text{ cm}^3$$

3. $f(x, y) = 2x^2 + 4xy + y^4$

$$f_x = 4x + 4y \quad \therefore D(x, y) = f_{xx}f_{yy} - f_{xy}^2 = 48y^2 - 16$$

$$f_y = 4x + 4y^3 \quad D(-1, 1) = 32 > 0 \quad f_{xx}(-1, 1) = 4 > 0$$

$$f_{xx} = 4$$

$$\therefore (-1, 1) \text{ local min} //$$

$$f_{yy} = 12y^2$$

$$D(1, -1) = 32 > 0 \quad f_{xx}(1, -1) = 4 > 0$$

$$\therefore (1, -1) \text{ local min} //$$

$$f_{xy} = 4$$

$$D(0, 0) = -16 < 0 \quad \therefore (0, 0) \text{ saddle} //$$