$$f(x,y) = 2x^2 + y^2 - 5y$$

$$f_x(x,y) = 4x$$

$$f_y(x,y) = 2y - 5$$

$$f_x(1,2) = \underline{4}$$

$$f_y(1,2) = \underline{\underline{-1}}$$

$$z - f(a,b) = f_x(a,b)(x-a) + f_y(a,b)(y-b)$$

$$(a,b) = (1,2)$$

$$f(a,b) = 2 \cdot 1^2 + 2^2 - 5 \cdot 2 = \underline{\underline{\underline{-4}}}$$

$$z - (\underline{\underline{\underline{-4}}}) = \underline{4}(x - \underset{\overset{\uparrow}{a}}{1}) + (\underline{\underline{-1}})(y - \underset{\overset{\uparrow}{b}}{2})$$

$$z + 4 = 4x - 4 - y + 2$$

$$z - 4x + y + 4 = 2 - 4$$

$$z - 4x + y = 2 - 8 = -6$$

$z = e^{x-y}$

$f(x,y) = e^{x-y}$

Tgt plane at $(\underset{a}{2}, \underset{b}{2}, \underline{\underline{1}})$

$f_x(x,y) = e^{x-y}$

$f_y(x,y) = e^{x-y}(-1)$

$f_x(2,2) = 1$

$f_y(2,2) = -1$

$z - f(a,b) = f_x(a,b)(x-a) + f_y(a,b)(y-b)$

$z - \underline{\underline{1}} = 1(x-2) + (-1)(y-2)$

Linear approximation to $f(x,y)$ near (a,b)

$$L(x,y) = f(a,b) + \cancel{f_x(a,b)(x}$$
$$+ f_x(a,b)(x-a) + f_y(a,b)(y-b)$$

1 $(a,b) = (0,0)$

$f(x,y) = e^x \cos(xy)$

$f(0,0) = e^0 \cos(0) = 1$

$f_x(x,y) = e^x \cos(xy) + e^x(-\sin(xy)\cdot y)$

$f_y(x,y) = e^x(-\sin(xy)\cdot x)$

$f_x(0,0) = e^0 \cos 0 + e^0(-\cancel{\sin(0)\cdot 0})$
$= 1$

$f_y(0,0) = e^0(-\sin(0)\cdot 0) = 0$

$L(x,y) = 1 + 1\cdot(x-0) + 0\cdot(y-0)$
$= 1+x$

2

$$L(x,y) = f(a,b) + f_x(a,b)(x-a) + f_y(a,b)(y-b)$$

$$(a,b) = (2,5)$$

$$f(a,b) = 6$$

$$f_x(a,b) = 1$$

$$f_y(a,b) = -1$$

$$L(x,y) = 6 + 1(x-2) + (-1)(y-5)$$

$$L(2.2, 4.9) = 6 + 1(2.2-2) + (-1)(4.9-5)$$

$$= 6 + 0.2 + 0.1$$

$$= 6.3$$

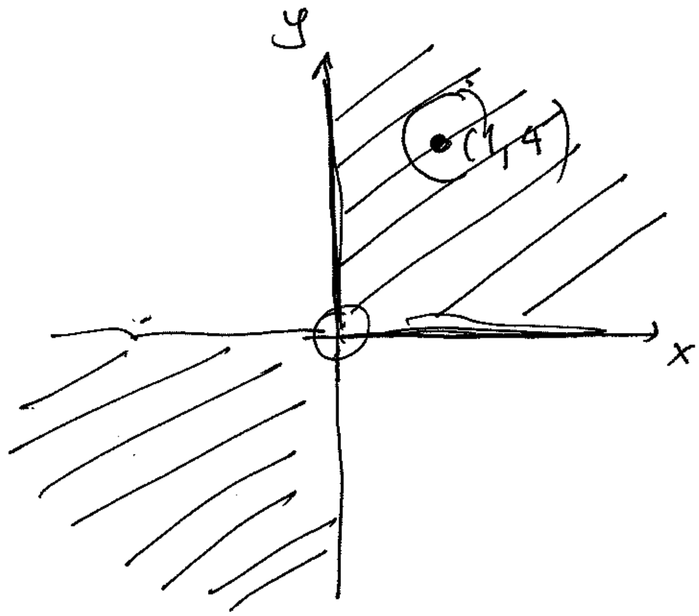
$x, y > 0$

$$f(x,y) = \sqrt{xy} = (xy)^{1/2} = x^{1/2} \cdot y^{1/2}$$

$$f_x(x,y) = \frac{1}{2} \cdot x^{-1/2} \cdot y^{1/2}$$

$$f_y(x,y) = \frac{1}{2} x^{1/2} \cdot y^{-1/2}$$

Domain:



$$L(x,y) = f(a,b) + f_x(a,b)(x-a) + f_y(a,b)(y-b)$$

$$(a,b) \doteq (1,4)$$

$$f(1,4) = 2$$

$$f_x(1,4) = \frac{1}{2} \cdot 1^{-1/2} \cdot 4^{1/2} = 1$$

$$f_y(1,4) = \frac{1}{2} \cdot 1^{1/2} \cdot 4^{-1/2} = \frac{1}{4}$$

$$\boxed{L(x,y) = 2 + 1(x-1) + \frac{1}{4}(y-4)}$$

$$f(x,y) = \frac{xy}{x^2+y^2} \qquad f(0,0) = 0$$

$$f_x(0,0) = \lim_{h\to 0} \frac{f(h,0) - \cancel{f(0,0)}^{\,0}}{h}$$

$$= \lim_{h\to 0} \left(\frac{1}{\cancel{h}} \frac{h\cdot 0}{h^2+0^2}\right) =$$

$$= \lim_{h\to 0} 0 = 0$$

$$f_y(0,0) = \lim_{h\to 0} \frac{\cancel{f(0,h)}^{\,0} - \cancel{f(0,0)}^{\,0}}{h}$$

$$= 0$$

$$f_x(x,y) = \frac{y\cdot(x^2+y^2) - xy(2x)}{(x^2+y^2)^2}$$

$$= \frac{yx^2+y^3-2x^2y}{(x^2+y^2)^2} = \frac{y^3-x^2y}{(x^2+y^2)^2}$$

$$f_y(x,y) = \frac{x^3-y^2x}{(x^2+y^2)^2}$$

Is $f_x(x,y)$ cont at $(0,0)$?

$$\lim_{(x,y)\to(0,0)} \underbrace{\left(\frac{y^3-x^2y}{(x^2+y^2)^2}\right)}_{f_x(x,y)} \qquad \text{DNE}$$