2) a) plano horizontal que es tangente

$$z = x^2 - 4xy - 2y^2 + 12x - 12y - 1$$

$$z_x = 2x - 4y + 12$$

$$z_y = -4x - 4y - 12$$

$$\nabla z_{(x_0,y_0)} = (2x_0 - 4y_0 + 12,\ -4x_0 - 4y_0 - 12)$$

Para que sea horizontal $(0,0) = (2x_0 - 4y_0 + 12,\ -4x_0 - 4y_0 - 12)$

- $0 = 2x_0 - 4y_0 + 12$
- $0 = -4x_0 - 4y_0 - 12$

$4y_0 = 2x_0 + 12$

$4y_0 = 2\cdot(-4) + 12$

$\boxed{y_0 = 1}$

$0 = -4x_0 - 2x_0 - 12 - 12$

$\frac{24}{-6} = x_0$

$\boxed{x_0 = -4}$

- Ecuacion del plano tangente

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

$$p = (x+4)\cdot(2\cdot(-4) - 4\cdot 1 + 12) + (y-1)(-4\cdot(-4) - 4\cdot 1 - 12) + \cdots$$

$$\cdots + ((-4)^2 - 4\cdot(-4)\cdot 1 - 2\cdot 1^2 + 12\cdot(-4) - 12\cdot 1 - 1$$

$$= 0 + 0 + (16 + 16 - 2 - 48 - 12 - 1)$$

$$\boxed{p = -31}$$

Rta: la ecuacion de plano horizontal que es tangente es: $\boxed{p = -31}$

y el punto es $(x_0, y_0) = (-4, 1)$

Molina Franco 44192153

2) b) $z = \operatorname{Sen}(x^2 y)$ $x = st^2$ $y = s^2 + 1/t$

$\frac{\partial z}{\partial s}(s,t)$ $\frac{\partial z}{\partial t}(s,t)$ $\cdot (s,t) = (1,1)$

$z_x = \cos(x^2 y) \cdot 2xy$ $z_y = \cos(x^2 y) \cdot x^2$

$x_s = t^2$ $y_s = 2s$

$x_t = 2st$ $y_t = \frac{-1}{t^2}$

$z_s = \cos(s^2t^4 \cdot (s^2 + 1/t))\, 2st^2(s^2 + 1/t)t^2 + \cos(s^2t^4 \cdot (s^2 + 1/t))\, s^2t^4 \cdot 2s$

$= \cos(s^4t^4 + s^2t^3)(2s^3t^4 + 2st^3) + \cos(s^4t^4 + s^2t^3)\, 2s^3t^4$

$= \cos(s^4t^4 + s^2t^3) \cdot (2s^3t^4 + 2st^3 + 2s^3t^4)$

$= \cos(s^4t^4 + s^2t^3) \cdot (4s^3t^4 + 2st^3)$

$z_t = \cos(s^2t^4 \cdot (s^2 + 1/t))\, 2st^2(s^2 + 1/t)\, 2st + \cos(s^2t^4 \cdot (s^2 + 1/t))\, s^2t^4 \cdot \frac{-1}{t^2}$

$= \cos(s^4t^4 + s^2t^3) \cdot (4s^4t^3 + 4s^2t^2) + \cos(s^2t^4 + s^2t^3)(-s^2t^2)$

$= \cos(s^4t^4 + s^2t^3)(4s^4t^3 + 4s^2t^2 - s^2t^2)$

$= \cos(s^4t^4 + s^2t^3)(4s^4t^3 + 3s^2t^2)$

$z_s(1,1) = \cos(1+1) \cdot (4 \cdot 1 + 2 \cdot 1)$

$= 6\cos(2)$

$z_t(1,1) = \cos(1+1) \cdot (4 \cdot 1 + 3 \cdot 1)$

$= 7\cos(2)$