The plane contains \( \mathbf{v} = (1, 0, 5) \) and \( \mathbf{w} = (0, -2, 2) \), so a potential normal is 
\[
\mathbf{n} = \mathbf{v} \times \mathbf{w} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 1 & 0 & 5 \\ 0 & -2 & 2 \end{vmatrix} = (10, -2, -2).
\]

So our plane is \( 10x - 2y - 2z = D \) for some \( D \). But \((1, 0, 1)\) is on the plane, so \( D = 10(1) - 2(0) - 2(1) = 8 \). Hence 
\[
10x - 2y - 2z = 8
\]
is an equation for the plane.

1. \( \mathbf{n}_1 = (10, -2, -2) \)

2. \( \mathbf{n}_2 = (2, 3, -1) \)

The angle between these vectors is 
\[
\theta = \cos^{-1} \left( \frac{\mathbf{n}_1 \cdot \mathbf{n}_2}{\|\mathbf{n}_1\| \|\mathbf{n}_2\|} \right) 
\]
\[
= \cos^{-1} \left( \frac{10 \cdot 2 + (-2) \cdot 3 + (-2) \cdot (-1)}{\sqrt{10^2 + (-2)^2 + (-2)^2} \sqrt{2^2 + 3^2 + (-1)^2}} \right) 
\]
\[
= \cos^{-1} \left( \frac{10}{\sqrt{100} \sqrt{14}} \right) 
\]
\[
= \cos^{-1} \left( \frac{10}{10 \sqrt{14}} \right) 
\]
\[
= \cos^{-1} \left( \frac{1}{\sqrt{14}} \right) 
\]
\[
= \cos^{-1} \left( \frac{\sqrt{14}}{14} \right) 
\]
c = x^3 - y
y = x^3 - c

x^2-plane, y = 0
z = x^3

y^2-plane, x = 0
z = y
\[( a \quad F(x, y) = (x \sin y, y^2 + 2x) \]\n\[\begin{bmatrix} \frac{\partial F_1}{\partial x} & \frac{\partial F_1}{\partial y} \\ \frac{\partial F_2}{\partial x} & \frac{\partial F_2}{\partial y} \end{bmatrix} = \begin{bmatrix} \sin y & x \cos y \\ 2y & 2y + 2x \end{bmatrix}\]

Yes, the partials are all clearly continuous functions of \( x \) and \( y \), so \( F \) is differentiable everywhere (i.e., the linear map determined by this matrix is always a good local approximation to the function).

\[( b \quad F(x, y) = xe^y + z \quad \frac{\partial F}{\partial x} = e^y \quad \frac{\partial F}{\partial y} = xe^y \]

**Tangent Plane at \((3, 0, 5)\)**

\[z = F(x_0, y_0) + \frac{\partial F}{\partial x}\bigg|_{(x_0, y_0)} (x - x_0) + \frac{\partial F}{\partial y}\bigg|_{(x_0, y_0)} (y - y_0)\]

\[z = 5 + (e^0)(x - 3) + 3e^0(y - 0)\]

\[z = 5 + (x - 3) + 3y\]

\[z = x + 3y\]
\[ \lim_{(x,y) \to (0,0)} \frac{(x+y)^2}{x^2 + y^2} \]

Approach along \( x = 0 \)

\[ \frac{(x+y)^2}{x^2 + y^2} = \frac{y^2}{y^2} = 1 \]

\[ \lim_{y \to 0} 1 = 1 \]

Approach along \( x = -y \)

\[ \frac{(x+y)^2}{x^2 + y^2} = \frac{0^2}{2y^2} = 0 \]

\[ \lim_{y \to 0} 0 = 0 \]

The limit does not exist.

\[ \lim_{(x,y) \to (0,1)} \frac{xy}{x^2 - y^2} \]

Note that \( \lim_{(x,y) \to (0,1)} x^2 = 0(1) = 0 \) and \( \lim_{(x,y) \to (0,1)} x^2 - y^2 = 0 - 1 = -1 \neq 0 \)

So \( \lim_{(x,y) \to (0,1)} \frac{xy}{x^2 - y^2} = \frac{0}{-1} = 0 \).
6. @ \( \tilde{c}(t) = (t^2, e^t) \)

\( \tilde{c}'(t) = (2t, e^t) \)

\( \tilde{c}'(1) = (2, e) \)

\( \tilde{\ell}(t) = (1, e) + (t-1)(2, e) = (1+2t, e) \)

6. At \((1, e)\), we have \( t=1 \).

\( \tilde{c}'(t) = (2t, e^t) \)

\( \tilde{c}'(1) = (2, e) \)

\( \tilde{\ell}(t) = (1, e) + (t-1)(2, e) = (1+2t, e) \)