(9) $\left(z = \dfrac{e^x}{y} \text{ at } (0,1,1) \right)$

Let $F(x,y,z) = \dfrac{e^x}{y} - z$. Then,

$\nabla F = \left\langle \dfrac{e^x}{y}, -\dfrac{e^x}{y^2}, -1 \right\rangle$ and

$\nabla F(0,1,1) = \langle 1, -1, -1 \rangle$ is a

normal vector for this tangent plane.

$\langle a^2, -2a, -1 \rangle \in$ tangent plane

$\Updownarrow$

$\langle a^2, -2a, -1 \rangle \circ \langle 1, -1, -1 \rangle$

$= a^2 + 2a + 1 = 0$

$\Leftrightarrow (a+1)^2 = 0$

$\Leftrightarrow a = -1$

(10) $f(x,y) = \ln(x^2 + y^2)$; at $(-1,1)$; $\vec{v} = 2\hat{i} - \hat{j}$

- $\vec{u} = \dfrac{1}{\|\vec{v}\|}\vec{v} = \dfrac{2}{\sqrt{5}}\hat{i} - \dfrac{1}{\sqrt{5}}\hat{j}$ and $\nabla f(-1,1) = -\hat{i} + \hat{j}$

$D_{\vec{u}} f(-1,1) = \nabla f(-1,1) \circ \vec{u} = -\dfrac{2}{\sqrt{5}} - \dfrac{1}{\sqrt{5}} = \dfrac{-3}{\sqrt{5}}$