

$$h(x, y, z) = \cos(xy) + e^{yz} + \ln(zx)$$

$$P_0(1, 0, 1/2) \quad \vec{u} = (1, 2, 2)$$

$$\textcircled{1} \quad D_{\vec{v}} h(P_0) = \nabla h(P_0) \cdot \vec{v}$$

$$\|\vec{u}\| = 3 \rightarrow \vec{v} = \frac{\vec{u}}{\|\vec{u}\|} = (1/3, 2/3, 2/3)$$

$$\begin{aligned} h_x(x, y, z) &= (-\sin(xy) \cdot y + \frac{1}{zx} \cdot z) \\ &= (-y \sin(xy) + \frac{1}{x}) \end{aligned}$$

$$h_x(1, 0, 1/2) = 1$$

$$\begin{aligned} h_y(x, y, z) &= (-\sin(xy) \cdot x + e^{yz} \cdot z) \\ &= -x \sin(xy) + z e^{yz} \end{aligned}$$

$$h_y(1, 0, 1/2) = 1/2$$

$$\begin{aligned} h_z(x, y, z) &= e^{yz} \cdot y + \frac{1}{zx} \cdot x \\ &= y e^{yz} + \frac{1}{z} \end{aligned}$$

$$h_z(1, 0, 1/2) = 2$$

$$\nabla h(1, 0, 1/2) = (1, 1/2, 2)$$

$$\textcircled{1} \quad D_{\vec{v}} h(P_0) = (1, 1/2, 2) \cdot (1/3, 2/3, 2/3) =$$