

Quiz 12

$$f = z + xy + x^2 \ln(yz)$$

$$1. \nabla f = \left\langle y + 2x \ln yz, x + \frac{x^2}{y}, 1 + \frac{x^2}{z} \right\rangle$$

$$\nabla f(2, 1, 1) = \langle 1, 6, 5 \rangle$$

$$2. D_u f(2, 1, 1) = \langle 1, 6, 5 \rangle \cdot \frac{\langle 9, 2, 6 \rangle}{\sqrt{121}} =$$

$$\frac{9 + 12 + 30}{11} = \frac{51}{11}$$

$$3. \text{direction } u_1 = \frac{\langle 1, 6, 5 \rangle}{|\langle 1, 6, 5 \rangle|} = \frac{\langle 1, 6, 5 \rangle}{\sqrt{62}}$$

$$D_{u_1} f(2, 1, 1) = \sqrt{62}$$

$$4. \text{direction } u_2 = \frac{-\langle 1, 6, 5 \rangle}{\sqrt{62}}$$

$$D_{u_2} f(2, 1, 1) = -\sqrt{62}$$