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8. Find $D_{\vec{u}} f(1, 4)$, where $f(x, y) = y^2 \ln x$ and $\vec{u} = \frac{(\vec{i} - \vec{j})}{\sqrt{2}}$.

15.5/2

$$D_{\vec{u}} f|_{(1,4)} = \vec{\nabla} f|_{(1,4)} \cdot \vec{u} = \left(\frac{y^2}{x} \vec{i} + 2y \ln x \vec{j} \right) \Big|_{(1,4)} \cdot \vec{u}$$

$$= (16\vec{i} + 0\vec{j}) \cdot \left(\frac{1}{\sqrt{2}}\vec{i} - \frac{1}{\sqrt{2}}\vec{j} \right) = \frac{16}{\sqrt{2}}$$

9. Find the equation of the plane tangent to $x^2 + y^2 + z^2 = 16$ at $(2, 3, \sqrt{3})$.

$\vec{\nabla}$ is the + level sets

15.7/1

$$\vec{\nabla} LHS|_{pt} = (2x\vec{i} + 2y\vec{j} + 2z\vec{k}) \Big|_{(2,3,\sqrt{3})} = 4\vec{i} + 6\vec{j} + 2\sqrt{3}\vec{k}$$

The plane + to $(2, 3, \sqrt{3})$ + to $4\vec{i} + 6\vec{j} + 2\sqrt{3}\vec{k}$ is

$$4(x-2) + 6(y-3) + 2\sqrt{3}(z-\sqrt{3}) = 0$$