DIRECTIONAL DERIVATIVES

For each of the following functions, find the directional derivative at the point $(1,1)$ in the direction $\vec{u} = \frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}$. For problems 1 through 3, also find the maximum and minimum values at $(1,1)$ for any directional derivative. If necessary, round to four decimal places.

1. $z = f(x,y) = x^3y^2$

2. $z = f(x,y) = \sin(x^3y^2)$

3. $z = f(x,y) = \sqrt{x^3y^2}$

4. $z = f(x,y) = \sec(x^3y^2)$

5. $z = f(x,y) = \tan(x^3y^2)$