Instructions: Show all work. Use exact answers unless otherwise asked to round.

1. Consider the function $f(x, y) = x^2 y - e^{x-y}$.
   a. Find the equation of the tangent plane at the point $(1,1)$.

   b. Find the equation of the normal line in vector-valued function form at the same point.

2. Find the equation of the tangent plane for the parametric surface $\vec{r}(u, v) = u \cos v \, \hat{\imath} + (u \sin v - 1)\hat{\jmath} + u^2 \hat{k}$ at $u = 2\sqrt{2}, v = \frac{\pi}{4}$.

3. What kind of surface is the function in #2? Use technology to produce a graph.