Principal Curvatures of a Surface- HW Problems

1. Find the principal curvatures and principal vectors for

a. $\vec{\Phi}(u,v) = (u,\ v,\ \frac{1}{2}u^2 - \frac{1}{2}v^2)$; at $(u,v) = (2,2)$.

b. $\vec{\Phi}(u,v) = (vcos(u), vsin(u), u)$; at $(u,v) \in \mathbb{R}^2$.

2. Find the principal curvatures of

$\vec{\Phi}(u,v) = (u,\ v,\ u^3 - 3v^2u)$ (Monkey Saddle), at $u = 0, v = 0$, and at $u = 0,\ v = 1$.

3a. Find the principal curvatures at any point (u,v) for the surface

$\vec{\Phi}(u,v) = (u,\ v,\ u^2)$, where $(u,v) \in \mathbb{R}^2$.

b. Using part "a", find the Gaussian curvature and mean curvature for this surface at any point (u,v).