3) (25 points) Let \( z = f(x, y) = (y - \cos x)^2; \) \( P = P(\frac{\pi}{2}, 1) \)

a) (5 points) Find the level curve \( z = f(P) \), that passes through \( P \). Sketch it in the \( xy \) plane and locate \( P \) on the curve.

b) (5 points) Find \( \nabla f; \nabla f(P) \).

c) (5 points) Sketch \( \nabla f(P) \) on the graph in a), with its tail at \( P \).

d) (5 points) Find a parametric representation \( \vec{r}(t) \), that lies on the curve in a), and goes through the point \( P \). Find a \( t_0 \) with \( \vec{r}(t_0) = P \).

e) (5 points) Compute \( \vec{r}'(t_0) \) and compute that \( \nabla f(P) \) is perpendicular to \( \vec{r}'(t_0) \).