first and and second principal components of  $\vec{v_1}$ 

$$\vec{v_1} = (3.38, 2.07)$$

$$proj_2 \vec{v_1} = (-0.10, 0.18)$$

$$proj_1 \vec{v_1} = (0, 0) \quad (3.47, 1.89)$$

$$|\vec{v_1}|^2 = |proj_1\vec{v_1}|^2 + |proj_2\vec{v_1}|^2 = 3.47^2 + 1.89^2 + -0.10^2 + 0.18^2$$