The following problems will be starred problems for January 30.

1. Find the projection matrix of $\mathbb{R}^4$ onto the subspace spanned by \left(\frac{5}{13}, 0, \frac{12}{13}, 0\right)$ and \left(\frac{5}{13}, 0, -\frac{12}{13}, 0\right).

2. Find the projection matrix of $\mathbb{R}^3$ onto the subspace spanned by \left(\frac{\sqrt{3}}{3}, \frac{\sqrt{3}}{3}, -\frac{\sqrt{3}}{3}\right)$ and \left(\frac{\sqrt{2}}{2}, 0, \frac{\sqrt{2}}{2}\right).

3. Let $P$ be an $n \times n$ matrix such that $P^2 = P$ and every vector in $N(P)$ is orthogonal to every vector in the column space of $P$. Show $P$ is a projection matrix.