

# Quiz 6

$$(a) \quad u_1 = \begin{bmatrix} 1 \\ 5 \\ 0 \end{bmatrix} \quad u_2 = \begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix}$$

$$(b) \quad p_1 = u_1 = \begin{bmatrix} 1 \\ 5 \\ 0 \end{bmatrix}$$

$$p_2 = u_2 - \frac{u_2 \cdot p_1}{p_1 \cdot p_1} p_1$$

$$= \begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix} - \frac{(3 \times 1) + (2 \times 5) + 0}{(1 \times 1) + (5 \times 5) + 0} \begin{bmatrix} 1 \\ 5 \\ 0 \end{bmatrix}$$

$$= \begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix} - \frac{13}{26} \begin{bmatrix} 1 \\ 5 \\ 0 \end{bmatrix}$$

$$= \begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix} - 0.5 \begin{bmatrix} 1 \\ 5 \\ 0 \end{bmatrix} = \begin{bmatrix} 2.5 \\ 2 \\ 0 \end{bmatrix} - \begin{bmatrix} 0.5 \\ 2.5 \\ 0 \end{bmatrix}$$

$$p_2 = \begin{bmatrix} 2.5 \\ -0.5 \\ 0 \end{bmatrix}$$

$$(c) \quad q_1 = \frac{p_1}{|p_1|} = \frac{1}{\sqrt{1^2 + 5^2 + 0^2}} \begin{bmatrix} 1 \\ 5 \\ 0 \end{bmatrix} = \frac{1}{\sqrt{26}} \begin{bmatrix} 1 \\ 5 \\ 0 \end{bmatrix}$$

$$= \begin{bmatrix} 1/\sqrt{26} \\ 5/\sqrt{26} \\ 0 \end{bmatrix}$$

$$q_2 = \frac{p_2}{|p_2|} = \frac{1}{\sqrt{2.5^2 + 0.5^2 + 0^2}} \begin{bmatrix} 2.5 \\ -0.5 \\ 0 \end{bmatrix} = \frac{1}{\frac{\sqrt{26}}{2}} \begin{bmatrix} 2.5 \\ -0.5 \\ 0 \end{bmatrix}$$

$$= \frac{2}{\sqrt{26}} \begin{bmatrix} 2.5 \\ -0.5 \\ 0 \end{bmatrix}$$

$$q_2 = \begin{bmatrix} 5/\sqrt{26} \\ -1/\sqrt{26} \\ 0 \end{bmatrix}$$

$$(d) \quad Q = \begin{bmatrix} 1/\sqrt{26} & 5/\sqrt{26} \\ 5/\sqrt{26} & -1/\sqrt{26} \\ 0 & 0 \end{bmatrix}$$

$$(e) \quad R = Q^T A$$

$$= \begin{bmatrix} 1/\sqrt{26} & 5/\sqrt{26} & 0 \\ 5/\sqrt{26} & -1/\sqrt{26} & 0 \end{bmatrix} \begin{bmatrix} 1 & 3 \\ 5 & 2 \\ 0 & 0 \end{bmatrix}$$

$\underbrace{\begin{matrix} 2 \times 3 & 3 \times 2 \end{matrix}}_{2 \times 2}$

$$= \begin{bmatrix} \sqrt{26} & \frac{\sqrt{26}}{2} \\ 0 & \frac{\sqrt{26}}{2} \end{bmatrix}$$

$$(f) \quad \begin{bmatrix} 1/\sqrt{26} & 5/\sqrt{26} & 0 \\ 5/\sqrt{26} & -1/\sqrt{26} & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 4 \\ 2 \end{bmatrix}$$

$\underbrace{\begin{matrix} 2 \times 3 & 3 \times 1 \end{matrix}}_{2 \times 1}$

$$= \begin{bmatrix} 20/\sqrt{26} \\ -4/\sqrt{26} \end{bmatrix}$$