

$$1) A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \xrightarrow{R_2 - 3R_1} \begin{bmatrix} 1 & 2 \\ 0 & -2 \end{bmatrix}$$

$$\text{Basis } \text{Row}(A) = \left\{ \begin{bmatrix} 1 \\ 2 \end{bmatrix}, \begin{bmatrix} 0 \\ -2 \end{bmatrix} \right\}$$

a) No, cannot be formed by the basis

b) No, can't be formed by the basis

c) Yes, it's a linear combo of the basis

d) No, can't be formed by basis

$$2) A\vec{v} = \lambda \vec{v}$$

$$\begin{bmatrix} 2 & 2 \\ 2 & -1 \end{bmatrix} \begin{bmatrix} 1 \\ -2 \end{bmatrix} = \begin{bmatrix} \lambda \\ -2\lambda \end{bmatrix}$$

$$\begin{bmatrix} -2 \\ 4 \end{bmatrix} = \begin{bmatrix} \lambda \\ -2\lambda \end{bmatrix} \rightarrow \lambda = -2$$

$$3) \text{proj}_{\vec{n}} \vec{v} = \left(\frac{\vec{v} \cdot \vec{n}}{\|\vec{n}\|^2} \right) \vec{n}$$

$$\vec{n} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

$$a) \vec{v} \cdot \vec{n} = 1 + 2$$

$$\|\vec{n}\|^2 = 1^2 + 2^2 + 3^2 = 14$$

$$\text{proj}_{\vec{n}} \vec{v} = \frac{3}{14} \vec{n}$$

$$b) \text{proj}_{\text{plane}} \vec{v} = \vec{v} - \text{proj}_{\vec{n}} \vec{v} =$$

$$\begin{bmatrix} 11/14 \\ 25/28 \\ 0 \\ -9/14 \end{bmatrix}$$