

1. $\dim W^\perp = 2, \quad W^\perp = \text{Vect}\{(1, 0, -1, -1), (0, 1, 0, 0)\}$

2. $[\vec{x}]_{\mathcal{B}} = \begin{bmatrix} \frac{8}{3} \\ -\frac{1}{2} \\ \frac{5}{6} \end{bmatrix}$

3. $[\vec{x}]_{\mathcal{B}} = \begin{bmatrix} 4 \\ -\frac{2}{3} \\ \frac{2}{3} \end{bmatrix}$

4. a) $\vec{u} \cdot \vec{v} = 8, \quad \|\vec{u}\| = 3, \quad \|\vec{v}\| = \sqrt{17}$
 b) $\text{dist}(\vec{u}, \vec{v}) = \|\vec{u} - \vec{v}\| = \sqrt{10}$
 c) $\text{proj}_{\vec{v}} \vec{u} = \frac{8}{17} \vec{v}, \quad \text{proj}_{\vec{u}} \vec{v} = \frac{8}{9} \vec{u}$

5. $\text{proj}_W \vec{y} = \frac{1}{2} \begin{bmatrix} 5 \\ 2 \\ 5 \end{bmatrix}, \quad \|\vec{y} - \text{proj}_W \vec{y}\| = \frac{\sqrt{2}}{2}$

6. $-v_1 + v_2 + v_3 = 0$

7. $\text{proj}_{\vec{u}} \vec{v} = -\vec{u}$

8. a) F b) V c) V d) F e) V

9. $\vec{u} \cdot \vec{v} = 0, \quad \|\vec{u}\|^2 = 26, \quad \|\vec{v}\|^2 = 129, \quad \|\vec{u} + \vec{v}\|^2 = 155$

10. a) $W_1^\perp = \text{Vect}\{(-2, 1, 0), (1, 0, 1)\}$
 b) $W_2^\perp = \text{Vect}\{(1, -2, 1)\}$

11. $\dim W^\perp = 1, \quad W^\perp = \text{Vect}\{1, -1, 0, 1\}$

12. $[\vec{x}]_{\mathcal{B}} = \begin{bmatrix} \frac{7}{8} \\ -1 \\ \frac{3}{2} \end{bmatrix}$

13. $[\vec{x}]_{\mathcal{B}} = \begin{bmatrix} \frac{5}{2} \\ -\frac{1}{2} \\ 1 \\ -1 \end{bmatrix}$

14. a) $\text{proj}_W \vec{y} = \vec{y}$

b) $\|\vec{y} - \text{proj}_W \vec{y}\| = 0$

15. $\dim(\text{Im } T) = 1$ $\text{Im } T = \text{Vect}\{\vec{x}\}$
 $\dim(\text{Ker } T) = n - 1$ $\text{Ker } T = (\text{Vect}\{\vec{x}\})^\perp$