This print-out should have 7 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 10.0 points

Determine c_1 so that

$$\mathbf{y} = c_1\mathbf{u}_1 + c_2\mathbf{u}_2 + c_3\mathbf{u}_3$$

when

$$\mathbf{y} = \begin{bmatrix} 1 \\ -3 \\ 0 \end{bmatrix}$$

and

$$\mathbf{u}_1 = \begin{bmatrix} 2 \\ -2 \\ 0 \end{bmatrix}, \quad \mathbf{u}_2 = \begin{bmatrix} 2 \\ 2 \\ -4 \end{bmatrix}, \quad \mathbf{u}_3 = \begin{bmatrix} -4 \\ -4 \\ -4 \end{bmatrix}.$$

1. $c_1 = 2$

2. No value of c_1 exists.

3. $c_1 = -2$

4. $c_1 = 0$

5. $c_1 = -1$

6. $c_1 = 1$

002 10.0 points

Find the projection of $\mathbf{y}$ onto $\mathbf{u}$ when

$$\mathbf{y} = \begin{bmatrix} -1 \\ 3 \end{bmatrix}, \quad \mathbf{u} = \begin{bmatrix} 4 \\ -2 \end{bmatrix}.$$

1. $\text{proj}_{\mathbf{u}}\mathbf{y} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$

2. $\text{proj}_{\mathbf{u}}\mathbf{y} = 4\begin{bmatrix} 2 \\ -1 \end{bmatrix}$

3. $\text{proj}_{\mathbf{u}}\mathbf{y} = \begin{bmatrix} -2 \\ 1 \end{bmatrix}$

4. $\text{proj}_{\mathbf{u}}\mathbf{y} = 4\begin{bmatrix} -2 \\ 1 \end{bmatrix}$

5. $\text{proj}_{\mathbf{u}}\mathbf{y} = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$

003 10.0 points

Write $\mathbf{y}$ as the sum of a vector in Span $\{\mathbf{u}\}$ and a vector orthogonal to $\mathbf{u}$ when

$$\mathbf{y} = \begin{bmatrix} 3 \\ 0 \\ -2 \end{bmatrix}, \quad \mathbf{u} = \begin{bmatrix} -1 \\ -4 \\ 4 \end{bmatrix}.$$

1. $\mathbf{y} = \frac{1}{3}\begin{bmatrix} -1 \\ -4 \\ 4 \end{bmatrix} + \frac{2}{3}\begin{bmatrix} 5 \\ 2 \\ -5 \end{bmatrix}$

2. $\mathbf{y} = \frac{1}{3}\begin{bmatrix} 1 \\ 4 \\ -4 \end{bmatrix} + \frac{2}{3}\begin{bmatrix} 4 \\ -2 \\ -1 \end{bmatrix}$

3. $\mathbf{y} = 3\begin{bmatrix} 1 \\ 4 \\ -4 \end{bmatrix} + 2\begin{bmatrix} 0 \\ -6 \\ 5 \end{bmatrix}$

4. $\mathbf{y} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} 3 \\ 0 \\ -2 \end{bmatrix}$

5. $\mathbf{y} = 3\begin{bmatrix} -1 \\ -4 \\ 4 \end{bmatrix} + 2\begin{bmatrix} 3 \\ 6 \\ -7 \end{bmatrix}$

004 10.0 points

Find the projection of $\mathbf{u}$ onto $\mathbf{v}$ when

$$\mathbf{u} = \begin{bmatrix} 4 \\ -1 \\ 2 \end{bmatrix}, \quad \mathbf{v} = \begin{bmatrix} 2 \\ 0 \\ -2 \end{bmatrix}.$$

1. $\text{proj}_{\mathbf{v}}\mathbf{u} = \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}$

2. $\text{proj}_{\mathbf{v}}\mathbf{u} = \begin{bmatrix} 4 \\ 0 \\ -4 \end{bmatrix}$

3. $\text{proj}_{\mathbf{v}}\mathbf{u} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

4. $\text{proj}_{\mathbf{v}}\mathbf{u} = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$

5. $\text{proj}_{\mathbf{v}}\mathbf{u} = \begin{bmatrix} -4 \\ 0 \\ 4 \end{bmatrix}$

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005 10.0 points

Determine the orthogonal projection of

$$\mathbf{y} = \begin{bmatrix} -5 \\ -1 \\ 10 \end{bmatrix}$$

onto the subspace W of $\mathbb{R}^3$ spanned by

$$\mathbf{u}_1 = \begin{bmatrix} -2 \\ 2 \\ 1 \end{bmatrix}, \quad \mathbf{u}_2 = \begin{bmatrix} 1 \\ 2 \\ -2 \end{bmatrix}.$$

1. $\text{proj}_W \mathbf{y} = \begin{bmatrix} -7 \\ 6 \\ 8 \end{bmatrix}$

2. $\text{proj}_W \mathbf{y} = \begin{bmatrix} -3 \\ -2 \\ 8 \end{bmatrix}$

3. $\text{proj}_W \mathbf{y} = \begin{bmatrix} -3 \\ 6 \\ 0 \end{bmatrix}$

4. $\text{proj}_W \mathbf{y} = \begin{bmatrix} -7 \\ -2 \\ 8 \end{bmatrix}$

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006 10.0 points

Find the projection of $\mathbf{u}$ onto $\mathbf{v}$ when

$$\mathbf{u} = \begin{bmatrix} 1 \\ -3 \\ -1 \end{bmatrix}, \quad \mathbf{v} = \begin{bmatrix} 0 \\ 4 \\ -4 \end{bmatrix}.$$

1. $\text{proj}_{\mathbf{v}}\mathbf{u} = \begin{bmatrix} 0 \\ -1 \\ 1 \end{bmatrix}$

2. $\text{proj}_{\mathbf{v}}\mathbf{u} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

3. $\text{proj}_{\mathbf{v}}\mathbf{u} = \begin{bmatrix} 0 \\ -16 \\ 16 \end{bmatrix}$

4. $\text{proj}_{\mathbf{v}}\mathbf{u} = \begin{bmatrix} 0 \\ 16 \\ -16 \end{bmatrix}$

5. $\text{proj}_{\mathbf{v}}\mathbf{u} = \begin{bmatrix} 0 \\ 1 \\ -1 \end{bmatrix}$

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007 10.0 points

Given vectors

$$\mathbf{u}_1 = \begin{bmatrix} -2 \\ 0 \\ 2 \end{bmatrix}, \quad \mathbf{u}_2 = \begin{bmatrix} 3 \\ 0 \\ 3 \end{bmatrix}, \quad \mathbf{y} = \begin{bmatrix} 2 \\ 2 \\ 4 \end{bmatrix},$$

in $\mathbb{R}^3$, determine $\text{proj}_W \mathbf{y}$ when

$$W = \text{Span}\{\mathbf{u}_1, \mathbf{u}_2\}.$$

1. $\text{proj}_W \mathbf{y} = -2 \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix}$

2. $\text{proj}_W \mathbf{y} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

3. $\text{proj}_W \mathbf{y} = 2 \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix}$

4. $\text{proj}_W \mathbf{y} = -2 \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix}$

5. $\text{proj}_W \mathbf{y} = 2 \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix}$