

This print-out should have 12 questions.
Multiple-choice questions may continue on
the next column or page – find all choices
before answering.

MatrixVecProd04

001 10.0 points

Determine $\mathbf{v}\mathbf{u}^T$ when

$$\mathbf{u} = \begin{bmatrix} -3 \\ 2 \\ -5 \end{bmatrix}, \quad \mathbf{v} = \begin{bmatrix} a \\ b \\ c \end{bmatrix}.$$

1. $\mathbf{v}\mathbf{u}^T = -3a + 2b - 5c$

2. $\mathbf{v}\mathbf{u}^T = \begin{bmatrix} -3a & 2a & -5a \\ -3b & 2b & -5b \\ -3c & 2c & -5c \end{bmatrix}$

3. $\mathbf{v}\mathbf{u}^T = \begin{bmatrix} -3a & -3b & -3c \\ 2a & 2b & 2c \\ -5a & -5b & -5c \end{bmatrix}$

4. $\mathbf{v}\mathbf{u}^T = -5a + 2b - 3c$

InverseMatrix01a

002 10.0 points

Solve for X when $AX + B = C$,

$$A = \begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}, \quad B = \begin{bmatrix} 4 & 2 \\ -1 & 5 \end{bmatrix},$$

and

$$C = \begin{bmatrix} 3 & 2 \\ 1 & 2 \end{bmatrix}.$$

LUDecomp06h

003 10.0 points

Find L in an LU decomposition of

$$A = \begin{bmatrix} -4 & 0 & 4 & -4 \\ 4 & 0 & -7 & 9 \\ -12 & 0 & 0 & 3 \end{bmatrix}.$$

1. $L = \begin{bmatrix} -1 & 0 & 0 \\ -1 & -1 & 0 \\ 3 & 4 & -1 \end{bmatrix}$

2. $L = \begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ -3 & -4 & 1 \end{bmatrix}$

3. $L = \begin{bmatrix} 2 & 0 & 0 \\ -1 & 2 & 0 \\ 3 & 4 & 2 \end{bmatrix}$

4. $L = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 3 & -4 & 1 \end{bmatrix}$

5. $L = \begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ 3 & 4 & 1 \end{bmatrix}$

6. $L = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ -3 & 4 & 1 \end{bmatrix}$

Let H be the set of all vectors

$$\begin{bmatrix} a - 2b \\ ab + 3a \\ b \end{bmatrix}$$

where a and b are real. Determine if H is a subspace of \mathbb{R}^3 , and then check the correct answer below.

1. H is not a subspace of \mathbb{R}^3 because it is not closed under vector addition.

2. H is a subspace of \mathbb{R}^3 because it can be written as $\text{Nul}(A)$ for some matrix A .

3. H is a subspace of \mathbb{R}^3 because it can be written as $\text{Span}\{\mathbf{v}_1, \mathbf{v}_2\}$ with $\mathbf{v}_1, \mathbf{v}_2$ in \mathbb{R}^3 .

4. H is not a subspace of \mathbb{R}^3 because it does not contain $\mathbf{0}$.

Invertible01/02
005 10.0 points

A is an $n \times n$ matrix. Which of the following statements are equivalent to A being invertible?

(i) There is no $n \times n$ matrix D such that $AD = I$.

(ii) $\text{Col } A = \{\mathbf{0}\}$.

(iii) A is row equivalent to the $n \times n$ identity matrix.

1. ii

2. i

3. i and ii

4. iii

5. All of these

6. None of these

where O is the origin in 3-space.

1. volume = 6
2. volume = 5
3. volume = 8
4. volume = 7
5. volume = 9

Rank02c
006 10.0 points

Determine the rank of the matrix

$$A = \begin{bmatrix} 1 & 1 & 3 \\ -2 & -2 & -7 \\ 1 & 1 & 3 \end{bmatrix}.$$

1. $\text{rank}(A) = 1$
2. $\text{rank}(A) = 3$
3. $\text{rank}(A) = 2$
4. $\text{rank}(A) = 5$
5. $\text{rank}(A) = 4$

BasisNul01a
008 10.0 points

Find a basis for the Null space of the matrix

$$A = \begin{bmatrix} 3 & -3 & -6 & 3 \\ 2 & -2 & -7 & -1 \\ -1 & 1 & 1 & -4 \end{bmatrix}.$$

DetVolume01a
007 10.0 points

Compute the volume of the parallelepiped with adjacent edges \overline{OP} , \overline{OQ} , and \overline{OR} determined by vertices

$$P(2, -1, -1), \quad Q(1, 4, 3), \quad R(1, 4, 4),$$

1. $\{ \cos t, \sin 2t \}$
2. $\{ \cos t, \sin 2t, \sin t \cos t \}$
3. $\{ \sin 2t, \sin t \cos t \}$
4. $\{ \sin t, \sin 2t \}$
5. $\{ \sin t, \sin 2t, \sin t \cos t \}$

PolyCoordVec01a
010 10.0 points

Find the coordinate vector $[\mathbf{p}]_{\mathcal{B}}$ in \mathbb{R}^3 for the polynomial

$$\mathbf{p}(t) = 1 + 4t + 7t^2$$

with respect to the basis

$$\mathcal{B} = \{1 + t^2, t + t^2, 1 + 2t + t^2\}$$

for \mathbb{P}_2 .

Basis03a
009 10.0 points

In the vector space V of all real-valued functions, find a basis for the subspace

$$H = \text{Span}\{ \sin t, \sin 2t, \sin t \cos t \}.$$

$$1. [\mathbf{p}]_{\mathcal{B}} = \begin{bmatrix} -6 \\ 1 \\ 2 \end{bmatrix}$$

$$\mathbf{2.} \quad [\mathbf{p}]_{\mathcal{B}} = \begin{bmatrix} -2 \\ -6 \\ 1 \end{bmatrix}$$

$$\mathbf{3.} \quad [\mathbf{p}]_{\mathcal{B}} = \begin{bmatrix} 6 \\ -1 \\ -2 \end{bmatrix}$$

$$\mathbf{4.} \quad [\mathbf{p}]_{\mathcal{B}} = \begin{bmatrix} 2 \\ 6 \\ -1 \end{bmatrix}$$

$$\mathbf{5.} \quad [\mathbf{p}]_{\mathcal{B}} = \begin{bmatrix} 1 \\ 2 \\ -6 \end{bmatrix}$$

$$\mathbf{6.} \quad [\mathbf{p}]_{\mathcal{B}} = \begin{bmatrix} -1 \\ 2 \\ 6 \end{bmatrix}$$

ChangeBasis01b

011

10.0 points

Determine the change of coordinates matrix $P_{\mathcal{C} \leftarrow \mathcal{B}}$ from basis $\mathcal{B} = \{\mathbf{b}_1, \mathbf{b}_2\}$ to $\mathcal{C} = \{\mathbf{c}_1, \mathbf{c}_2\}$ of a vector space V when

$$\mathbf{b}_1 = 6\mathbf{c}_1 - 2\mathbf{c}_2, \quad \mathbf{b}_2 = 9\mathbf{c}_1 - 4\mathbf{c}_2.$$