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NPTEL

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Courses » Mathematical Methods and Techniques in Signal Processing

Announcements **Course** Ask a Question Progress FAQ

Week 2 - Vector Spaces - II

Register for Certification exam

Course outline

Assignment 02

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-02-13, 23:59 IST.

Instructions:

1. **Attempt all questions.**
2. **Submission deadline**: 13th February 2019 23:55 IST
3. **Solutions to be posted**: 14th February 2019
4. Older browsers might show **unnecessary vertical bars** at the end of math equations

1) Consider the vectors $u = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ and $v = \begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix}$ in $\mathbb{R}^3$. Let us consider the inner product,

$$\langle u, v \rangle = u_1 v_1 + b(u_2 v_2) + u_3 v_3$$

where $b \in \mathbb{R}$. u_i and v_i represent the i^{th} element of u and v respectively.
For what value of b are the vectors u and v orthogonal?

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 2

1 point

2) Let $\mathcal{S} = \{a, b, c, d\}$ be a subset of $\mathbb{R}^5$ where

1.5 points

$a = \begin{bmatrix} 1 \\ 0 \\ 1 \\ 2 \end{bmatrix}, b = \begin{bmatrix} 0 \\ 1 \\ 3 \\ 1 \end{bmatrix}, c = \begin{bmatrix} 1 \\ 1 \\ 4 \\ 4 \end{bmatrix}, d = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$

ce De

4

5

No, the answer is incorrect.
Score: 0

Accepted Answers:
3

3) Consider the vectors $u = [1\ -2\ 3]^{\mathrm{T}}$ and $v = [-2\ 4\ -6]^{\mathrm{T}}$ in $\mathbb{R}^3$. Using which of the following sets can these vectors be represented uniquely? ***1.5 points***

$A = \{[1\ -2\ 3]^{\mathrm{T}}\}$

$B = \{[1\ 0\ 0]^{\mathrm{T}}, [0\ 0\ 1]^{\mathrm{T}}\}$

$C = \{[1\ -2\ 3]^{\mathrm{T}}, [-2\ 4\ -6]^{\mathrm{T}}\}$

None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
$A = \{[1\ -2\ 3]^{\mathrm{T}}\}$

4) The L_2-norm of $g(x) = 5x^2 - 3x - 1$ over $[0, 1]$ is ***1.5 points***

$\sqrt{\frac{5}{6}}$

$\sqrt{\frac{25}{6}}$

$\sqrt{\frac{7}{6}}$

$\frac{5}{\sqrt{6}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\sqrt{\frac{7}{6}}$

5) Consider vectors $x, y, z \in \mathbb{R}^2$ such that $y = x - z$ and $||x|| = ||z||$. Let θ_1 be the angle between x and y. Let θ_2 be the angle between z and y. Which of the following relations does θ_1 and θ_2 always satisfy? ***2 points***

$|cos\theta_1| = |cos\theta_2|$

$|\cos\theta_1|^2 + |\cos\theta_2|^2 = 1$

$|\cos\theta_1|^2 + |\sin\theta_2|^2 = 1$

No relation exists.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$|cos\theta_1| = |cos\theta_2|$
$|\cos\theta_1|^2 + |\sin\theta_2|^2 = 1$

6) If u and v are orthogonal vectors in the inner product space $\mathcal{V}$, such that $||u|| = 6$ and $||u + v|| = 10$, then what is the value of $||v||$ and $||u - v||$? *2 points*

- $4, 2$
- $8, 10$
- $6, 12$
- $8, \sqrt{28}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$8, 10$

7) Find the dimension of the plane $2x - 3y = 0$ in $\mathbb{R}^3$.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 2

2 points

8) Let A and B be subspaces of the vector space of 2×2 matrices defined over integers. Then, subspace C is said to be the direct sum of A and B if $C = A + B$ and $A \cap B = \left\{\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}\right\}$.The basis of the subspaces are given by $\mathcal{B}_A = \left\{\begin{bmatrix} m-12 & 9 \\ 0 & m \end{bmatrix}, \begin{bmatrix} 0 & m \\ 1 & 2 \end{bmatrix}\right\}$ and $\mathcal{B}_B = \left\{\begin{bmatrix} m & 0 \\ 1 & 1 \end{bmatrix}\right\}$. For what value of m is $C = A + B$ not a direct sum?

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 3

2.5 points

9) Let $S = \{u_1, u_2, u_3\}$ be a linearly independent set in $\mathbb{R}^n$, which of the following are true? *3 points*

- [ ] The set $\{u_1 + u_2, u_2 + u_3, u_3 + u_1\}$ is linearly independent.
- [ ] The set $\{u_1 - u_2, u_2 - u_3, u_3 - u_1\}$ is linearly independent.
- [ ]

The set $\{u_1, u_1 + u_2, u_1 + u_2 + u_3\}$ is linearly independent.

The set $\{u_1 - 2u_2, u_2 - 2u_3, u_3 - 2u_1\}$ is linearly independent.

No, the answer is incorrect.
Score: 0

Accepted Answers:
The set $\{u_1 + u_2, u_2 + u_3, u_3 + u_1\}$ *is linearly independent.*
The set $\{u_1, u_1 + u_2, u_1 + u_2 + u_3\}$ *is linearly independent.*
The set $\{u_1 - 2u_2, u_2 - 2u_3, u_3 - 2u_1\}$ *is linearly independent.*

10) What is the maximum value of $x - 2y + z$ subject to the constraint $x^2 + 2y^2 + z^2 = 1$? ***3 points***

- 0
- 1
- 2
- 3

No, the answer is incorrect.
Score: 0

Accepted Answers:
2

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