(*Specimen*)

King Saud University
College of Sciences
Department of Mathematics
Semester 432 / MATH-244 / Quiz-II

Max. Marks: 10 **Max. Time: 30 Min.**

Question 1 [Marks: 1.5]**:**

Show that $\{(\boldsymbol{x},\boldsymbol{y}) \in \mathbb{R}^{\mathbf{2}} \mid \boldsymbol{x}^{\mathbf{2}}+\boldsymbol{y}^{\mathbf{2}} \leq \mathbf{0}\}$ is a *vector subspace* of *Euclidean space* $\mathbb{R}^2$.

Question 2 [Marks: 2.5]**:**

Let $\boldsymbol{B}=\{(\mathbf{1},\mathbf{0},\mathbf{0}),(\mathbf{0},\mathbf{1},\mathbf{0}),(\mathbf{0},\mathbf{0},\mathbf{1})\}$ and $\boldsymbol{C}=\{(\mathbf{1},\mathbf{0},\mathbf{0}),(\mathbf{0},\mathbf{1},\mathbf{0}),(\mathbf{0},\mathbf{0},\mathbf{1})\}$ be *bases* of *Euclidean space* $\mathbb{R}^3$ and $\boldsymbol{u}=(\mathbf{3},\mathbf{2},\mathbf{1})$. **Find** the *transition matrix* ${}_{\boldsymbol{C}}\boldsymbol{P}_{\boldsymbol{B}}$ and the *coordinate vector* $[\boldsymbol{u}]_{\boldsymbol{C}}$.

Question 3 [Marks: 2]**:**

Let $\boldsymbol{A}$ be 4×3 *matrix* with *rank* $(\boldsymbol{A})=\mathbf{3}$. **Find** *nullity* $(\boldsymbol{A}^T)$**.**

Question 4 [Marks: 2]**:**

Explain! **why** the *function* $<(\boldsymbol{x_1},\boldsymbol{y_1},\boldsymbol{z_1}),(\boldsymbol{x_2},\boldsymbol{y_2},\boldsymbol{z_2})>=\ \mathbf{2}\boldsymbol{x_1}\boldsymbol{y_1}+\boldsymbol{y_2}+\mathbf{2}\boldsymbol{z_1}\boldsymbol{z_2}$ is not an *inner product* on $\mathbb{R}^3$.

Question 5 [Marks: 2]**:**

Which *one* of the following *vectors* in *Euclidean space* $\mathbb{R}^3$:

$\boldsymbol{u_1}=(\mathbf{0},\frac{\mathbf{-1}}{\sqrt{\mathbf{2}}},\frac{\mathbf{1}}{\sqrt{\mathbf{2}}}),\ \boldsymbol{u_2}=(\mathbf{0},\frac{\mathbf{1}}{\sqrt{\mathbf{2}}},\frac{\mathbf{1}}{\sqrt{\mathbf{2}}}),\ \boldsymbol{u_3}=(\mathbf{0},\frac{\mathbf{1}}{\sqrt{\mathbf{3}}},\frac{\mathbf{-1}}{\sqrt{\mathbf{3}}})$ and $\boldsymbol{u_4}=(\mathbf{0},\frac{\mathbf{-1}}{\sqrt{\mathbf{3}}},\frac{\mathbf{1}}{\sqrt{\mathbf{3}}})$

is *orthogonal* to *both vectors* $\boldsymbol{v_1}=(\mathbf{1},-\mathbf{1},\mathbf{1})$ and $\boldsymbol{v_2}=(\mathbf{1},\mathbf{0},\mathbf{0})$?

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SOLUTION KEY:

Question 1:
Question 2:
Question 3:
Question 4:
Question 5: