[illegible]
[illegible]
[illegible]

[illegible]

---

1. [illegible] **always true** [illegible]
[illegible] **No justification is necessary**.

(a) A 4×4 [illegible] $-1, 0, 6$ [illegible]

(b) [illegible]

(c) [illegible] $\|\cdot\|$ [illegible] $< \cdot, \cdot >$. [illegible] $\|x+y\|^2 = \|x\|^2 + \|y\|^2$ [illegible] x [illegible] y [illegible]

(d) [illegible] $< \cdot, \cdot >$ [illegible] $< w, v > = < v, w >$.

(e) [illegible] $\mathbb{R}^n$ [illegible]

(f) [illegible] W [illegible] V [illegible] V [illegible] $W = \text{span}\{v_1, v_2, v_3\}$ [illegible] $< \cdot, \cdot >$. [illegible] $v \in V$ [illegible]

$$Pv = < v, v_1 > \frac{v_1}{\|v_1\|^2} + < v, v_2 > \frac{v_2}{\|v_2\|^2} + < v, v_3 > \frac{v_3}{\|v_3\|^2}.$$

(g) [illegible] A [illegible] $\det(A) = 0$ [illegible] A.

2. [illegible]

$$C = \begin{bmatrix} 1 & 0 & -2 \\ 0 & 2 & -2 \\ -2 & -2 & 7 \end{bmatrix}, \quad v_1 = \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}, \quad v_2 = \begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}, \quad v_3 = \begin{bmatrix} 1 \\ -3 \\ -2 \end{bmatrix}.$$

(a) [illegible] $q(x, y, z) = x^T C x$. [illegible]

[illegible]

(b) [illegible] K [illegible] v_1, v_2, v_3 [illegible] $\langle x, y \rangle = x^T C y$. [illegible] K [illegible] $C > 0$ [illegible]

3. [illegible]

[illegible] $A = \begin{pmatrix} 0 & 2 & -2 \\ 1 & 1 & 0 \\ 4 & -4 & 5 \end{pmatrix}$ [illegible] $B = \begin{pmatrix} 3 & 0 & -1 \\ 1 & 2 & -1 \\ -1 & 0 & 3 \end{pmatrix}$.

(a) [illegible] A [illegible]

(b) [illegible] B [illegible] 2 [illegible] 2 [illegible] 4 [illegible]
[illegible] 1 [illegible] B [illegible]
[illegible]

(c) [illegible] S [illegible] D [illegible] $B = SDS^{-1}$? [illegible]
[illegible] S^{-1}.

4. [illegible] $A = \begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}$ [illegible] $K = \begin{pmatrix} 2 & 2 & 0 \\ 2 & 3 & 1 \\ 0 & 1 & 2 \end{pmatrix}$.

(a) [illegible] A.

(b) [illegible] $\langle x, y \rangle = x^T K y$, [illegible] A. [illegible] K [illegible]

(c) [illegible] A.

5. [illegible] P [illegible] $\frac{1}{3}; \frac{2}{3}; \frac{2}{3}$: