Mohammad Ali Jinnah University

Chartered by Government of Sindh - Recognized by HEC

Quiz 5

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Subject: Linear Algebra (Fall 2020)

Section: AM

Teacher: Dr. Asmat Ara

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Q1 (a) Let be the Euclidean inner Product .Use the Gram-Schmidt process of Find its an orthogonal basis Find its Orthonormal basis

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Quiz #5

Date: _____

Q_1

Solution:

Orthogonal basis:

$\|v\| = \sqrt{(r \cdot 0 \cdot 0)}$

$= \sqrt{1}$

$\|v\|^2 = 1^2$

$\|v\|^2 = 1$

i) $V_1 = u_1$,

$V_1 = (1,0,0)$

ii) $V_2 = u_2 - \dfrac{(u_2 \cdot v_1)}{\|v_1\|^2} \cdot v_1$

$V_2 = (3,7,-2) - \dfrac{((3,7,-2) \cdot (1,0,0))}{1} \cdot (1,0,0)$

$V_2 = (3,7,-2) - (3/1)(1,0,0)$

$V_2 = (3,7,-2) - (3,0,0)$

$V_2 = (0,7,-2)$

iii) $V_3 = u_3 - \dfrac{(u_3 \cdot v_1)}{\|v_1\|} \cdot v_1 - \dfrac{(u_3 \cdot v_2)}{\|v_2\|} \cdot v_2$

$V_3 = (0,4,1) - \dfrac{((0,4,1) \cdot (1,0,0))}{1} \cdot (1,0,0) - \dfrac{((0,4,1) \cdot (0,7,-2))}{53} \cdot (0,7,-2)$

$V_3 = (0,4,1) - (0,0,0) - \dfrac{26}{53}(0,7,-2)$

$V_3 = (0-0-0, 4-0-\dfrac{182}{53}, 1-0+\dfrac{52}{53})$

$V_3 = (0, \dfrac{30}{53}, \dfrac{105}{53})$

Ans

MIGHTY PAPER PRODUCT

Orthonormal basis (q_1, q_2, q_3):-

$$q_1 = \frac{v_1}{\|v_1\|} \quad , \quad q_2 = \frac{v_2}{\|v_2\|} \quad , \quad q_3 = \frac{v_3}{\|v_3\|}$$

$\|v_1\| = \sqrt{1^2 + 0^2 + 0^4} \Rightarrow \sqrt{1^2} \Rightarrow 1$

$\|v_2\| = \sqrt{0^2 + 7^2 + 2^2} \Rightarrow \sqrt{53}$

$\|v_3\| = \sqrt{0^2 + (30/53)^2 + (100/53)^2}$

$\|v_3\| = \cancel{0}, \dfrac{15\sqrt{53}}{53}$

$q_1 = (1,0,0)/1 \Rightarrow (1,0,0)$

$q_2 = \left(0, \; 7/\sqrt{53}, \; -2/\sqrt{53}\right)$

$q_3 = \left(0, \; 30/15\sqrt{53}, \; 105/15\sqrt{53}\right)$

Ans