STUDY GUIDE FOR TEST II IN-CLASS PART

MATH 2201

1. Find the distance between **u** and **v**.
   (a) $\mathbf{u} = (1, 0, 6)$, $\mathbf{v} = (4, 3. -2)$ (b) $\mathbf{u} = (7, -4, 5)$, $\mathbf{v} = (8, -2, -3)$

2. Find the angle between **u** and **v**.
   (a) $\mathbf{u} = (3, -1, 5)$, $\mathbf{v} = (-2, 4, 3)$ (b) $\mathbf{u} = (0, 1, 1)$, $\mathbf{v} = (1, 2, -3)$

3. Find the orthogonal projection of **v** on **u**; that is, $\text{proj}_{\mathbf{u}}\, \mathbf{v}$.
   (a) $\mathbf{u} = (3, 6, -2)$, $\mathbf{v} = (1, 2, 3)$ (b) $\mathbf{u} = (2, -1, 4)$, $\mathbf{v} = (0, 1, \tfrac{1}{2})$

4. Find the cross product of **u** and **v**.
   (a) $\mathbf{u} = (1, 3, 4)$, $\mathbf{v} = (2, 7, -5)$ (b) $\mathbf{u} = (-3, 1, -7)$, $\mathbf{v} = (0, -5, -5)$

5. Determine if the following pairs of vectors are orthogonal.
   (a) $\mathbf{u} = (1, -1, 2, 3)$, $\mathbf{v} = (3, 3, -6ˏ4)$ (b) $\mathbf{u} = (1, 3, 2, 6, -1)$, $\mathbf{v} = (0, 0, 2, 4, 1)$

6. Express **w** as a linear combination of the other vectors.
   (a) $\mathbf{w} = (-1, 4, 15)$, $\mathbf{v}_1 = (1, 2, 8)$, $\mathbf{v}_2 = (3, 0, 1)$
   (b) $\mathbf{w} = (4, 5, 10)$, $\mathbf{v}_1 = (1, 2, ,3)$, $\mathbf{v}_2 = (3, 1, 2)$, $\mathbf{v}_3 = (4, 1, 0)$
   (c) $\mathbf{w} = (3, -17, 17, 7)$, $\mathbf{v}_1 = (2, -3, 4, 1)$, $\mathbf{v}_2 = (1, 6, -1. 2)$, $\mathbf{v}_3 = (-1, -1, 2, 3)$

7. Determine if W is a subspace of the vector space V.
   (a) $V = R^2$; $W = \{(a, a + 1)\}$
   (b) $V = R^3$; $W = \{(3t, 0, -2t\ )\}$
   (c) $V = R^3$; $W = \{(x, y, z) \mid xyz = 0\}$
   (d) $V = M_{22}$; $W = \left\{ \begin{bmatrix} a & b \\ c & d \end{bmatrix} \middle|\ a + d = 0 \right\}$

8. Find a basis for and the dimension of the null space of the given matrix.

(a) $A = \begin{bmatrix} 1 & -3 & 3 \\ 2 & -6 & 8 \\ 3 & -9 & 11 \end{bmatrix}$ (b) $B = \begin{bmatrix} 5 & -5 & -1 & 0 \\ 5 & 0 & 3 & 10 \\ 10 & -5 & 2 & 10 \end{bmatrix}$

(c) $C = \begin{bmatrix} 1 & 0 & 0 & 3 \\ 1 & 0 & 1 & 4 \\ 1 & 0 & -1 & 2 \\ 1 & 1 & 2 & 7 \end{bmatrix}$

9. Use Theorem 4.10.2 (the Additivity and Homogeneity Properties of matrix transforms) to determine wither T is a matrix transform.

(a) $T(x, y) = (x - 2y, 3x + y)$ (b) $T(x, y) = (x + y, 2xy)$

(b) $T(x, y) = (0.3x, 0.4y)$ (c) $T(x, y, z) = (x - y, y - z, z - x)$

ANSWERS

1. (a) $\sqrt{82}$ (b) $\sqrt{69}$

2. (a) 81.0° (b) 100.9°

3. (a) $\left(\frac{27}{49}, \frac{54}{49}, -\frac{18}{49}\right)$ (b) $\left(\frac{2}{21}, -\frac{1}{21}, \frac{4}{21}\right)$

4. (a) (−43, 13, 1) (b) (−40, −15, 15)

5. (a) orthogonal (b) not orthogonal

6. (a) $\mathbf{w} = 2\mathbf{v}_1 - \mathbf{v}_2$ (b) $\mathbf{w} = 2\mathbf{v}_1 + 2\mathbf{v}_2 - \mathbf{v}_3$
(c) $\mathbf{w} = 3\mathbf{v}_1 - \mathbf{v}_2 + 2\mathbf{v}_3$

7 (a) no (b) yes
(c) no (d) yes

8. (a) basis: {(3, 1, 0)}; dimension: 1
(b) basis: $\left\{\left(-\frac{3}{5}, -\frac{4}{5}, 1, 0\right), (-2, -2, 0, 1)\right\}$; dimension: 2
(c) basis: {(−3, −2. −1, 1)}; dimension: 1

9. (a) matrix transform (b) not a matrix transform
(c) matrix transform (d) matrix transform