# Math 227 Assignment 4

## Due Thursday, February 19

**1)** a) (3 points) If $v = \begin{bmatrix} 9 \\ 7 \\ -12 \end{bmatrix}$ and $w = \begin{bmatrix} -8 \\ 11 \\ -2 \end{bmatrix}$, compute $\langle v, w \rangle$, $\|v\|_2$, $\|w\|_2$, and the angle between $v$ and $w$.

b) (4 points) Find two non-parallel vectors $v_1$ and $v_2$ in $\mathbb{R}^2$ such that $\|v_1\|_2 = \|v_2\|_2 = 1$ and whose angle with $\begin{bmatrix} 3 \\ 4 \end{bmatrix}$ is $42°$.

**2)** Let $A \in M_2(\mathbb{R})$.

a) (2 points) Show that if $A = aI_2$, then $AB = BA$ for all $B \in M_2(\mathbb{R})$.

b) (4 points) For all $A \in M_2(\mathbb{R})$ where $A$ is NOT a scalar multiple of $I_2$, find $C \in M_2(\mathbb{R})$ with $AC \neq CA$ (*Hint:* use the matrix units.)

**3)** Find the inverse of the following matrices, then check that your answer is correct. Do part a) BY HAND.

a) (3 points) $A = \begin{bmatrix} -1 & 2 \\ 4 & 6 \end{bmatrix}$.

b) (2 points) $B = \begin{bmatrix} 6 & 8 & 4 \\ 5 & 1 & -10 \\ 11 & 9 & 9 \end{bmatrix}$.

**4)** Find a single $3 \times 3$ matrix that, in homogeneous coordinates,

a) (1 point) rotates a 2-vector $\pi/6$ radians,

b) (2 points) shifts a 2-vector down by 3 and right by 12,

c) (1 points) scales a 2-vector up by 9, and finally

d) (3 points) does parts a)-c) in order, starting with a).