Part I (due Wednesday, January 31 at the beginning of class)

1. Try some more examples with A and B as $n \times n$ matrices to address the question of whether $AB = BA$ in the case that the matrices are square matrices of the same size.
2. Think about the question of a multiplicative identity for matrices more: is there a matrix that we can multiply on either side of A and get A back as the result? Try this from the linear combination of the columns perspective for multiplication of matrices: what matrix do you need to multiply by A so that the first column of the product is the first column of A, the second column of the product is the second column of A, etc.?

You don't need to turn anything in for Part I this time, but come prepared to discuss the examples you considered and the ideas you had.

Part II (prepare for Wednesday, January 31)

1. Let

$$A = \begin{bmatrix} 1 & 2 & 0 & 1 \\ 3 & 0 & -4 & 5 \\ 7 & 6 & -1 & 0 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 4 & -3 \\ 5 & 1 & 9 \\ 1 & 1 & -2 \end{bmatrix}$$

$$C = \begin{bmatrix} 0 & -1 & 6 \\ 3 & -2 & 5 \\ 1 & 0 & 4 \end{bmatrix} \quad D = \begin{bmatrix} 10 & -4 \\ 5 & 2 \\ 8 & -1 \end{bmatrix}$$

$$E = \begin{bmatrix} 1 & 0 \\ 4 & -3 \\ 5 & -1 \end{bmatrix} \quad F = \begin{bmatrix} -2 & 1 & 5 \\ 6 & 3 & -8 \\ 1 & 0 & -1 \\ 7 & 0 & -5 \end{bmatrix}$$

Find the following, if defined. If not defined, explain why not.

(a) AF

(b) $A(BC)$

(c) $(BC)A$

(d) $(B + C)D$

(e) $D^T E$

(f) $(A^T + F)^T$

Part III: Homework (due Wednesday, February 7 at the beginning of class)

1. We talked in class about two different ways to compute matrix products. Apply both methods to the matrix-vector product $A\vec{x}$, where $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ and $\vec{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ and show that they both produce the same result.
2. Suppose that we have three vectors $\vec{v}_1$, $\vec{v}_2$, and $\vec{v}_3$ such that $\vec{v}_3 = 2\vec{v}_1 - \vec{v}_2$. Let A be the matrix whose columns are $\vec{v}_1$, $\vec{v}_2$, and $\vec{v}_3$, in that order. Find a nonzero vector $\vec{x}$ such that $A\vec{x} = \vec{0}$.

Running list of vocabulary words that could be a quiz word

- linear equation
- system of linear equations
- linear combination of a set of vectors
- span of a set of vectors
- linearly independent
- linearly dependent
- reduced row echelon form
- pivot
- homogeneous system
- free variable
- row equivalent
- consistent system
- inconsistent system
- trace
- transpose