Part I (due Monday, February 19 at the beginning of class)

Think about whether the set

$$V = \left\{ \begin{bmatrix} a & b \\ c & d \end{bmatrix} : a, b, c, d \in \mathbb{R} \right\}$$

satisfies the vector space axioms we talked about in class Friday. You don't need to turn anything in for this, but come prepared to discuss it.

Here's the definition again:

Definition 1. *Let V be a nonempty set of objects on which addition and scalar multiplication are defined. If the following axioms hold for all $\vec{u}$, $\vec{v}$, and $\vec{w}$ in V and for all scalars c and d, then V is a* vector space *(and the objects in V are* vectors*).*

1. *$\vec{v}, \vec{w} \in V$ implies $\vec{v} + \vec{w} \in V$ (closure under addition)*
2. *$\vec{v} + \vec{w} = \vec{w} + \vec{v}$ (addition is commutative)*
3. *$\vec{u} + (\vec{v} + \vec{w}) = (\vec{u} + \vec{v}) + \vec{w}$ (addition is associative)*
4. *There is a $\vec{0} \in V$ such that $\vec{0} + \vec{v} = \vec{v} + \vec{0} = \vec{v}$ (additive identity)*
5. *For each $\vec{v} \in V$, there exists a vector $-\vec{v} \in V$ such that $\vec{v} + (-\vec{v}) = -\vec{v} + \vec{v} = \vec{0}$ (additive inverse)*
6. *$c\vec{v} \in V$ (closure under scalar multiplication)*
7. *$c(\vec{v} + \vec{w}) = c\vec{v} + c\vec{w}$ (distributivity of scalar multiplication over addition)*
8. *$(c + d)\vec{v} = c\vec{v} + d\vec{v}$ (another form of distributivity)*
9. *$c(d\vec{v}) = (cd)\vec{v}$ (associativity of scalar multiplication)*
10. *$1\vec{v} = \vec{v}$ (scalar multiplicative identity)*

Part II (prepare for Wednesday, February 21)

There will be a WeBWorK assignment posted by Friday night.

Part III: Homework (due Wednesday, February 21 at the beginning of class)

1. For each of the following, give an explained example or explain why such an example does not exist.
   (a) a one-to-one transformation from $\mathbb{R}^3$ to $\mathbb{R}^4$
   (b) an onto transformation from $\mathbb{R}^3$ to $\mathbb{R}^4$
   (c) a one-to-one but not onto transformation from $\mathbb{R}^4$ to $\mathbb{R}^4$

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 of a matrix
- transpose of a matrix
- inverse of a matrix
- elementary matrix
- transformation
- domain
- codomain
- range
- vector space (I will not ever ask you to define this on a quiz—the definition is way too long—but you should make sure you know what makes something a vector space)