Math 212 Common Errors in Homework # 4

1. Do not be sloppy: staple your homework and do not turn in paper that has been ripped out of a notebook without removing the tear-away frills on the side.
2. Write complete sentences. Everything you write should be able to be read from top to bottom. Equations are sentences too, so make sure to use punctuation properly! Don't use symbols like $\therefore$ or $\implies$ in a sentence mostly words.
3. The symbol $\to$ should only be used when discussing maps. For example, the function $f : \mathbb{R}^4 \to \mathbb{R}^5$ cannot be onto.
4. The implication symbol is $\implies$, not $\to$.
5. Do not turn in rough drafts! Check your work and write your solutions neatly and clearly before turning them in. Make sure that every word or symbol you put on the paper is necessary. Do NOT include work that you did to think through the problem unless it is necessary to the solution. Nothing should be crossed out or out of order.
6. Think about the easiest and simplest way to do something. Don't do extra and unnecessary work.
7. If it is possible to prove or explain something without using a contradiction technique, it is better to avoid doing so. That being said, if you are trying to *disprove* something, it is usually simplest to provide a counterexample.
8. Do not use the word 'it' unless you are 100% sure that it is clear what *it* is referring to. It is best practice to eliminate 'it' (and other words like 'it') from your proofs.
9. Always justify answers unless it is specifically stated not to do so.
10. Cite theorems with proper references to chapters. For example, everyone's favorite, Theorem 4 from Chapter 1 can be written Theorem 1.4.
11. If you are asked to prove $P \implies Q$, do not prove that $Q \implies P$.
12. Quantify variables and do so in the proper place. For example, "for all $b \in \mathbb{R},\ 0 \neq b$" is not equivalent to "$0 \neq b$ for all $b \in \mathbb{R}$."
13. Doing row reductions horizontally is better organizationally, and remember to put the row operations above the similar symbol between matrices like this: $\overset{R_1 \to R_1 + R_2}{\sim}$.
14. If a system has a free variable, this does not imply that the system has infinitely many solutions. If a column of a matrix is not a pivot column, it is not necessarily corresponding to a free variable. For example, the system corresponding to the matrix
$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 3 \\ 0 & 1 & 0 & 0 & 0 & 0 & 4 \end{bmatrix}$$
has no free variables.
15. Do not confuse sets and matrices:
$$\begin{bmatrix} a & b & c \end{bmatrix} \neq \{a, b, c\}.$$
16. Do not start talking about a matrix for a transformation before you have noted that one even exists. Also not confuse the matrix for a transformation with the function itself. For example, do not say "the transformation T has n pivots" or "A maps from $\mathbb{R}^m$ to $\mathbb{R}^n$."
17. Sets of vectors or columns (or rows) of a matrix can be linearly (in)dependent, not matrices themselves.
18. The matrix equation $A\vec{x} = 0$ always has the trivial solution, $\vec{x} = 0$.

19. Nul A refers to the nullspace of the matrix A, and so is a set. For example, the sets $\{0\}$, and $\text{span}\{(1,0,3),(1,2,0)\}$ could be the nullspace of a matrix. The nullity of A is the dimension of the nullspace and so is a natural number.

20. col A is the columnspace of the matrix A and so is a set. Writing

$$\text{col } A = \{\text{columns of } A\}$$

is ridiculous. You may write, however,

$$\text{col } A = \text{span}\{\text{columns of } A\}.$$

21. col A is only ever a finite set if col $A = \{0\}$. Otherwise, col A is either a span of a set of vectors or is $\mathbb{R}^n$ for some $n \in \mathbb{N}$.

22. Something can't 'fail' the IMT. If the IMT says that $P \iff Q$, then $\neg P \iff \neg Q$ is also true. In another situation, you may be interested in a statement 'contradicting' the IMT, if you are doing a proof by contradiction.

23. The zero subspace is $\{0\}$, not 0.

$$\text{Nul } A = 0$$

doesn't make sense, but

$$\dim \text{Nul } A = \text{Nulltiy } A = 0$$

does make sense.

NOTE: If you are interested in learning to type in LaTeX(it is a good skill to have and comes in handy in many courses and situations), reach out to the department and they will put you in contact with me or another student who can help you learn it.