Name ______________________ Class ______________ Date ______________

Practice 3-3

In a soon-to-be-built town, all streets will be designated either as avenues or as boulevards. The avenues will all be parallel to one another, the boulevards will all be parallel to one another, and in the middle of town, Center City Boulevard will intersect Founders Avenue at right angles. Which of the following statements must be true? Justify your answer in each case.

1. Every avenue will be perpendicular to every boulevard.
2. All city blocks will be the same size.
3. All city blocks will be rectangular.
4. All city blocks will be bordered by two avenues and two boulevards.
5. All city blocks will be bordered on one side by either Center City Boulevard or Founders Avenue.

***a, b, c, d,* and *e* are distinct lines in the same plane. For each combination of relationships between *a* and *b, b* and *c, c* and *d,* and d and *e,* how are *a* and *e* related?**

6. $a \parallel b, b \parallel c, c \perp d, d \parallel e$
7. $a \perp b, b \parallel c, c \parallel d, d \perp e$
8. $a \parallel b, b \parallel c, c \perp d, d \perp e$
9. $a \perp b, b \parallel c, c \perp d, d \perp e$
10. $a \perp b, b \perp c, c \perp d, d \parallel e$
11. $a \perp b, b \perp c, c \perp d, d \perp e$
12. Suppose you are given information about a sequence of lines, ℓ_1 through ℓ_n, in the following form:

$$\ell_1 \square \ell_2, \ell_2 \square \ell_3, \ell_3 \square \ell_4, \ldots, \ell_{n-2} \square \ell_{n-1}, \text{ and } \ell_{n-1} \square \ell_n,$$

where each $\square$ is either a $\parallel$ or a $\perp$. Now you are asked whether $\ell_1 \parallel \ell_n$ or $\ell_1 \perp \ell_n$. How can you decide by simply counting the number of $\perp$ statements in the given information?

13. **Critical Thinking** Theorem 3-10 says that in a plane, if two lines are perpendicular to the same line, then they are parallel to each other. What are some ways to prove this without using the concept of corresponding angles?
14. **Critical Thinking** In three dimensions, is it possible for lines ℓ_1, ℓ_2 and ℓ_3 all to intersect at one point in such a way that ℓ_1 and ℓ_2 are each perpendicular to ℓ_3 but ℓ_1 and ℓ_2 are neither parallel nor perpendicular to one another? Explain why or why not, using a sketch if necessary.