Math 444 **Geometry for Teachers** **Winter 2009**

Homework Assignment: Due Wednesday, 2/11/08

Part I:

Each of the statements below is an implication. For each statement, do all of the following:

- Identify the hypothesis and the conclusion.
- Write the converse.
- Write the inverse.
- Write the contrapositive.

1. If P, Q, and R lie on ℓ, then they are collinear.
2. If ℓ is a line, then it contains at least two distinct points.
3. A quadrilateral is a parallelogram if it is a rectangle.
4. For a triangle to be isosceles, it is necessary that it have two equal angles.
5. x is divisible by 4 only if it is even.
6. If $2x + 1 = 5$, then $x = 2$ or $x = 3$.
7. If the 10^{100}th decimal digit of π is 3, then $\sqrt{5} = 2$.

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Part II:

8. Venema, page 42, Exercises 3.1, 3.2.
9. Write the negations of each of the three incidence axioms.
10. Write the negation of each of the following statements.
    (a) If P, Q, and R all lie on ℓ, then they are collinear.
    (b) P lies on ℓ or it lies on m.
    (c) For any three points P, Q, and R, if they are collinear, then there is another point S that is not equal to P, Q, or R.
    (d) For every line ℓ, if ℓ contains three distinct points, then it has points in common with three distinct lines.
    (e) There exists a line ℓ such that for every point P, P lies on ℓ.
    (f) There exists a point P that does not lie on any line.
11. Below is the outline of a proof of Theorem 3.6.2. Fill in the blanks with appropriate reasons.

    Theorem 3.6.2. *If ℓ is any line, then there exists at least one point P such that P does not lie on ℓ.*

    Proof:

	Statement	**Reason**
1.	Let ℓ be a line.	____________________
2.	Let P, Q, and R be three noncollinear points.	____________________
3.	P, Q, and R do not all lie on any one line.	____________________
4.	At least one of the points P, Q, or R does not lie on ℓ.	____________________
5.	There is a point that does not lie on ℓ.	____________________

Part III:

12. Write proofs in two-column format for Venema's Theorems 3.6.3 and 3.6.4 on page 41.