More practice with logic and proofs:

1. Turn these logic statements into set statements, and make both the truth table and the Venn diagram:

a. $\sim(p \vee q)$

b. $(p \vee q) \wedge r$

2. Use truth tables to show that the statement $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$ is a tautology

3. Use truth tables to show that these statements are logically equivalent:

$\sim(p \wedge \sim q)$ and $p \rightarrow q$

4. Use truth tables to show these statements are not logically equivalent:

$p \rightarrow q$ and $\sim p \rightarrow \sim q$

5. Write the contrapositive of each of these statements:

a. If n is a multiple of 6, then it is a multiple of 3.

b. If n is a multiple of 3 and a multiple of 2 then it is a multiple of 6

c. If xy is a multiple of 3 then x is a multiple of 3 or y is a multiple of 3

d. If n is greater than 10, then it is not a negative number.

6. Write proofs for each of these statements:

a. If a number is the sum of an even number and an odd number, then it is an odd number.

b. If $xy + 2y$ is odd then x is odd or y is odd

c. If $xy > 25$ then $x > 5$ or $y > 5$

d. If n is an integer then $n^2 + 3n$ is even.