Homework problems due 2/9/2015 (notionally – I think an extension is extremely likely if indeed you work on all of these).
You have the Frege book to read and comment on.

1. If we write $x + y$ for $x \cup y$ and $xy$ for $x \cap y$ where $x, y$ are sets, along with $-x$ for $x^c$, 0 for $\emptyset$ and 1 for $V$, we get the following interesting theorems

$x + y = y + x$, $xy = yx$ (commutative laws)

$(x + y) + z = x + (y + z)$, $(xy)z = x(yz)$ (associative laws)

$x(y + z) = xy + xz$, $x + yz = (x + y)(x + z)$ (distributive laws, in both directions (surprise!))

$x + 0 = x$, $x1 = x$ (identity laws)

$x0 = 0$, $x + 1 = 1$ (zero laws, with an unexpected extra)

$-(−x) = x$, $-(xy) = -x + -y$, $-(x + y) = (-x)(-y)$ (double negation and de Morgan)

$x + -x = 1$, $x(-x) = 0$ (excluded middle and noncontradiction)

This set of algebraic laws is called “Boolean algebra”. Illustrate the two distributive laws with Venn diagrams (I think you mentioned those, so I hope you know how to do this). If you are feeling really clever, write a proof in English of one of the distributive laws. You might need guidance on that. Notice though that I do give proof strategies for proving equalities between sets (introduce an arbitrary element of one and show that it belongs to the other, and vice versa), and the definitions of the operations of intersection and union suggest strategies: for example, $a \in y + z \iff a \in x \lor a \in y$. 

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2. problem 1, problem 3, problem 4 in section 3.6.2 in the text. If you can answer problem 9 in the same section I will be quite impressed.

3. If inclined, try proving one or both of the following by math induction. This doesn’t require more than high school math along with the math induction...

The sum of the first $n$ squares is $\frac{n(n+1)(2n+1)}{6}$

For any natural number $n$, $n^3 + 5n$ is divisible by three (the formula $(n + 1)^3 = n^3 + 3n^2 + 3n + 1$ is useful here).