Problem Set #2

(50 points)

Name: ____________________________________

Work on the following problems to turn in **Wednesday, March 20**. Please make sure your work is clear, neat, and organized. A reminder: You may discuss these problems with each other, but your write-up and your submission must represent **your own work written up independently of others**.

1. **Base 3 Addition Chart**.

+	0	1	2	10	11	12	20	21
0								
1								
2								
10								
11								
12								
20								
21								

Describe any pattern(s) you see in this chart as a whole.

2. **Some Arithmetic Problems in Base 5 and Base 7**. Solve the following arithmetic problems twice, first in Base 5 and then again in Base 7. You do not need to show detailed work, but it may be helpful.

(a) BASE 5.

34	213	22
+ 22	– 144	x 14
_____ **five**	______**five**	_____**five**

(b) BASE 7.

34	213	22
+ 22	– 144	x 14
_____ **seven**	______**seven**	_____**seven**

3. **Propositional Logic and Venn Diagrams**. Construct Venn Diagrams for each of the following two statements; this will show that they are logically equivalent.

(a) Use truth tables to show these statements are equivalent

$p \wedge (\neg q)$ $\neg((\neg p) \vee q)$

(b) Use Venn Diagrams to show these expressions are equivalent

$\boldsymbol{P} \cap \overline{\boldsymbol{Q}}$ $\overline{(\overline{\boldsymbol{P}} \cup \boldsymbol{Q})}$

4. **Propositional Logic and Truth Tables**. Show that the following logical implications are <u>**NOT**</u> valid arguments by constructing the appropriate truth table and showing it does **not** give you a tautology.

(a) Fallacy of the inverse, i.e. "hypothetical denial"

$$((p \to q) \wedge \neg p) \to \neg q$$

(b) Fallacy of the converse, i.e. "consequential affirmation"

$$((p \to q) \wedge q) \to p$$

5. **Propositional Logic and English Sentences**. Pick two statements **p** and **q** that should make sense in a "If p, then q" logical conclusion, such as "IF **I have a PhD in Mathematics**" THEN "**I know how to add 3 digit numbers.**" Use your English sentence values for **p** and **q** and replicate the following syllogisms

(a) Fallacy of the inverse, i.e. "hypothetical denial" $((p \rightarrow q) \wedge \neg p) \rightarrow \neg q$

(b) Fallacy of the converse, i.e. "consequential affirmation" $((p \rightarrow q) \wedge q) \rightarrow p$

(c) *Modus tollendo ponens* or "Disjunctive syllogism" $((p \vee q) \wedge \neg p) \rightarrow q$