Name: **Section:**

HW 2.1

1. (24 $points$) Consider the following two statement forms:
   - $A: p \longrightarrow (\sim q \wedge r)$
   - $B: (\sim p \vee \sim q) \wedge r$

   a) (15 $points$) Construct a **single** truth table that displays the truth values of the above two statement forms. Use as many rows & columns as you need in the following table.

   b) (9 $points$) Define what it means for two statement forms A & B to be logically equivalent. Are the above A & B logically equivalent? Prove or disprove the following **using only the definition (i.e. without using the truth table)**.

$$p \longrightarrow (\sim q \wedge r) \equiv (\sim p \vee \sim q) \wedge r$$

2. (22 $points$) Consider the following statement:

"If Trevor didn't pass quiz 1, then he needs to redo quiz 1 and study harder for quiz 2"

a) (5 $points$) Define 3 statement variables $p, q, \& \, r$, and write the **statement form** of the above conditional statement involving only "$\rightarrow$, $\vee$ or $\wedge$". Do not use negation "$\sim$".

$p =$

$q =$

$r =$

Statement form:

b) (5 $points$) Using the same $p, q, \& \, r$ as above, write the statement in words that corresponds to:

$$\sim p \vee (q \wedge r)$$

c) (6 $points$) Apply the negation "$\sim$" to the statement form given in part b), and ***simplify it*** using logical equivalences laws. Use only one law in each step and include a name for each law.

d) (6 $points$) Write in words the negation of the statement that you found in part b). (**Hint**: use part c))

3. (24 $points$) Prove the following logical equivalence using **standard logical equivalences**. Justify each step by stating the name of the standard logical equivalence law & use only one law in each step.

$$(p \wedge q) \wedge \sim r \quad \equiv \quad \sim(p \wedge r) \wedge (q \wedge p)$$