MACM 101 **Midterm Test** **Some Day, 2026**

This is a sample!

Last Name _____ First Name and Initials _____

Student No. _____

One 8.5"x11" cheat sheet (double sided) allowed. No other aids allowed. Answer ALL questions on the test paper. Use backs of sheets for scratch work.

Total Marks: 100

1. State DeMorgan's logical laws [8]

2. Show that $\neg(p \to q) \to \neg q$ is a tautology. [12]

3. Show that $(p \to q) \to r$ and $p \to (q \to r)$ are not logically equivalent. [16]

4. Give the reasons for each step needed to show that the following argument is valid [16]
   Premises: $p, p \to q, s \vee r, r \to \neg q$
   Conclusion: s.

Steps	Reasons
1. p	
2. $p \to q$	
3. q	
4. $r \to \neg q$	
5. $q \to \neg r$	
6. $\neg r$	
7. $s \vee r$	
8. s	

5. How to prove that a universally quantified statement is false? [12]

6. Show that $\exists x\ (P(x) \wedge Q(x))$ is not logically equivalent to $(\exists x\ P(x)) \wedge (\exists x\ Q(x))$. [16]

7. What is the difference between the difference of two sets and their symmetric difference? [8]

8. What is the power set? Find the power set of $A = \{a, \{\alpha, \beta\}, X, 3\}$. [12]