MAT2440, Quiz2, Spring2025

ID:_____ Name:_____

1. Translate the given statement into propositional logic using the propositions provided:

'You can see the movie **only if** you are over 18 years old or you have the permission of a parent.' Express your answer in terms of ***m***: 'You can see the movie,' ***e***: 'You are over 18 years old,' and ***p***: 'You have the permission of a parent.'

Sol: since a only if b is $a \to b$, then we have

$m \to (e \vee p)$

2. Use identities to prove De Morgan's law for 3 propositions:

$$\neg(p \wedge q \wedge r) = (\neg p) \vee (\neg q) \vee (\neg r).$$

Sol:

$\neg(p \wedge q \wedge r) \equiv \neg((p \wedge q) \wedge r)$

$\equiv \neg(p \wedge q) \vee \neg r$ by De Morgan's law

$\equiv \neg p \vee \neg q \vee \neg r$ by De Morgan's law.

3. Show that $(p \to r) \vee (q \to r)$ and $(p \wedge q) \to r$ are logically equivalent.

p	q	r	p→r	q→r	(p→r)∨(q→r)	(p∧q)	(p∧q)→r
T	T	T	T	T	T	T	T
T	T	F	F	F	F	T	F
T	F	T	T	T	T	F	T
T	F	F	F	T	T	F	T
F	T	T	T	T	T	F	T
F	T	F	T	F	T	F	T
F	F	T	T	T	T	F	T
F	F	F	T	T	T	F	T

Since $(p \to r) \vee (q \to r)$ has the same truth values of $(p \wedge q) \to r$, they are equivalent.