

## 201801 Math 122 [A01] Quiz #1

#V00: \_\_\_\_\_

Name: Key

This quiz has 2 pages and 6 questions. There are 15 marks available. The time limit is 25 minutes. Math and Stats standard calculators are allowed, but not needed. Except where explicitly noted, it is necessary to show clearly organized work in order to receive full or partial credit. Use the back of the pages for rough or extra work.

1. [2] Use the blank to indicate whether each statement is **True (T)** or **False (F)**.

F If  $p \wedge q$  is false, then  $p \vee \neg q$  is true.

T If  $q$  is true, then  $\neg p \rightarrow q$  is true.

T The negation of  $p \rightarrow q$  is logically equivalent to  $p \wedge \neg q$ ,

F There are truth values for  $p$  and  $q$  so that statements  $p \leftrightarrow q$  and  $p \vee q$  are both false.

2. Let  $p, q, r$  be the statements  $p$ : "Henrik is in the penalty box",  $q$ : "the penalty is for hooking",  $r$ : "the penalty is for holding". For the statement  $p \rightarrow (q \vee r)$ :

- (a) [1] write the the converse in English;

If the penalty is for hooking or the penalty is for holding, then Henrik is in the penalty box.

- (b) [1] write the contrapositive in English;

If the penalty is not for hooking and the penalty is not for holding, then Henrik is not in the penalty box.

- (c) [1] write the statement "If Henrik is not in the penalty box, then the penalty is not for hooking and the penalty is not for holding" in symbolic form.

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

- (d) [1] Is the statement in (c) logically equivalent to one the statements in (a) or (b) above? Which one?

Yes: (a); It is the contrapositive of the statement in (a).

3. [1] Let  $e, v$  be the statements  $e$ : "you are at least 18 years old",  $v$ : "you can vote". Write the statement "You must be at least eighteen years old to vote" in symbolic form.

$$v \rightarrow e$$

(being 18 is necessary for voting)

4. [3] Use a truth table to determine whether  $(p \leftrightarrow q) \vee \neg q$  is logically equivalent to  $\neg(\neg p \wedge q)$ . Write a sentence that answers the question based on the information in the truth table.

P	Q	$\neg P$	$\neg Q$	① $p \leftrightarrow q$	① $\vee \neg q$	② $\neg p \wedge q$	$\neg$ ②
F	F	T	T	T	T	F	T
F	T	T	F	F	F	T	F
T	F	F	T	F	T	F	T
T	T	F	F	T	T	F	T

The columns corresponding to the given starts are the same  $\therefore$  They are logically equivalent.

5. [3] Use the Laws of Logic to show that  $\neg q \wedge (\neg p \rightarrow q)$  is logically equivalent to  $(p \wedge \neg q)$ . ^ TYPO!

$$\begin{aligned}
 \neg q \wedge (\neg p \rightarrow q) &\Leftrightarrow \neg q \wedge (\neg \neg p \vee q) && \text{Known LE} \\
 &\Leftrightarrow \neg q \wedge (p \vee q) && \text{Dbl Neg'n} \\
 &\Leftrightarrow (\neg q \wedge p) \vee (\cancel{\neg q \wedge q})^F && \text{Dist \& Known Contra.} \\
 &\Leftrightarrow \neg q \wedge p && \text{Identity}
 \end{aligned}$$

6. [2] Use the blank to indicate whether each statement is True (T) or False (F). No reasons are necessary.

T  $p \vee (p \rightarrow q)$  is a tautology.

F  $p \vee (q \wedge r)$  is logically equivalent to  $(p \vee q) \wedge r$ .

T If  $s_1 \rightarrow s_2$  is false, then  $s_1$  and  $s_2$  are not logically equivalent.

T If  $s_1 \leftrightarrow s_2$  is a contradiction, then so is  $s_1 \wedge s_2$ .