202201 Math 122 [A01] Quiz #1

#V00:_____ Name: _____

There are total of 15 marks available. There are 25 minutes to write the quiz, plus another 5 minutes to upload your answers, so the time limit is 30 minutes. Solutions are due at 9:20 am. After that a late penalty of 2% per minute applies.

You are not permitted to collaborate or communication with anyone in any way; you may not access any "tutoring" or "help" website or any social media in any way. You may use a calculator (you wont need one), and anything available via the course Brightspace pages, including the course notes. You may also use your own notes.

Except where indicated, you must show your work in order to receive full or partial credit.

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

   T If q is true, then $p \to q$ is true.

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

   F A statement and its negation can sometimes have the same truth value.

   T There are truth values for p and q so that the statements $\neg p \wedge q$ and $p \leftrightarrow \neg q$ are both false.

2. [3] Suppose the statement $p \leftrightarrow \neg q$ is true. Find all combinations of truth values for p, q and r so that the statement $\neg(r \vee p) \wedge (q \to r)$ is true.

   If $p \leftrightarrow q$ is true, then p & q have opposite truth values.

   If p is true, then $\neg(r \vee p)$ is false and the given stmt is false.

   If p is false then q is true. Statement r must be false for $\neg(r \vee p)$ to be true, but then $q \to r$ is false, and the given stmt is false ∴ There are none.

3. [3] For the statement "*If a is odd and b is even, then $a + (a \times b)$ is even*", write in English the

   Converse:

   If $a+(a\times b)$ is even, then a is odd and b is even

   Contrapositive:

   If $a+(a\times b)$ is odd, then a is even or b is odd

   Negation:

   The number a is odd, the number b is even, and $a+(a\times b)$ is odd.

4. [2] Use the statements

$$p\text{: } \textit{Gary cycles}, \quad q\text{: } \textit{it is raining}, \text{ and } r\text{: } \textit{Gary gets wet}$$

to write each statement in symbolic form.

(a) Gary cycles and gets wet when it is raining.

$q \to (p \wedge r)$

(b) In order for Gary to get wet it must be raining.

$r \to q$

5. [3] Are the statements $p \to (p \to q)$ and $(p \to q) \to q$ logically equivalent? Write a sentence to justify your conclusion.

No. For example if p & q are both false, then $p \to (p \to q)$ is true and $(p \to q) \to q$ is false.

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

F $(p \vee q) \wedge (\neg p \vee \neg q)$ is a contradiction.

T $\neg(\neg p \to \neg q)$ is logically equivalent to $\neg p \wedge q$.

T If s_1 is logically equivalent to s_2, then $\neg s_1$ is logically equivalent to $\neg s_2$.

T $p \vee \neg q$ is logically equivalent to $q \to p$.