

HOMEWORK 1
MATH 3345 – AUTUMN 2022 – KUTLER

Please complete the following problems on your own paper. Solutions should be written clearly, legibly, and with appropriate style.

1. **[Falkner Section 2 Exercise 1]** Let P and Q be logical sentences. Prove the second DeMorgan Law

$$\neg(P \vee Q) \text{ is logically equivalent to } \neg P \wedge \neg Q$$

in two ways:

- (a) By means of a truth table;
 - (b) By means of an explanation in words.
2. Let P , Q , and R be logical sentences. Show by means of a truth table that the sentence $P \wedge (Q \vee R)$ is not logically equivalent to the sentence $(P \wedge Q) \vee R$.

Practice Problems

It is strongly recommended that you complete the following problems. There is no need to write up polished, final versions of your solutions (although you may find this a useful exercise). Please do not submit any work for these problems.

1. Explain why the sentence

“This sentence is false.”

is not a logical sentence.

2. For each sentence below, describe (in interval notation) the set of real numbers x for which the sentence is true.

- (a) $(x > 1) \wedge (x < 3)$
- (b) $(x > 1) \vee (x < 3)$
- (c) $\neg((x > 1) \wedge (x < 3))$
- (d) $(\neg((x > 1) \wedge (x < 3))) \vee ((x < 2) \wedge (x > 1))$.

For example, the sentence $(x \geq 0) \wedge (x < 5)$ is true for exactly the real numbers x in the half-open interval $[0, 5)$.

You may have to write your answer as a union of intervals.