Name: *Caleb McWhorter — Solutions*
MATH 308
Fall 2022
HW 1: Due 09/08

"I mean not homework. It's not work if you love it."
–Alex Dunphy, Modern Family

Problem 1. (10pt) Determine if each of the following are propositions. If the example is a proposition, state its truth value with a brief justification. If the example is *not* a proposition, briefly explain why:

(a) Have you been watching 'The Rings of Power'?

(b) $|9 - 17| > 10$

(c) $x^2 + x - 2 = 0$

(d) The novel *Ulysses* was written by James Joyce.

(e) The sixth digit of e is 1.

Solution.

(a)

(b)

(c)

(d)

(e)

Problem 2. (10pt) For each of the following, either define appropriate primitive propositions (using P, Q, R, etc.) and write the 'statement' using logical connectives, or give an English sentence for the given primitives and 'translate' the logical 'sentence' into an English sentence:

(a) Either he is lying and isn't coming, or we are at the wrong place.

(b) $(P \wedge \neg Q) \rightarrow R$

(c) If you exercise and eat healthy, then you will live a long life.

(d) $P \vee (\neg P \wedge Q)$

Solution.

(a)

(b)

(c)

(d)

Problem 3. (10pt) Consider the following compound statement: $(P \vee \neg Q) \to (\neg P \wedge Q) \vee \neg Q$

(a) Determine whether the given compound statement is a tautology. Be sure to justify your response.

(b) Using a truth table, show that the *negation* of the given compound statement is logically equivalent to $P \wedge Q$.

(c) Show that the *negation* of the given compound statement is logically equivalent to $P \wedge Q$ by simplifying the given compound statement.

Solution.

(a)

(b)

(c)

Problem 4. (10pt) Consider the statement, "if $x = 3$, then $x^2 = 9$."

(a) Determine the truth value of this statement with an explanation.

(b) Rewrite the given statement by defining appropriate primitive propositions and logical connectives.

(c) Find the negation, converse, and contrapositive of your result from (b).

(d) Rewrite your answers from (c) as English sentences. Then determine the truth value, with explanation, of each of the statements.

Solution.

(a)

(b)

(c)

(d)