Give 5 homework problems on truth tables using and, or and not operators

1. Simple Combinations:

- **Problem:** Construct truth tables for the following logical expressions:
    - `A AND (NOT B)`
    - `(A OR B) AND (NOT A)`
    - `NOT (A AND B)`
- **Instructions:** Create a truth table with columns for `A`, `B`, and the resulting expression. Fill in all possible combinations of True/False for `A` and `B`, and then evaluate the expression for each row.

2. Equivalence:

- **Problem:** Show that the following two expressions are logically equivalent by constructing their truth tables:
    - `NOT (A OR B)`
    - `(NOT A) AND (NOT B)` (This is one of De Morgan's Laws)
- **Instructions:** Create truth tables for both expressions with columns for `A`, `B`, and the result of each expression. If the output columns for both expressions are identical, they are equivalent.

3. Implication:

- **Problem:** In logic, `A implies B` is often represented as `(NOT A) OR B`. Construct a truth table for `(NOT A) OR B` and analyze the results. When is this expression False?
- **Instructions:** Create a truth table with columns for `A`, `B`, and `(NOT A) OR B`. Pay close attention to the rows where the expression evaluates to False.

4. Truth Table to Expression:

- **Problem:** Given the following truth table, find a logical expression using `AND`, `OR`, and `NOT` that produces this output:

  | A | B | Output | |---|---|---| | True | True | False | | True | False | True | | False | True | True | | False | False | False |

- **Instructions:** Analyze the table to identify the conditions under which the output is True. Use `AND`, `OR`, and `NOT` to combine `A` and `B` to match these conditions.

5. Circuit Analysis:

- **Problem:** A simple logic circuit has two inputs, `A` and `B`, and one output. The output is True only when `A` is True and `B` is False.
    - Draw a simple diagram of this circuit using AND, OR, and NOT gates.
    - Construct a truth table to represent the circuit's behavior.
- **Instructions:** Think about how to combine the gates to achieve the desired output. Use the truth table to verify that your circuit produces the correct output for all input combinations.

These problems will give you practice in constructing truth tables, understanding logical equivalence, analyzing logical expressions, and relating truth tables to logic circuits.