Write out proofs of the following using the rules of $\mathcal{F}$. Do not cite Taut Con. Turn in your proofs to your preceptor’s mailbox in 1879 Hall.

1. \[ \neg(A \rightarrow B) \]
   \[ \begin{array}{l}
   A \\
   A \land \neg B
   \end{array} \]

2. \[ (A \lor B) \rightarrow \neg A \]
   \[ \begin{array}{l}
   \neg A
   \end{array} \]

3. \[ (A \rightarrow A) \rightarrow B \]
   \[ \begin{array}{l}
   (\neg B \land \neg C) \lor D
   \end{array} \]
   \[ \begin{array}{l}
   D
   \end{array} \]

For the next two problems, you can use DeMorgan’s equivalences as if they were rules of $\mathcal{F}$. Whenever you use one of these equivalences, cite “DeMorgan’s” plus the appropriate line number.

4. \[ A \rightarrow (B \lor \neg C) \]
   \[ \begin{array}{l}
   C \rightarrow (\neg B \lor D)
   \end{array} \]
   \[ \begin{array}{l}
   (A \land C) \rightarrow \neg D
   \end{array} \]
   \[ \begin{array}{l}
   \neg A \lor \neg C
   \end{array} \]

5. \[ (A \rightarrow B) \lor (\neg A \rightarrow C) \]