CIS1910 Discrete Structures in Computing (I)
Winter 2019, Lab 8 Notes

Here are recommended practice exercises on rules of inference and common proof methods. Many of these exercises have been covered in Lab 8. For proofs by induction, see Lab 9. Note that the examples and exercises listed in blue come from the following textbook:
"Discrete Mathematics and Its Applications," by Rosen, Mc Graw Hill, 7th Edition

Rules of Inference
Examples 12 and 13, and Exercises 7, 9, 13, 27 and 29 from Section 1.6 of the textbook

Direct Proofs
Example 2, Definition 2 and Example 7, as well as Exercises 1, 5 and 7 from Section 1.7

Proofs By Contraposition
Examples 3 and 4, and Exercises 13, 15 and 17a from Section 1.7

Proofs By Contradiction
Examples 11 and 9, and Exercises 9 and 17b from Section 1.7

Proofs of Biconditional Statements
To prove a biconditional statement $p \leftrightarrow q$, show $p \rightarrow q$ and $q \rightarrow p$.
The validity of this approach is based on the fact that $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$.
Exercise 27 from Section 1.7

Proofs of Equivalences
You may be asked to show that three propositions (or more) p, q and r are ***equivalent***, i.e., that $p \leftrightarrow q$, $q \leftrightarrow r$ and $p \leftrightarrow r$. To do that, you only need to show $p \rightarrow q$, $q \rightarrow r$ and $r \rightarrow p$. Indeed, if $p \rightarrow q$ and $q \rightarrow r$ are true, then $p \rightarrow r$ must be true (according to the hypothetical syllogism); if $q \rightarrow r$ and $r \rightarrow p$ are true then $q \rightarrow p$ must be true; etc.
Example 13, and Exercises 31, 33 and 41 from Section 1.7

Existence and Uniqueness Proofs
Exercises 9, 11, 13, 15 and 35 from Section 1.8

Other
Examples 14 and 15 from Section 1.7
Example 4 and Exercises 3, 7, 17, 29 and 31 from Section 1.8