Deductive Reasoning

- Using logic from given statements to form a conclusion

- 2 Rules of Inference
  1) Law of Detachment (Modus Ponens → "the way that affirms by affirming")
     - If $p \to q$ is true + p is true, then q is true

$$\frac{\begin{array}{l} p \to q \\ p \end{array}}{q}$$

EX → If a person lives in Williamsburg, then they live in Kentucky
George lives in Williamsburg

George lives in KY

2) Law of Syllogism (Transitive Property)

- If $p \to q$ is true & $q \to r$ is true, then $p \to r$ is true

$$\begin{array}{l} p \to q \\ q \to r \\ \hline p \to r \end{array}$$

(*) Cannot write as biconditional b/c converse isn't always true

EX → If a figure is a rectangle, then it has 4 sides
If a shape has 4 sides, then it is a quadrilateral

If a figure is a rectangle, then it is a quadrilateral

EX → If you score more points than the other team, you win the game
If you score more points than the other team, you rise in the standings

→ hypotheses same → can't use LoS

BONUS

5) Law of Contrapositive (Modus Tollens → "The way that denies by denying")

- b/c contrapositive & its conditional statement have the same truth value, we can make inferences using the contrapositive ($\sim q \to \sim p$)

$$\begin{array}{l} p \to q \\ \sim q \\ \hline \therefore \sim p \end{array}$$

Ex → If you live in W'burg, then you live in KY
George does not live in KY

∴ George doesn't live in W'burg

- Fallacies (Faulty Logic)
  - Affirming the Consequent → inferring converse

$$\frac{\begin{array}{l} p \to q \\ \quad q \end{array}}{p}$$ (Converse not always true)

  - Denying the antecedent → inferring inverse

$$\frac{\begin{array}{l} p \to q \\ \sim p \end{array}}{\sim q}$$ (Inverse not always true)

HW: p. 110 → 6-17, 19-24