3. w: “Randy works hard.” d: “Randy is a dull boy.” j: “Randy will get the job.”
   1) \( w \) Hypothesis
   2) \( w \rightarrow d \) Hypothesis
   3) \( \therefore d \) 1), 2) Modus Ponens
   4) \( \overline{d} \rightarrow \overline{j} \) Hypothesis
   5) \( \overline{\overline{j}} \) 3), 4) Modus Ponens

5. “All men are mortal.” \( \forall x, \text{if } x \text{ is a man, } x \text{ is mortal.} \) This allows us to state:
   “If Socrates is a man, Socrates is mortal.”
   “Socrates is a man.” Is hypothesis.
   Therefore [by Modus Ponens], Socrates is mortal.
   Note: a more formal analysis would use predicates: \( H(x) : \text{“}x\text{ is a man.”} \) \( D(x) : \text{“}x\text{ is mortal.”} \)

7. a) \( D(x) \) : “I took the day \( x \) off.” \( r \) : “It rains.” \( s \) : “It snows.”
   1) “If I take the day off, it either rains or snows.” \( \forall x, D(x) \rightarrow (r \lor s) \)
   2) “I took Tuesday off or I took Thursday off.” \( D(\text{Tuesday}) \lor D(\text{Thursday}) \)
   3) “It was sunny on Tuesday.” May be interpreted to mean
   “It did not rain or snow on Tuesday.”
   4) “It did not snow on Thursday.”
   5) \( \therefore \text{“}I \text{ did not take off Tuesday.”} \) by Modus Tollens using 3) & 1) with \( x = \text{Tuesday}. \)
   6) \( \therefore \text{“}I \text{ took Thursday off.”} \) by Disjunctive Syllogism using 5) & 2).
   7) \( \therefore \text{“}I \text{ rained or snowed on Thursday.”} \) by Modus Ponens using 6) & 1): \( x = \text{Thursday}. \)

11. a) Define predicates \( S(x) : \text{“}x\text{ is a student in this class.”} \) \( L(x) : \text{“}x\text{ understands logic.”} \)
   1) “All students in this class understand logic.” : \( \forall x, S(x) \rightarrow L(x) \)
   allows us to state: “If Xavier is a student in this class, Xavier understands logic.”
   2) “Xavier is a student in this class.” : \( S(\text{Xavier}) \)
   3) “Therefore, Xavier understands logic.” : by Modus Ponens using 1) and 2).

13. b) “The number \( \log_2 3 \) is irrational if it is not the ratio of two integers. Therefore, since
   \( \log_2 3 \) cannot be written in the form \( a/b \) where \( a \) and \( b \) are integers, it is irrational.”
   This is the fallacy of “begging the question” or circular reasoning, because it a assumes
   the conclusion “\( \log_2 3 \) is irrational” with no proof that it cannot be written in the form \( a/b \).