Symbolic notation:
1. Define the following symbols.
   - $a \rightarrow b$
   - $\sim c$
   - $d \leftrightarrow e$
   - $\therefore g$
   - $a \cup b$
   - $c \cap d$
   - $a \land b$
   - $c \lor d$

2. Consider the following legend:
   - Let $p = $ You love bananas.
   - Let $q = $ You are a monkey’s uncle.
   - Let $r = $ Your nephew is a chimp.

   Express the following in words.
   - $q \rightarrow p$
   - $\sim r \rightarrow \sim p$
   - $q \leftrightarrow r$
   - $q \land p$

Inductive Reasoning:
Write a counterexample, if possible:
3. All Park View students do not go to school in the summer.

4. Park View football has 2 home games every year.

5. If you multiply a number by itself, the answer is always non-negative.

Analyzing conditional statements
6. For the following statement, do each of the following:
   - Write the sentence as a conditional statement in if-then form in words.
   - Write the inverse, converse and contrapositive in words.
   - Write all the statements using symbolic notation.

   “All Park View students will graduate.”
   - Conditional: _____________________________ Symbolic: ________
   - Inverse: _____________________________ Symbolic: ________
   - Converse: _____________________________ Symbolic: ________
   - Contrapositive: _____________________________ Symbolic: ________
7. Write a statement that you know is true, but whose converse is not always true. Then write its converse, inverse, and contrapositive and the symbolic notation for each. State the truth value (whether it’s true or false) for each.

Conditional: __________________________________________________ True/False: ________
Inverse: _____________________________________________________   True/False: ________
Converse: ___________________________________________________   True/False: ________
Contrapositive: ________________________________________________ True/False: ________

8. State the (a) converse, (b) inverse, (c) contrapositive of the following statement
“If today is Monday, then tomorrow is Tuesday”

(a) converse: _________________________________________________________________

(b) inverse: __________________________________________________________________

(c) contrapositive: ____________________________________________________________

(d) Can we write the biconditional of the statement from the problem above? Why or why not? If so, write it.________________________________________________________________________
________________________________________________________________________

9. Rewrite the biconditional statement as a conditional statement and its converse.

“The game is cancelled if and only if it rains.”

Conditional Statement:_________________________________________________________

Converse:____________________________________________________________________

Use Venn diagrams to represent set relationships:
In #10-13, draw a Venn diagram for the following statements.

10. There are some students in Park View that are in the Band and are on the Football Team.

11. There are no students at Park View that are on both the Wrestling team and the Basketball team.
12. A Park View Student might be a member of the marching band and the Chorus.

13. There are some students at Park View that play football, basketball, and baseball, some that just play one sport, and some that play two of the sports.

14. Write a statement that is true according to the Venn diagram.

15. Write a statement for the shaded part of the following Venn diagram.

16. Shade the region for the following statements:

   - The union of A and C
   - The intersection of A and B and C
   - \((A \cup B) \cap C\)
   - Some cars are red
Deductive reasoning:

17. Write a conclusion to each group of statements (if possible). State whether your conclusion is based on the Law of Detachment, Law of Syllogism, Law of Contrapositive, or none of these (invalid).

   Virginia is north of Florida.
   You are in Virginia.
   Conclusion: ______________________________________________________
   Law: ________________________________

   Virginia is north of Florida.
   You are north of Florida.
   Conclusion: ______________________________________________________
   Law: ________________________________

   Virginia is north of Florida.
   You are not north of Florida.
   Conclusion: ______________________________________________________
   Law: ________________________________

   If you go to Park View, then you are a Patriot.
   If you are a Patriot, then your mascot wears red, white, and blue.
   Conclusion: ______________________________________________________
   Law: ________________________________

   If you drive 50 miles per hour in a school zone, then you will get a speeding ticket.
   If you get a speeding ticket, then you will pay a fine.
   If you pay a fine, you will be broke.
   If you are broke, then you will not be able to go to the movies.
   Conclusion: ______________________________________________________
   Law: ________________________________

In #18-19, study the argument and decide whether it is “valid” or “not valid.”

18. If a penny has an Indian head on it, it is very old.
   If a penny has an Indian head on it, it is worth more than one cent.
   Therefore, if a penny is very old, then it is worth more than one cent. ________________

19. If you visit Hawaii, then you will walk under coconut trees.
   If you walk under a coconut tree, you will probably be hit on the head.
   Therefore, if you visit Hawaii, you will probably be hit on the head. ________________
20. Assume the following statements are true.
   (a) If Arlo goes to the baseball game, he will buy and eat a hot dog.
   (b) If Mia eats popcorn, then she will become ill.
   (c) If the baseball game is not sold out, then Arlo and Mia will go to the game.
   (d) If Arlo buys a hot dog, then Mia will buy and eat popcorn.
   (e) The baseball game is not sold out.

   Write these premises in an order which makes a valid argument. (You may just write the letters.)
   Then state the conclusion of the argument.

   Logical order: _____________________________________________________

   Conclusion: _____________________________________________________

21. Using the Law of Syllogism, write up a 5 statement argument that will conclude with the following
 statement: “If you feed your dog, then you’ll be able to turn in your homework”.

   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

22. Circle all of the following that allows the conclusion given the true statement.
   “If it is Saturday, then Nina’s family rents movies. Today is Saturday, therefore Nina concludes her family will
   rent movies.”
   (a) Law of Detachment    (b) Law of Syllogism    (c) Law of Contrapositive    (d) Deductive reasoning    (e) Inductive reasoning

23. Circle all of the following that allows the conclusion given the true statement.
   “For the past 4 weeks the ski club has gone skiing on Friday nights. Wendy concludes that the ski club will go
   skiing this Friday.”
   (a) Law of Detachment    (b) Law of Syllogism    (c) Law of Contrapositive    (d) Deductive reasoning    (e) Inductive reasoning

24. Circle all of the following that allows the conclusion given the true statement.
   “If Jimmy works in the afternoon, then he does not play football. If Jimmy plays football, then he did not work
   this afternoon.”
   (a) Law of Detachment    (b) Law of Syllogism    (c) Law of Contrapositive    (d) Deductive reasoning    (e) Inductive reasoning