Conditional Statements and Logical Reasoning

A. Write the negation of each statement.
    1. Two angles are congruent.   2. You are not sixteen years old.

    3. $m\angle B = 85°$ 4. At least one angle is obtuse.

B. For each conditional statement:
    - ❑ Identify the hypothesis and conclusion
    - ❑ Re-write in "if-then" form.
    - ❑ Write the converse, inverse and contrapositive of the statement.
    5. People who live in NY City also live in NY State.

    6. The midpoint of a segment divides the segment into two congruent segments.

    7. All cowboys are from Texas.

    8. Every piece of fruit is an apple.

    9. A square is a rectangle.

    10. Any dogs in the park must be on a leash.

C. For each conditional statement:
- ❑ Write the converse of the statement.
- ❑ Is the statement a bi-conditional statement if yes briefly explain.

11. If a quadrilateral is a parallelogram, then its opposite sides are parallel.

12. If two segments have the same measure, then they are congruent.

13. If two coplanar lines are parallel, then they do not intersect.

14. If two angles are supplementary, then their measures add to $180°$.

D. For questions 14 – 17, study each of the arguments and state whether or not the conclusion is deducible (i.e. does the reasoning allow you to make the conclusion?). If it is not, comment on the error in the reasoning.

15. If a student at North Attleboro High School has room 303 as his or her homeroom, the student is a freshman. Joe is a student at N.A. H. S. and has room 303 as his homeroom. Therefore, Joe is a freshman.

16. If the three angles of a triangle are acute, then the triangle is acute. In triangle ABC, angle A and angle B are acute. Therefore, triangle ABC is acute.

17. All school busses stop at railroad crossings. A vehicle stopped at the Santa Fe railroad crossing. Therefore, that vehicle is a school bus.

18. All cloudy days are depressing. Therefore, since I was depressed on Thursday, Thursday was cloudy.

19. Information is given below about some animals at a zoo. Use this information to match each animal with its name.
    The Bronx Zoo has a green lizard, a red crocodile, and a purple monkey. They are the only animals of their kind in existence. One violently windy Saturday, their name tags blew off, and their keeper's journal was torn to shreds. In as much as they were to appear on television at 7:30 Sunday morning, the night watchman had to replace their name tags. He managed to piece together the following information from the mangled journal.

    a. Wendy does not get along with the lizard.
    b. Katie playfully took a bite out of the monkey's ear one month ago.
    c. Wendy never casts a red reflection in the mirror.
    d. Jody has the personality of a crocodile, but she isn't one.

Answer Key - Conditional Statements and Logical Reasoning

1. Two angles **are not** congruent.
2. You **are** sixteen years old.
3. $m\angle B \ne 85°$
4. **No** angles are obtuse.

5. <u>People who live in NY City</u> also <u>live in NY State</u>.
   If you live in NY City, then you also live in NY State.
   If you live in NY State, then you also live in NY City.
   If you *do not* live in NY City, then you *do not* also live in NY State.
   If you *do not* live in NY State, then you *do not* live in NY City.

6. The <u>midpoint of a segment</u> <u>divides the segment into two congruent segments</u>.
   If a point on a segment is a midpoint, then it divides the segment into 2 congruent segments.
   If a point on a segment divides the segment into 2 congruent segments, then it is a midpoint.
   If a point on a segment is *not* a midpoint, then it *does not* divide the segment into 2 congruent segments.
   If a point on a segment *does not* divide the segment into 2 congruent segments, then it is *not* a midpoint.

7. All <u>cowboys</u> are <u>from Texas</u>.
   If a person is a cowboy, then he is from Texas.
   If a person is from Texas, then he is a cowboy.
   If a person is *not* a cowboy, then he is *not* from Texas.
   If a person is *not* from Texas, then he is *not* a cowboy.

8. Every <u>piece of fruit</u> <u>is an apple</u>.
   If something is a fruit, then it is an apple.
   If something is an apple, then it is a fruit.
   If something is *not* a fruit, then it is *not* an apple.
   If something is *not* an apple, then it is *not* a fruit.

9. A <u>square</u> is <u>a rectangle</u>.
   If a polygon is a square, then it is a rectangle.
   If a polygon is a rectangle, then it is a square.
   If a polygon is *not* a square, then it is *not* a rectangle.
   If a polygon is *not* a rectangle, then it is *not* a square.

10. Any <u>dogs in the park</u> <u>must be on a leash</u>.
    If a dog is in the park, then it must be on a leash.
    If a dog must be on a leash, then it is in the park.
    If a dog is not in the park, then it must not be on a leash.
    If a dog must not be on a leash, then it is not in the park.

11. If a quadrilateral's opposite sides are parallel, then it is a parallelogram.
     A quadrilateral is a parallelogram if and only if its opposite sides are parallel.

12. If two segments are congruent, then they have the same measure.
     Two segments have the same measure if and only if they are congruent.

13. If two coplanar lines do not intersect, then they are parallel.
     Two coplanar lines are parallel if and only if they do not intersect.

14. If the measures of two angles add to $180°$, then they are supplementary.
     Two angles are supplementary if and only if their measures add to $180°$.

15. Yes.

16. No. The triangle could be a right triangle or an obtuse triangle.

17. No. It could be a truck or car stopping at the tracks.

18. No. You can be depressed no matter what the weather is like.

19. Wendy = Monkey;   Jody = Lizard;   Katie = Crocodile