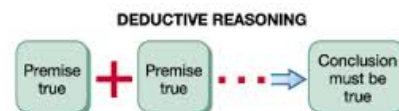## 2.3 Apply Deductive Reasoning

Goal: Use deductive reasoning to form a logical argument.

So, inductive reasoning is when someone unfriends you on Facebook but you know its because his girlfriend is jealous cause he really wants to hook up with you...or is that deductive?

if   all *a* are *b*
and   all *b* are *c*,
then   all *a* are *c*

DEDUCTIVE REASONING

Premise true **+** Premise true **···⇒** Conclusion must be true

---

Deductive Reasoning - use facts, definitions, properties, and laws of logic to form logical arguments

deductive reasoning

The process of using logic to draw conclusions.

Law of Detachment - if the hypothesis of a true conditional is true, then the conclusion is also true

> If A then B.
> A is true.
> Therefore, B is true.

Law of Detachment -

$p \Rightarrow q$

From a true conditional p $\Rightarrow$ q and
a true statement p, you may conclude q

P

$\therefore q$

$\therefore$ therefore

Use the Law of Detachment

Use the Law of Detachment to make a valid conclusion in the true situation.

a. If two segments have the same length, then they are congruent. You know that $BC = XY$.

P Q

$p \Rightarrow q$

P

$\therefore q$

$BC \cong XY$

b. Mary goes to the movies every Friday and Saturday night. Today is Friday.

Mary goes to the movies.

Law of Syllogism - "chain rule"   Law of Transitivity

IF LEFT IS RIGHT, AND RIGHT IS WRONG

If p, then ~~q~~.   if both are true
If ~~q~~, then r.

ISN'T LEFT WRONG?

(then) If p, then r.

If p $\Rightarrow$ q and q $\Rightarrow$ r are true, then p $\Rightarrow$ r is true

$$p \Rightarrow q$$
$$q \Rightarrow r$$
$$\therefore p \Rightarrow r$$

$$p \Rightarrow q$$
$$q \Rightarrow r$$
$$\therefore p \Rightarrow r$$

Use the Law of Syllogism

If possible, use the Law of Syllogism to write a new conditional statement that follows from the pair of true statements.

The order in which the statements are given does not affect whether you can use the Law of Syllogism.

a. If Rick takes chemistry this year, then Jesse will be Rick's lab partner. **p** ... **q**
   If Jesse is Rick's lab partner, then Rick will get an A in chemistry. **q** ... **r**

If Rick takes Chemistry this year then Rick will get an A.

b. If $x > 25$, then $x^2 > 20$. **q** ... **r**
   If $x > 5$, then $x^2 > 25$. **p** ... **q**
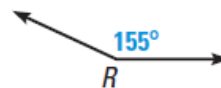
If $x > 5$ then $x^2 > 20$

c. If a polygon is regular, then all angles in the interior of the polygon are congruent. **p** ... **q**
   If a polygon is regular, then all of its sides are congruent. **p** ... **r**

No Conclusion

1. If $90° < m\angle R < 180°$, then $\angle R$ is obtuse. The measure
   of $\angle R$ is 155°. Using the Law of Detachment, what
   statement can you make?

   P   q
   P

   155°
   R

   $\angle R$ is obtuse

2. If Jenelle gets a job, then she can afford a car. If Jenelle can afford a car,
   then she will drive to school. Using the Law of Syllogism, what statement
   can you make?

State the law of logic that is illustrated.

3. If you get an A or better on your math test, then you can go to the movies.
   If you go to the movies, then you can watch your favorite actor.

   If you get an A or better on your math test, then you can watch your
   favorite actor.

4. If $x > 12$, then $x + 9 > 20$. The value of x is 14.

   Therefore, $x + 9 > 20$.

Decide whether *inductive* or *deductive* reasoning is used to reach the conclusion. *Explain* your reasoning.

a. Each time Monica kicks a ball up in the air, it returns to the ground. So the next time Monica kicks a ball up in the air, it will return to the ground.

b. All reptiles are cold-blooded. Parrots are not cold-blooded. Sue's pet parrot is not a reptile.

In 1–3, use both given statements. a. What (if anything) can you conclude? b. What law(s) of reasoning have you used?

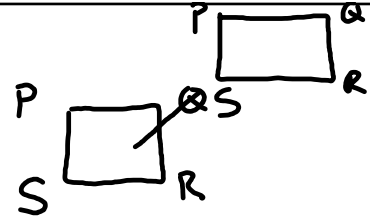1. (1) If a triangle has two congruent sides, it is an isosceles triangle.
   (2) In $\triangle ABC$, $\overline{AB} \cong \overline{BC}$.

   a. <u>$\triangle ABC$ is Isosceles</u>

   b. <u>Law of Detachment</u>

2. (1) If $a = 4$, then $b = 7$.
   (2) If $b = 7$, then $c = 9$.

   a. <u>If $a = 4$ then $c = 9$</u>

   b. <u>Law of Transitivity</u>

3. (1) If quadrilateral *PQRS* is a square, it is also
       a rectangle.
   (2) Quadrilateral *PQRS* is a rectangle.

   a. ___No Conclusion___

   b. _____

**In 4–6, use all the given statements. What
(if anything) can you conclude?**

4. (1) Maria practices the cello on every day whose
       name begins with the letter *T*.
   (2) Today is Thursday.

   ___Maria practices the cello___

5. (1) Sam eats tiramisu every year on his birthday.
   (2) Last Tuesday, Sam ate tiramisu.

   ___No Conclusion___

6. (1) If the Central High Cougars win Friday's game,
       they will win the championship.
   (2) If Jaime pitches for Friday's game, the Cougars
       will certainly win the game.
   (3) Jaime will pitch on Friday night.

   ___Cougars will win the championship___

HW: Worksheet

A Closer Look at Inductive vs. Deductive Reasoning

Stress that inductive reasoning is based on past observations or patterns, while deductive reasoning is based on facts or accepted statements.

Deductive reasoning uses facts, definitions, accepted properties, and the laws of logic to form a logical argument. The Law of Detachment (direct argument) states that if the hypothesis of a true conditional statement is true, the conclusion is also true. The Law of Syllogism (the chain rule) states that if an original hypothesis "a" leads to a conclusion "b", which becomes the hypothesis of the second statement, that leads to a second conclusion "c" and are all true, then the original hypothesis "a" will lead to a true second conclusion "c".