# 1.1 Notes   Using Inductive and Deductive Reasoning to Problem Solve

**Inductive Reasoning**

**Inductive Reasoning** is the process of arriving at a general conclusion based on observations of specific examples. When you try to find the pattern for a list of numbers or visuals, you are using inductive reasoning.

Although inductive reasoning is a powerful method of drawing conclusions, we can never be absolutely certain that these conclusions are true.  For this reason, the conclusions are called **conjectures, hypotheses, or educated guesses.**  A **counterexample** is an example that shows or proves that the conjecture is false.

Ex.1 Each example below shows that the sum of two two-digit numbers is a three-digit number.  Can we conclude that the sum of any two two-digit numbers is always a three-digit number?

$$47 + 73 = 120 \qquad 56 + 46 = 102 \qquad 56 + 80 = 136 \qquad 91 + 48 = 139$$

Ex. 2 Identify a pattern in each list of numbers.  Then use this pattern to find the next number.

a) 3, 12, 21, 30, 39, _____

b) 3, 12, 48, 192, 768, _____

c) 3, 4, 6, 9, 13, 18, _____

d) 3, 6, 18, 36, 108, 216, _____

e) 3, 6, 18, 72, 144, 432, 1728, _____

f) 1, 9, 17, 3, 11, 19, 5, 13, 21, _____

g) 1, 1, 2, 3, 5, 8, 13, 21, _____

h) 23, 54, 95, 146, 117, 98, _____

i) 2, 3, 5, 9, 17, 33, 65, 129, _____

j) 1, 2, 4, _____

k) 1, 4, 9, 16, 25, _____

l)  –5, 3, -2, 1, -1, 0, _____,

* Note: Inductive reasoning can result in different patterns that produce the same result as well as different results.

**Deductive Reasoning** is the process of making conclusions based on previously known facts. A conclusion that is proved to be true by deductive reasoning is called a **theorem**.  Deductive reasoning can be used to prove that some conjectures are true.

Known facts: The sum of the measures of the angles of a triangle is 180 degrees.
          In triangle ABC, the measure of angle A is 50 and the measure of angle B is 70.

Conclusion:

**Inductive and Deductive Reasoning:**

Ex. 5 Consider the following procedure:

Select a number. Multiply the number by 6.  Add 8 to the product.  Divide this sum by 2. Subtract 4 from the quotient.

a) **Inductive Reasoning**: Repeat this procedure for 4 different numbers. Do you notice a pattern between your original number and the result you obtain by plugging that number into the above procedure? Write a conjecture for this pattern.

b) **Deductive Reasoning**: Use the variable $n$ to represent the original number.  Plug $n$ into the procedure above then simplify the expression. Does this agree with your conjecture above?

More Practice:        Consider the following procedures:

1) Select a number.  Add 6 to the number. Triple the sum. Subtract 12 from the product. Divide the difference by 3. Subtract the original number from the quotient.

a) **Inductive Reasoning**: Repeat this procedure for 4 different numbers. Do you notice a pattern between your original number and the result you obtain by plugging that number into the above procedure? Write a conjecture for this pattern.

b) **Deductive Reasoning**: Use the variable $n$ to represent the original number.  Plug $n$ into the procedure above then simplify the expression. Does this agree with your conjecture above?

2) Select a number.  Multiply it by 2.  Subtract 1 from the product.  Multiply the result by 4. Subtract 5 times the original number.  Add 4 to the result.

a)

b)

3)  Select a number.  Multiply it by 6.  Add 6 to the product.  Divide the result by 3.  Subtract the original number from the quotient.

a)

b)

4) Select a number.  Add 3.  Multiply the sum by 2.  Subtract 6 from the product.  Divide the
   result by 2.

a)

b)