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# Inductive Reasoning

Unit 1 Lesson 9

### Students will be able to:

Make conjectures and build a logical progression of statements to explore the truth of their conjectures;

Recognize and use counterexamples

### Key Vocabulary:

Conjecture

Counterexamples

## Inductive Reasoning

**Inductive reasoning** is a type of reasoning in which you look at a pattern and then make some type of prediction based on the pattern.

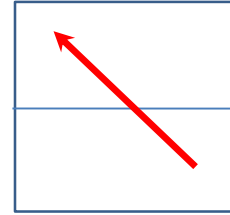
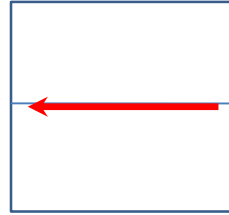
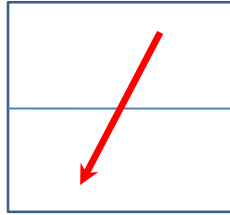
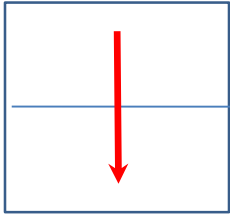
These predictions are also called **conjectures**.

**A conjecture** is a statement about what you think will happen based on the pattern you observed.

## Inductive Reasoning

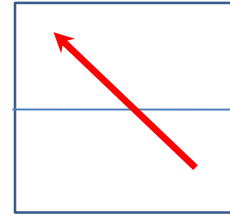
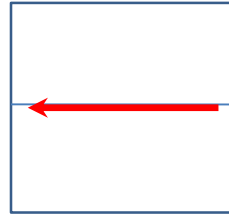
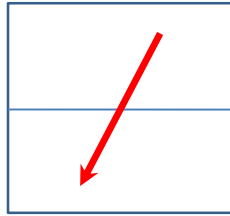
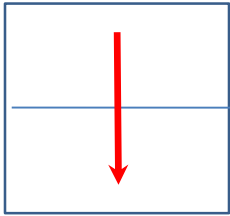
**Sample Problem 1:** Make a conjecture about the next figure in the pattern. Then draw the figure.

a.



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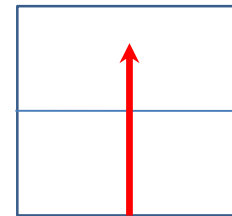
a.



**Observation:**

The direction of the arrow rotates by  $45^\circ$  clockwise each time.

**Conjecture:** Next figure is:



## Inductive Reasoning

**Sample Problem 1:** Make a conjecture about the next figure in the pattern. Then draw the figure.

b.



**Sample Problem 1:** Make a conjecture about the next figure in the pattern. Then draw the figure.

b.



**Observation:** Each next figure has two more triangles than previous.

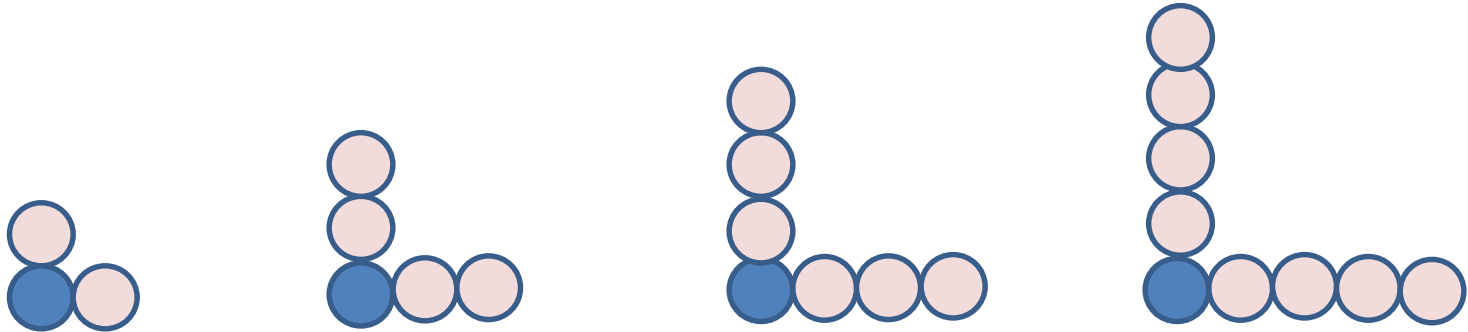
**Conjecture:** Next figure is:



## Inductive Reasoning

**Sample Problem 1:** Make a conjecture about the next figure in the pattern. Then draw the figure.

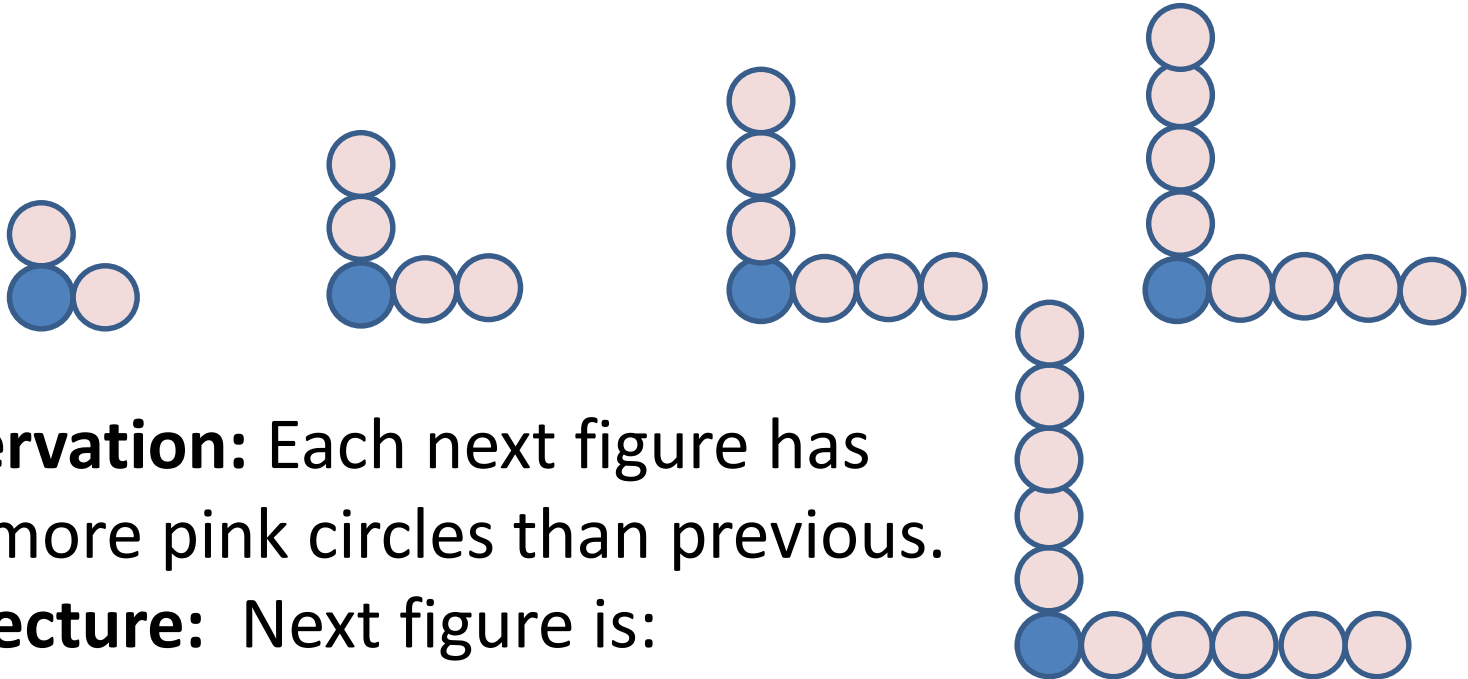
**C.**





**Sample Problem 1:** Make a conjecture about the next figure in the pattern. Then draw the figure.

**c.**



**Observation:** Each next figure has two more pink circles than previous.

**Conjecture:** Next figure is:

**Sample Problem 2:** Write a rule for each number pattern, and find the next number.

a. 3, 7, 11, 15, 19 ... ..

**Sample Problem 2:** Write a rule for each number pattern, and find the next number.

a. **3, 7, 11, 15, 19** ... ..

Start with 3, each number is obtained by adding 4 to the previous number.

$$3 + 4 = 7$$

$$7 + 4 = 11$$

$$11 + 4 = 15$$

$$15 + 4 = 19$$

$$19 + 4 = 23$$

The next number is **23**

**Sample Problem 2:** Write a rule for each number pattern, and find the next number.

b. 1, 2, 4, 8, 16 ... ..

**Sample Problem 2:** Write a rule for each number pattern, and find the next number.

b. **1, 2, 4, 8, 16** ... ..

Each number is two times the previous number.

$$1 * 2 = 2$$

$$2 * 2 = 4$$

$$4 * 2 = 8$$

$$8 * 2 = 16$$

$$16 * 2 = 32$$

The next number is **32**

**Sample Problem 2:** Write a rule for each number pattern, and find the next number.

c. 10, 5, 2.5, 1.25 ... ..

**Sample Problem 2:** Write a rule for each number pattern, and find the next number.

c. 10, 5, 2.5, 1.25 ... ..

Each number is  $\frac{1}{2}$  of the previous number

$$10 * \frac{1}{2} = 5$$

$$1.25 * \frac{1}{2} = 0.625$$

$$5 * \frac{1}{2} = 2.5$$

$$2.5 * \frac{1}{2} = 1.25$$

The next number is **0.625**

## Inductive Reasoning

One way to show that a conjecture is not true is to find a counterexample.

**A counterexample** is an instance in which the conjectured pattern does not work.

Only one counterexample is needed to prove a conjecture false.

A counterexample can be a drawing, a statement, or a number.



**Sample Problem 3:** Find one counterexample to show that each conjecture is false.

- a. The difference between two integers is always positive.

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- a. The difference between two integers is always positive.

**Counterexample:**

$$\begin{aligned} & -7 - 9 = \\ & = -7 + (-9) = \\ & = -16 \end{aligned}$$

**Sample Problem 3:** Find one counterexample to show that each conjecture is false.

- b. All prime numbers are odd integers.

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**Counterexample:** 2 is prime number but it is even.

**Sample Problem 3:** Find one counterexample to show that each conjecture is false.

- c. If the product of two numbers is positive, then the two numbers must both be positive.

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- c. If the product of two numbers is positive, then the two numbers must both be positive.

**Counterexample:**  $-4 * (-5) =$   
 $= -4 * (-5) =$   
 $= 20$

## Sample Problem 4: Find the $n$ term.

a.

$n$	1	2	3	4	5	6	7
$4n - 2$							

## Sample Problem 4: Find the $n$ term.

a.

$n$	1	2	3	4	5	6	7
$4n - 2$	2	6	10	14	18	22	26



## Sample Problem 4: Find the $n$ term.

b.

$n$	1	2	3	4	5	6	7
$5n + 2$							

## Sample Problem 4: Find the $n$ term.

b.

$n$	1	2	3	4	5	6	7
$5n + 2$	7	12	17	22	27	32	37