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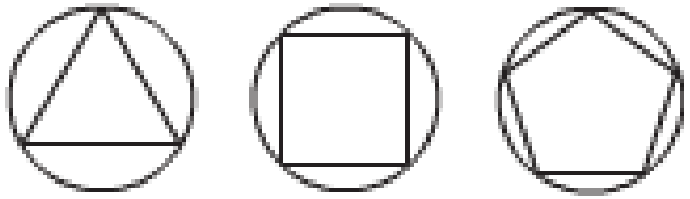
Patterns and Inductive Reasoning

- Inductive reasoning – reasoning based on patterns you observe.
  - You can observe patterns in some number sequences and some sequences of geometric figures to discover relationships.

Finding and Using a Pattern

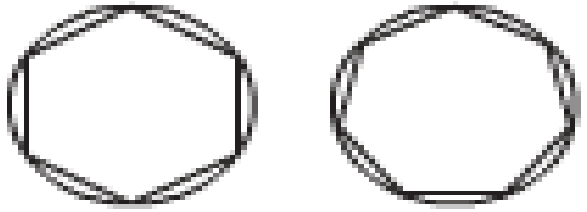
- Look for a pattern. What are the next two terms in each sequence?

  a. 3, 9, 27, 81, …

  b. 

a. Each term is three times the previous term. The next two terms are 81 * 3 = 243 and 243 * 3 = 729.

b. Each circle contains a polygon that has one more side than the preceding polygon. The next two circles contain a six-sided and a seven-sided polygon.



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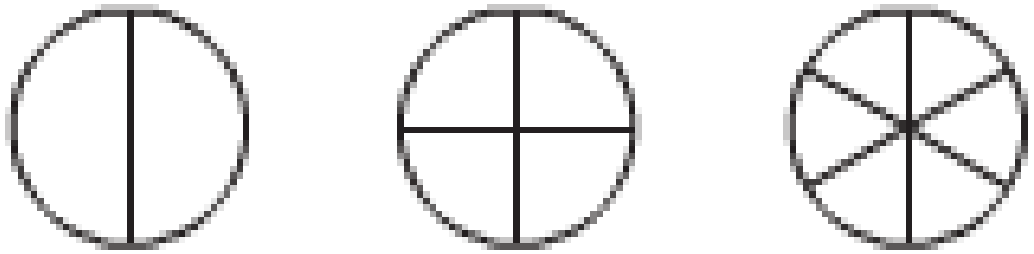
Conjecture

- You may want to find the tenth or the one-hundredth term in a sequence.
  - Rather than find every previous term, you look for a pattern and make a conjecture.
- A **conjecture** – a conclusion you reach using inductive reasoning.

Using Inductive Reasoning

- Look at the circles. What conjecture can you make about the number of regions 20 diameters form?

- Each c  eters. Twenty diame

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Collecting Information to Make a Conjecture

- What conjecture can you make about the sum of the first 30 even numbers?
- Find the first few sums and look for a pattern.

Number of Terms	Sum
1	$2 = 2 = 1 \cdot 2$
2	$2 + 4 = 6 = 2 \cdot 3$
3	$2 + 4 + 6 = 12 = 3 \cdot 4$
4	$2 + 4 + 6 + 8 = 20 = 4 \cdot 5$

- You can conclude that the sum of the first 30 even numbers is 30 * 31 = 390.

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Counterexample

- Not all conjectures turn out to be true.
  - You should test your conjecture many times.
  - You can prove a conjecture is false by finding *one* counterexample.

- A **counterexample** – an example that shows that a conjecture is incorrect.

Finding a Counterexample

- What is a counterexample for each conjecture?

A. If the name of a month starts with the letter J, it is a summer month.

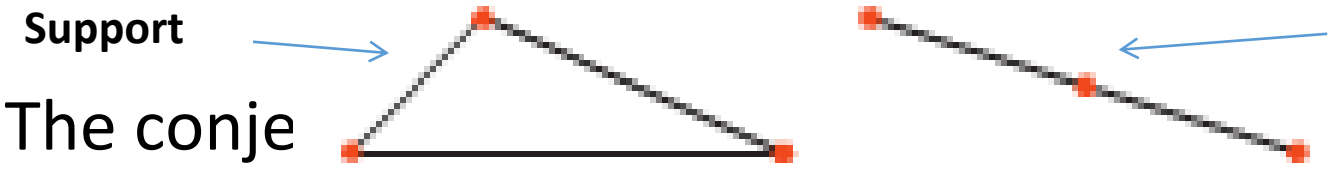
B. You can connect any three points to form a triangle.

C. When you multiply a number by 2, the product is greater than the original number.

Finding a Counterexample

A. Counterexample: January starts with J and it is a winter month.

B. Counterexample: if the three points lie on a line, you cannot form a triangle.



C. The conje but it is false for negati

Counterexample: -4 * 2 = -8 and -8 is not greater than -4.