

2 Types of Reasoning

1. Inductive Reasoning process that includes looking for patterns and making conjectures an unproven statement that is based on observations

Ex. What is the next number in the sequence:

$$\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \dots$$

$$\frac{1}{16}$$

conjecture: multiplying den by 2
rule $\rightarrow \frac{1}{2^n}$

2. Deductive Reasoning

using facts, definitions, and accepted properties in a logical order to prove statements true or false

Conjectures

*Not every conjecture is true \rightarrow unproven/undecided

Ex. Goldbach's Conjecture: every even number can be written as the sum of two primes.

$$4 = 2 + 2$$

$$10 = 5 + 5$$

$$6 = 3 + 3$$

$$8 = 3 + 5$$

proven out to 4×10^{18}

Counterexample: example that shows a conjecture is false

Reasoning Process:

1. look for a pattern
2. make a conjecture
3. verify conjecture (prove for all cases)

Examples:

1. The sum of the first n odd positive integers is n^2 ?

$$n=1 \quad 1 = 1$$

$$n=2 \quad 1+3 = 4$$

$$n=3 \quad 1+3+5 = 9$$

$$n=4 \quad 1+3+5+7 = 16$$

* perfect
squares

$$1^2$$

$$2^2$$

$$3^2$$

$$4^2$$

2. Make a conjecture for the following statement:

The product of two even numbers.

is always even

$$2 * 2 = 4$$

$$4 * 6 = 24$$

$$4 * 10 = 40$$

3. Find a counterexample:

For all real numbers x , the expression x^2 is greater than or equal to x .

$$x = \frac{1}{2}$$

$$\left(\frac{1}{2}\right)^2 = \frac{1}{4}$$

$$\frac{1}{4} \neq \frac{1}{2}$$

2.1 Inductive Reasoning and Conjecture

4. Write a conjecture that describes the pattern in the sequence below. Then use your conjecture to find the next item in the sequence.



3 sides

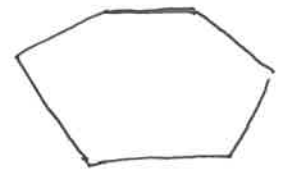


4 sides



5 sides

conjecture: add a side



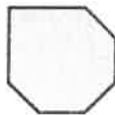
6 sides

Standardized Test Practice

59. Look at the pattern below.



8

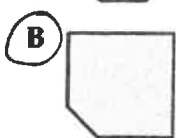


7



6

If the pattern continues, what will be the next shape?



60. GRIDDED RESPONSE What is the value of the expression below if $a = 10$ and $b = 1$?

$$2b + ab \div (a + b)$$

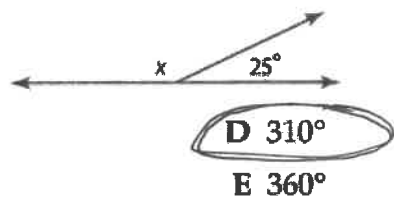
$$2(1) + \frac{10(1)}{(10+1)}$$

$$2 + \frac{10}{11}$$

$$\frac{22}{11} + \frac{10}{11}$$

$$\frac{32}{11}$$

62. SAT/ACT Which of the following is equal to $2x$?



$$x + 25 = 180$$

$$x = 155$$

$$2x = 310^\circ$$