Inductive Reasoning

- Look at specific examples.
- Recognize patterns, which you assume will continue.
- Use the examples to find a general rule.
- We call the general rule a **conjecture** or **hypothesis**.

We use inductive reasoning all the time in everyday life.
Example:

- $1 + 2 = 3$, which happens to equal $(2 \times 3) \div 2$
- $1 + 2 + 3 = 6$, which equals $(3 \times 4) \div 2$
- $1 + 2 + 3 + 4 = 10$, which equals $(4 \times 5) \div 2$
- $1 + 2 + 3 + 4 + 5 = 15$, which equals $(5 \times 6) \div 2$
- $1 + 2 + 3 + 4 + 5 + 6 = 21$, which equals $(6 \times 7) \div 2$
- $1 + 2 + 3 + 4 + 5 + 6 + 7 = 28$, which is $(7 \times 8) \div 2$

You might notice that the answer is always

- the number of things you are adding up
- TIMES
- one more than that
- DIVIDED BY
- 2

Books will tell you that "the sum of the first 'n' natural numbers is $n(n+1) \div 2$".

A trivia question…

Spaces on a roulette wheel are numbered 1 – 36. Gamblers might not feel so lucky if they knew these numbers added up to what value?

- $(36 \times 37) \div 2$

  $1332 \div 2$

  666

NOTE: The conjectures or hypotheses you find through inductive reasoning aren't necessarily always true.

- You found them by **assuming** the pattern would continue, which you can't always say for sure it will.

Counterexample

- A single example that shows a general rule **doesn't** always work.
- Even though a rule might work in most cases, you can't say it's "true" if there is even one counterexample.
- Unless you can find an example for every possible case, you can't actually prove anything will always work with inductive reasoning (but you often can find out all you need to know for practical purposes).

Deductive Reasoning

- Start with general rules you know are always true.
- Use those to **prove** a conclusion.
- The conclusion you prove will **always** be true. It is called a **theorem**.
- It is usually harder to use deductive reasoning than inductive reasoning.

Estimation

- Finding a reasonable, approximate answer.
- You usually want an answer that's "good enough" for whatever purpose you're using it for.\

Steps for Problem Solving

1. Understand the problem.
2. Devise a plan.
    - Inductive reasoning – look for a pattern
    - List, table, or chart.
    - Estimate, and refine
    - Solve simpler problem, and go from there.
    - Use trial & error.
    - Sketch or diagram
    - Look for a "catch"
    - Process of elimination
    - Common sense
3. Carry out the plan, and solve the problem.
4. Look back, and check the answer.