

# Pólya's Problem Solving Method

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## Introduction

George Pólya was a pioneering mathematician whose legacy includes an influential approach to solving problems effectively. In his book *How to Solve It*, he offered a timeless, structured framework that helps learners and thinkers across disciplines tackle complex problems with clarity and logic. This document presents a thoroughly paraphrased and expanded version of his method, focusing on practical understanding and application.

## 1. Grasping the Problem Fully

Before attempting to solve a problem, it is essential to gain a clear and accurate understanding of what the problem is actually asking.

- **Clarify what you're trying to find:** Pinpoint the unknown. What is the core question you need to answer? Understanding this sets a clear target for your efforts.
- **Take inventory of what is given:** Collect and list all the provided facts, data, relationships, and constraints. These are your tools and boundaries.
- **Assess the adequacy of the information:** Is the provided data enough to proceed? Sometimes, conditions are too vague, too restrictive, or even contradictory. Analyzing this helps determine the right direction.
- **Visualize whenever possible:** If the problem involves shapes, positions, quantities, or change over time, drawing a diagram or sketch can reveal hidden patterns and relationships.
- **Rewrite the problem in simpler terms:** Rephrasing in your own words forces you to process and internalize the problem, helping to uncover its structure and make implicit details explicit.

## 2. Creating a Strategy for the Solution

Once the problem is fully understood, the next step is to build a logical bridge from what you know to what you want to find.

- **Link known facts to the unknown:** Consider how the given information can be combined or manipulated to reveal the unknown. Sometimes, intermediate steps or constructs are required.

- **Recall related problems:** Try to remember a similar problem you’ve solved or studied. It might offer a method, pattern, or shortcut that can help.
- **Draw on general mathematical tools:** Think about applicable formulas, identities, principles, or theorems. For example, if you’re dealing with a triangle, properties from geometry might be useful.
- **Break it down:** Divide the problem into smaller parts. Solving a simpler sub-problem might provide insight or a stepping stone toward solving the whole.
- **Consider variations of the problem:** If the original version is too difficult, modify it. Try solving a more specific, general, or analogous version to gain perspective.
- **Experiment with modifying the data or unknowns:** Adjust the values or assumptions temporarily to explore new possibilities. This experimentation can reveal new paths to a solution.

### 3. Putting the Plan into Action

Now that you have a strategy, it’s time to implement it carefully and systematically.

- **Follow the steps with discipline:** Proceed step by step as planned. Stay focused and do not rush.
- **Verify as you go:** After each step, check whether it logically follows from the previous. This prevents error accumulation and helps maintain a correct path.
- **Be adaptable:** If you find that a step leads to a dead end or contradiction, reevaluate the plan. Be willing to backtrack and revise as needed.

### 4. Reflecting on the Outcome

Once a solution has been found, don’t stop there. Take time to review and learn from the experience.

- **Check your solution’s validity:** Reinsert your answer into the original conditions and verify if it makes sense in the full context.
- **Rethink the path you took:** Could there be a more elegant or efficient method? Looking back may improve your technique.
- **Explore alternative methods:** Trying a different approach might deepen your understanding or uncover new insights.
- **Ask what this teaches you:** Identify what principles, tools, or techniques were helpful, and consider where else they might apply.

## 5. Extending the Problem (An Additional Step)

Pólya's framework is enriched by a fifth step: generalization and extension.

- **Generalize the problem:** Can the solution method be applied to a broader class of problems? Try identifying patterns that make this possible.
- **Look for structural insights:** Understanding the underlying structure often reveals why a method works and helps in transferring that method to other contexts.
- **Pose new questions:** What variations or extensions can be derived? Asking "What if...?" opens the door to further exploration and discovery.

## Conclusion

Solving problems is not just about finding answers—it's about developing habits of thought that promote clarity, adaptability, and critical reasoning. Pólya's method encourages a disciplined yet flexible approach, helping us think deeply and work creatively across a wide range of intellectual challenges.