This "mindmap" shows the major steps involved in successfully solving complex problems.

Problem Solving Steps

Comprehending The Problem

- What are you expected to do?
- What is the goal?
- What is to be solved for?
- What concepts, laws, rules, principles are applicable?
- What information is available on inputs, outputs and constraints?
- What assumptions have to be made or inferred?
- Identify conflicting information
- What methods and strategies can be employed to solve the problem?
- What differences and similarities exist with problems in the text or those you have solved before?
- What are the relationships between various elements of the problem?
- Anticipate the form and characteristics of the solution. Single answer, table, plot, etc.
- Do not skip (ignore) words you do not know
- What facts are unstated or implicit?

Formulate The Options

How are you going to do it? Outline the strategy. Write it !!

- What tools, systems, procedures, methods can be used?
- Form relationships in the data
- Think of formulas, definitions, equations, principles that might be relevant
- Determine what else you need to get the answer
- Relate the problem to similar examples from previous work or reading
- Work on a simplified version of the problem
- Work on a portion of the problem
- Guess and answer and try to check it.
- Generate alternatives, brainstorm

Plan The Strategy

- Is this a standard or known problem type?
  - Yes (Go to Step 4)
  - No
- Can the problem be converted to a standard type?
  - Yes (Go to Step 4)
  - No
- Generate alternative ways to solve the problem
  - Review principles involved
  - Hypothesize, visualize
  - Divide the problem up into simpler subproblems
  - Simplify, approximate
  - Eliminate alternatives which will not reach the objective

Execute The Strategy

- Write down the steps in the strategy. Reveal your strategy
- Implement the solution
  - Draw diagram(s) of flows, variables
  - State what the objective is
  - Enter known data on diagram
  - Enter symbols for unknown data on diagram
  - List relevant principles, physical laws
  - List assumptions and inferred conditions
  - Locate missing information
  - Chose a basis
- Work forward until stuck
- Work backward until stuck
- Relax when stuck
- Guess at the solution and attempt to verify the guess
- Review what you have done so far
- Rewrite what you have done striving to be more concise and clear
- Redraw critical sketches
- Review prior steps looking for new insight and understanding
- Whenever you are stuck, identify the obstacle

Evaluate The Solution

- Is the answer reasonable (magnitude, sign, etc)
- Was the solution reasonably accurate
- Consider carrying out a sensitivity analysis
- What errors were made and why? Are you sure the corrections are correct?
- How could you have been more efficient?
- Have all the constraints been satisfied?
- Was the solution obtained in reasonable time?
- What solution strategies worked and did not work?
- Did you answer the question that was asked?
- Did you employ the units specified in the problem?
- Become aware of what skills need improvement

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