

how to solve a problem

four principles

1. *understand* the *problem*
2. after understanding, *make a plan*
3. carry out the plan
4. *look back* on your work, *how could it be better?*

understand the problem

- what are you asked to find or show?
- can you restate the problem in your own words?
- can you think of a picture or diagram that might help you understand the problem?
- is there enough information to enable you to find a solution?
- do you understand all the words used in stating the problem?
- do you need to ask a question to get the answer?

devise a plan

- guess and check
- make an orderly list
- eliminate possibilities
- use symmetry
- consider special cases
- use direct reasoning
- solve an equation

heuristics

- **analogy** - can you find a problem analogous to your problem and solve it?
- **generalisation** - can you find a problem more general than your problem?
- **induction** - can you solve your problem by deriving a generalisation from some examples?
- **variation of the problem** - can you vary or change your problem to create a new problem (or set of problems) whose solution(s) will help you solve your original problem?
- **auxiliary problem** - can you find a subproblem or side problem whose solution will help you solve your problem?
- **specialisation** - can you find a problem more specialised?
- **decomposing** and **recombining** - can you decompose the problem and *recombine its elements in some new manner?*
- **working backward** - can you start with the goal and work backwards to something you already know?
- **draw a figure** - can you draw a picture of the problem?
- **auxiliary elements** - can you add some new element to your problem to get closer to a solution?