

GATES: A Five Step Problem Solving Method

Most math students need to be taught this basic five-step method for solving problems. However, it can be challenging for them to learn to use a method consistently. Often—particularly if they do not enjoy or feel confident doing math—they will try almost anything at random just to get rid of the problem.

You will have to be persistent to get students to regularly use the method when working on problems.

Each of the books we recommend teaches some variation of this method. In *Smart Solutions* it is called the Five-Step Method. However, research shows that students often find a mnemonic device is useful—in this case we use the initial letters of each step to spell the word GATES. Once students have learned the steps, the word will trigger their memory.

The following list outlines the method. On the next page is a student handout sheet to help them learn the method.

1. Grasp the Problem

Obviously the first step to solving a problem is to understand what exactly the problem is. Students often need to be helped to slow down at the beginning in order to be sure they really understand what information they are trying to find. It can be very helpful for them to restate the problem in their own language.

Encourage your students to use scratch paper to help them think through the problem. They may find it useful to draw a little picture or table to help them understand it. For real life problems, they will also need to decide at this point what degree of precision is necessary— $1/16$ th of an inch, one inch, one foot, one mile, or one light year for example.

2. Ask the right questions.

Students need to determine whether they have all the information they need to solve a problem and to eliminate distracting information that is not needed. The GED test includes questions which have as their answer “Not enough information is given.”

3. Think about what steps to take.

This is when students need to figure out HOW to solve the problem. They need to think about what the appropriate procedures are and what order they will need to carry those procedures out in. They may decide they need some help—a calculator or a study sheet of formulas, for example—to help them solve the problem. Finally, they need to set up the problem so that they can easily see and check their work.

4. Estimate an answer

In most cases, students need to have some kind of idea of what a reasonable answer to the problem is—this prevents them from being satisfied with ridiculous solutions (and of course is invaluable for working multiple choice tests.) They can be encouraged to view estimation as a challenge.

5. Solve, check and communicate your answer.

Students need to learn how to use the Solve—Check feedback loop to help them develop confidence in math. It is only when we are sure that we can discover our mistakes and correct them that we feel able to use our answers for important problems. There are many methods of checking work—resolving the problem, doing reverse calculations, etc—but a very important step is to go back to the estimate and see whether the answer is reasonable.

Finally, students should be helped to understand different ways of communicating their answer. In real life situations, this might vary quite a bit.

GATES

Grasp the Problem

- What am I looking for?
- Do I understand the problem?
- Can I put it in my own words?



Ask the right questions.

- What information do I need to know?
- Is all the information here or do I need to get some from somewhere else?
- Do I have information here I don't need?



Think about what procedure to use.

- What procedure should I follow? (Remember the key words for operations.)
- What order do I need to do things in?
- What equations should I set up?
- Do I need to get a study sheet to help me?



Estimate an answer

- About how large (or small) should the answer be? (Use round numbers.)

Solve, check and communicate your answer.

- Solve the problem.
- Does my answer make sense?
(If not, do I need to think some more?)
- Is it close to my estimate?
- Double check your work.
- Did I get the same answer?
- How am I going to communicate my answer?

