

How to study Mathematics

Thinking skills and problem-solving activities are indispensable to every area of our lives. To some extent, we are all problem solvers. The problem solver's work is mostly a tangle of guesswork, analogy, wishful thinking, observing patterns, and frustration. To become a master problem solver may be as inaccessible as acquiring the skills of a virtuoso, but **everyone can become a better, more confident problem solver.**

Study habits. To master mathematical concepts all we need to do is practice, practice and more practice. A steady pace, practice and patience will take you farther than any short cuts. You may have to change your study habits because study habits that were sufficient for success in high school are either inadequate or not good enough for success in university. If you do exercise whose solutions or answers are provided do not look at them before giving at least one honest try to the answer (if there is one), in other words do not give up easily. The process of learning from an exercise starts with the right questions: what do I want to know? What do I have to explain? What do I know about this? What is this exercise saying? What is this exercise testing?

Making your own summaries. At the end of each section make a summary, table, or flow chart of the concepts learned. By looking at your summary you should be able to know what the section is all about, why is important, and what are the strategies and skills needed to solve the problems presented at the end of the section.

Know your textbooks and learning materials. Review all learning materials and take note of the information provided and learn how to use them. Bookmark the recommended websites (if any) and go through links and any other features.

Familiarize yourself with all the learning features of your textbook. Most textbooks provide summaries at the end of sections or chapters, quizzes and review problems. Take note of those you find most useful and faithfully do them. At the university level no all answers to the exercises in a textbook are provided because students are expected that through the course they will develop the ability to know when their work is correct, also with learning comes self-confidence, towards the end of a course students should feel confident about their learning. More importantly professionals need to be able to learn to detect their own mistakes and those of others.

Your textbooks are not a collection of assigned problems; you are expected to understand the course material, and put it to use to solve problems.

Hunting through a section to find a worked out exercise that is similar to the one assigned, is totally inappropriate. Solutions of mathematics problems require understanding of the concepts discussed. Never read mathematics without pencil and paper in hand.

Read the corresponding assigned section before trying the exercises.

You should treat the examples as exercises, and try to solve them without the author's help. Be prepared to check all the details as you read, and above all, read critically. Take nothing for granted.

If you do not understand a statement go back in the section, or to a previous section, to see if you misunderstood something. If you still fail to understand after puzzling over a while, mark the place, continue reading, and ask your tutor for help on that point. You will be asked to do exercises as concepts arise, do them at this precise moment no later; you need to make sure you understand what is presented before going into the next concept. Do not limit yourself to the assigned exercises in the course, try to do as many exercises as you can, do not avoid those that appear to be challenging, the fun in learning is the satisfaction of being able to positively respond to a challenge. The time you have spent in knowing your learning materials will hold you in good stead. It might even save you time in the long run.

Expectations. In high school students are accustomed to the first few weeks of a new course being nothing more than a review of the last course, or even the last few courses. When a new idea is finally presented, the class spends several days working on it before moving ahead. Students quickly learn that there is no major crisis if they do not follow what is said the first time or miss a class. It is repeated soon (and sometimes ad nauseam).

In university, however, there is a brief review (if any) of previous material. From the start you will study something new. Moreover, every subsequent new concept will assume mastery of previous ones and will involve the presentation of new ideas. This is why you have to study, definition by definition, topic by topic, steadily and constantly throughout each one of them. Mathematics cannot be learned on a hurry.

Mastery of the basics is always assumed. For example, to find the solutions of the equation $5x^2 + 6 = 7$, you would expect your high school teacher to write

$$5x^2 + 6 = 7, \text{ hence } 5x^2 = 7 - 6 = 1, \text{ this implies } x^2 = 1/5, \text{ and we conclude that } x = \pm \frac{1}{\sqrt{5}}.$$

In university you will find something like

$$\text{The solutions of the equation } 5x^2 + 6 = 7 \text{ are } x = \pm \frac{1}{\sqrt{5}}.$$

No details are given. If you cannot work out the details, review your basics and make sure you understand the algebraic process. Ask for assistance if necessary. Do not leave it for another day. *Lack of proficiency on the basics is the major cause of students' frustration in mathematics courses.*

Asking for help. You will receive helpful assistance if you clearly articulate your problems and difficulties. Be prepared to give the exact reference where your difficulties lie (source, problem number, page, section, etc.) and indicate what is that you do not understand or why you cannot conclude.

If you do not know where to start, ask yourself why? Review definitions, results and examples that involved the concepts involved in the problem.

Discussing problems and course material with someone can help you to gain insight into difficult concepts. But take warning: others cannot understand the concept for you. It may be tempting to let others do your homework for you, but you will not learn it this way.

You must take the time to learn! It is unwise to pretend that you understand when you do not.