

Pointers for Students of Mathematics

(According to Chris Hay-Jahans)

For most, mathematics is considered to be a difficult subject. While some fields of mathematics truly are very difficult, many students' difficulties in lower-level mathematics courses (calculus and below) are rooted in misconceptions that exist about what is really involved in learning mathematics. Other difficulties are a direct result of uninformed or poor choices made by students.

What most people do not realize is that two simple steps can be taken (by students themselves) to help the majority of struggling students improve their abilities in mathematics:

Step 1: Clear all misconceptions about mathematics.

Step 2: Don't make poor choices when it comes to mathematics courses.

These steps can also help students who do not struggle in lower level courses by raising their skills to a much higher level, and providing them with a sound foundation for later courses.

Some Common Misconceptions

Over the past several years I have taught a variety of mathematics courses to students ranging from extremely weak and/or disinterested to extremely strong and/or enthusiastic. Given below is a short list of misconceptions I have observed, even among strong students. The majority of students in my classes had at least one of the misconceptions listed, many had two or more.

Misconception 1: *The only way to do well in mathematics is to memorize as many formulas and examples as possible.*

More like the Truth:- While memorizing some material does help, it is much more effective to focus on understanding concepts and what drives a particular process. This permits you to learn how to "*think your way through problems,*" a consequence is that you develop skills that will help you do well in mathematics, as well as in any other discipline.

Misconception 2: *For each math problem there is only one way to arrive at the correct answer, and only the final answer matters.*

More like the Truth:- Most mathematics problems can be approached, and worked, from a variety of angles. Among the many "*complete and correct solutions*" to a particular problem there may be one that is more "*elegant*" than the others. Elegance is a good thing to aim for.

Getting the correct answer to a problem is only a small part of "*solving*" a problem. The more important part lies in understanding

what makes the process of arriving at the solution correct. For this reason, work leading to a solution should always be provided in a clear and logical fashion.

Misconception 3: *If students are not taught how to do a problem in class by way of an example, students will be unable to solve a similar problem on homework assignments or exams.*

More like the Truth:- If you begin to “*think your way through problems*” and develop a habit of looking at problems from more than one point of view you will find that most mathematics problems are really “*equivalent problems*” attached to “*a different story.*” Clearing Misconceptions 1 and 2 will generally take care of this misconception.

Misconception 4: *If students are not given a sample exam to study before an examination, they will not be able to prepare for the examination.*

More like the Truth:- Sample exams encourage memorization and discourage students from “*broadening their zone of comfort.*” If you take care of Misconceptions 1 through 3, not having a sample exam will not worry you, and will not hurt your ability to prepare for an exam. Besides, there are usually plenty of problems in textbooks to help prepare for any exam.

Misconception 5: *The only way to learn from the instructor is write down everything he or she writes on the board.*

More like the Truth:- While taking detailed notes can be helpful, this practice can cause you to miss many subtle points that the instructor talks about. What is more helpful is to “*watch and listen.*” If you read the text, work through examples in the text and jot down questions to yourself before each class you will find that you will be able to focus on watching and listening, and be able to follow class discussions much more comfortably. In turn, homework assignments and preparing for exams will be less of a burden.

More importantly, if the instructor asks you to work a problem in class, do so. There is usually a good reason behind asking you to do this, and it is for your benefit to take advantage of such opportunities.

Misconception 6: *A student should avoid asking questions in class as it will only serve to identify her/him as being a weak student.*

More like the Truth:- While it is true that all instructors appreciate disciplined and respectful students, many instructors delight in teaching classes in which students ask questions of the instructor and engage in classroom discussions. Asking questions and engaging in discussions can help broaden your understanding of many difficult concepts and clear some, possibly, simple misunderstandings on important

concepts.

Remember, the only “*dumb question*” is the question that is not asked – if you have a question it is highly likely that someone else has the same question.

Misconception 7: *Every mathematics course is different from others, and the material for each course has to be learned from scratch.*

More like the Truth:- Mathematics courses build on earlier courses, so what was important in MATH 055 can be important and helps in calculus, and higher. Also, as the level of courses increase the level of difficulty increases. Knowing earlier (prerequisite) material makes the content of later courses much more accessible.

Take time to see the connections between what you do in a current course and what was done in a past course. You will be surprised how much “*revisiting of past topics and concepts*” is involved

Misconception 8: *Success in a mathematics course is completely dependent on the instructor.*

More like the Truth:- While a good instructor helps, the final grade earned rests squarely on the students’ shoulders. Self-motivation, discipline, flexibility, openness to learning new ideas, effort and understanding are what determine the final grade.

Misconception 9: *The instructor never makes mistakes and knows all the answers.*

More like the Truth:- Instructors can and do make mistakes and will sometimes not know the answer to a question. Most instructors appreciate it when their students point out a mistake that is made on the board, or in grading, or in discussions. Most instructors will catch their own mistakes, and sometimes even say “duh.” Most instructors also like being asked difficult questions, and if they cannot answer a question they will typically find a satisfactory explanation (from a variety of angles) and get back to it later.

Misconception 10: *There are some people who just cannot learn mathematics.*

More like the Truth:- Some people find mathematics harder than others, but everyone can learn lower level mathematics (at least up through college algebra). It takes discipline, an open mind, and a willingness to learn and put in the needed time.

If a person has misconceptions about mathematics and what is involved in learning it, it is highly likely this person will also make (or has made) some poor choices.

Some Poor Choices

Again, I have observed a large number of students make one or more of the following poor choices. Many students who made one or more of these choices failed the course they were enrolled in. *All* of the students who made one or more of these choices ended up struggling in later mathematics courses.

Poor Choice 1: *Registering for a course without satisfying the course prerequisite.*

Better Choice:- Do not try to take a course you are not ready for. Prerequisites are there for a reason.

Some students have been known to repeat a course up to five times simply because they refused to take the course they were actually placed in.

Poor Choice 2: *Skipping semesters before moving on to the next course.*

Better Choice:- Take all your mathematics courses in sequence until you have completed all courses needed. Do not wait till later, else you might end up not graduating when you planned to.

Mathematics courses are typically sequential in nature (e.g. MATH 054 all the way through to MATH 251). Missing a semester or two between courses may result in you forgetting concepts and good habits you might have learned.

Poor Choice 3: *Not reading the text.*

Better Choice:- Always read the text. Lectures and class discussions are meant to supplement the text, not replace it.

Poor Choice 4: *Not working problems assigned for homework.*

Better Choice:- Always work and hand in homework assignments. Aside from influencing your final course grade, working problems will help identify mistakes and missing conceptual ideas.

Poor Choice 5: *Waiting till the last “minute” to finish homework assignments.*

Better Choice:- Start and complete your homework assignments as early as possible. This will allow you to delve deeper into topics of difficulty, and prepare for upcoming classes. Last minute rushed efforts are bad for two reasons: You will make mistakes; and you will not have time to actually digest what you work on.

Poor Choice 6: *Copying homework from classmates, or having TLC tutors or your instructor work through problems for you to copy without understanding.*

Better Choice:- Do not copy homework from friends or classmates. Besides being unethical, you will learn absolutely nothing and will probably fail exams because of this.

Rather than having tutors work out problems for you, ask them to ask you guiding questions that will allow you to find the answer, or correct methods of solution yourself. One way to strengthen your skills in mathematics is to learn to ask (yourself) good questions. Having tutors or your instructor ask you questions rather than work out a problem is one way to learn how to ask helpful questions of yourself.

Poor Choice 7: *Not working additional problems that are not assigned*

Better Choice:- Work at least a few additional problems. Pick out odd numbered problems and try a few to check if you have grasped concepts.

Poor Choice 8: *Preferring to learn shortcuts rather than details provided in the text or by the instructor.*

Better Choice:- Learn the details provided by the instructor or the text. There is usually a reason for the extra detail; it will be needed in later material.

Poor Choice 9: *Not writing detailed answers/solutions to problems.*

Better Choice:- Always provide adequate detail for every problem you work. This helps the instructor/grader grade your work and provide helpful feedback. Neat and detailed assignments also provide for a good set of useful review material.

Poor Choice 10: *Missing classes regularly.*

Better Choice:- Try not to miss any classes.

There are plenty of studies proving that poor attendance will pretty much guarantee a failing grade – there are exceptions to the rule, but very, very few. If you dislike mathematics, you should try to “*get it out of the way successfully*” as soon as possible. This will make for a much more pleasant college experience.