

STRATEGIES FOR MATH SUCCESS



"Do not worry about your problems with mathematics; I assure you mine are far greater."
Albert Einstein

How is Math Similar to Other Subjects?

1. Math is like learning a foreign language and may require the same kind of devotion to master its symbols and unusual vocabulary.
2. Like playing an instrument, Math requires practice, usually on a daily basis, to perform well.
3. Like English composition, it is a subject that cannot be avoided if you want to complete an Associate degree or transfer to a university.



How is Math Different from Other Subjects?

1. You apply what you've learned to solve a large number of problems that usually require an exact answer.
2. Most of the time you must demonstrate how you got the answer and you are graded on how well you recorded your steps.
3. You need to remember material from the past, including formulas and procedures, in order to learn new material.
4. Math is taught in sequential courses requiring you to build your knowledge and skill over many semesters.
5. You may need to complete a long sequence of courses in Math to complete an Associate degree, transfer to a university in any major, or major in Science Technology Engineering or Math (STEM).
6. You must receive a "C" or better to advance (but a "C" grade may not give you confidence with the next course. "A" and "B" grades are better for future understanding and performance.)

What is Your Math Experience?

Rate your answers from 1 to 5; add them up and check your score below.

(1) = Disagree, (5) = Agree

I cringe when I have to go to math class.	1 2 3 4 5
I am uneasy about going to the board in a math class.	1 2 3 4 5
I am afraid to ask questions in math class.	1 2 3 4 5
I am always worried about being called on in math class.	1 2 3 4 5
I understand math now, but I worry that it's going to get really difficult soon.	1 2 3 4 5
I tend to zone out in math class.	1 2 3 4 5
I fear math tests more than any other kind.	1 2 3 4 5
I don't know how to study for math tests.	1 2 3 4 5
It's clear to me in math class, but when I go home it's like I was never there.	1 2 3 4 5
I'm afraid I won't be able to keep up with the rest of the class.	1 2 3 4 5

CHECK YOUR SCORE:

40-50 Indicates you have a high level of stress about math.

30-39 Math stresses you out.

20-29 You may be moderately stressed out about math.

10-19 You may have little or no stress about math.

Math anxiety is an emotional reaction to mathematics based on a past unpleasant experience which harms future learning. A good experience learning mathematics can overcome these past feelings and success and future achievement in math can be attained.

12 Ways to Improve Math Performance

1. **RELAX!** You are not alone! Everybody gets nervous. Even experienced mathematicians! As Einstein said, "Do not worry about your difficulties in mathematics; I assure you that mine are greater." So relax. You'll be able to concentrate better at your homework if you are comfortable and calm! And admit when you have anxiety! Ignoring it will not help you to manage it.
2. **PRACTICE** a little math everyday, maybe 15-30 minutes. Just reading the text will not help. Treat math like a foreign language. It uses both words and symbols to communicate. If you don't understand its vocabulary or cannot recognize its symbols, then trying to solve a problem will prove difficult. Use flashcards to help familiarize you with its vocabulary and symbols. Try to incorporate it into your daily life (i.e. out shopping, restaurant bill, etc.) and quiz yourself regularly.
3. **ASK** questions. Even if you think it's silly, chances are your other classmates may be thinking the same thing. Take charge of your education and **SPEAK UP!**
4. **STUDY** smart! "Each mind has its own method." Do math in a way that's in your learning style. But be open to other ways as well. Learning other methods will help you to understand the concepts behind math.
5. **ORGANIZE** yourself. Date and number each page of notes. Keep them neatly in a 3-ring binder. Staying organized will help you feel not so overwhelmed. And **NEATNESS** counts! The more frustrated or angry you get, the sloppier your writing becomes and the biggest pitfall of most student is their inability to read their own writing. If you notice your work is getting sloppy, take a breather and come back to it.
6. **REMEMBER** the basics! Math builds on itself. If it has been awhile since your last math course, pick up a textbook from the thrift store, from the library or go online for a quick refresher. There's plenty of math help out there. If you struggled with the last class, you may want to talk to a counselor about repeating it.
7. **GO TO CLASS!** This cannot be stressed enough. Especially if you take a summer or late start math class. You learn the same material in a shorter amount of time. You miss one class you may fall behind. And as before, math **BUILDS** on itself...once you're lost it will be difficult to catch up.
8. **UNDERSTAND** math, don't just memorize. Nervousness affects your memory so don't rely on it. Also, math is more than just numbers and symbols but concepts and theorems as well.
9. **READ** the text as well as practicing the problems. If your math book gives you trouble, try checking out another one from the library. Or try a self-teaching guide which will explain things in simpler terms.
10. **USE** your resources. Study groups, study buddies, instructor office hours, Tutor Center, private tutors, Math Lab, workshops, library, internet, self-teaching guides, etc. there's plenty of help out there and you're not alone!
11. **RESPONSIBILITY** is key. This is your education! Some instructors only focus on theorems and ideas in class and expect the student (**YOU**) to do the problem solving at home. Or the instructor may only go over one problem in class. This means you must make it your responsibility to do homework, **EVEN IF IT IS NOT GOING TO BE COLLECTED!** It is assumed that each student is practicing the application of ideas to problems outside of class. Your successes (and failures) are **YOURS!**
12. **OVERCOME** negativity! You are your own worst enemy, so try to stay positive and establish mantras until you believe them!



Adapted from *Math Study Skills for College Students* by Alan Bass, "Nervous in Numberland" Scholastic Math, "Math! A Four Letter Word" Public Films Inc. & *Ten Ways to Reduce Math Anxiety* by Ellen Freedman

Asking Questions

Don't be afraid to ask questions. **Any** question is better than no question at all (at least your Instructor/tutor will know you are confused). But a **good question** will allow your helper to quickly identify exactly **what** you don't understand.

- Not too helpful comment: "I don't understand this section." The best you can expect in reply to such a remark is a brief review of the section, and this will likely overlook the particular thing(s) which you don't understand.
- Good comment: "I don't understand why $f(x + h)$ doesn't equal $f(x) + f(h)$." This is a very specific remark that will get a very specific response and hopefully clear up your difficulty.
- Good question: "How can you tell the difference between the equation of a circle and the equation of a line?"
- Okay question: "How do you do #17?"
- Better question: "Can you show me how to set up #17?" (the Instructor can let you try to finish the problem on your own), or "This is how I tried to do #17. What went wrong?" The focus of attention is on **your** thought process.
- Right after you get help with a problem, work another similar problem by yourself.

<http://euler.slu.edu/dept/successinmath.html>

The 5 R's of Math

- **R₁** – Recopy your work
- **R₂** – Rework model problems
- **R₃** – Recite aloud to explain each step of the problem solving process
- **R₄** – Recheck your work
- **R₅** – Test for reasonableness – ensure your answer makes sense

REMEMBER: if you are confused, do not wait to get help! The longer you are lost, the more likely you'll stay lost!

"MINDCHATTER"

When the internal thinking of professionals was questioned and recorded by Dr. Arthur Whimbey and Dr. Jack Lochhead, a typical dialogue was similar to the following:

1. "Let me read the question again to be sure what's being asked. I'll circle or underline the question."
2. "Okay. I see, but I'll read it again to be sure."
3. "Slow down. Don't rush."
4. "What is given? What is known?"
5. "How can I diagram, make a chart or draw a visual to help me?"

In all cases, lawyers, doctors, engineers, etc., were painstakingly careful to reread and double check their work.



Mathematical Note Taking Tips

1. Using the Cornell Method (draw a two inch margin in your notebook, and use the left side of the margin for key words and the right side for notes), record each problem step in the **notes** section.
2. Record the reasons for each step in a designated section by using:
 - a. abbreviations
 - b. short phrases not sentences and
 - c. key words, properties principles or formulas
3. Record **key words/concepts (including theorems and formulas)** in the left two-inch margin either during or immediately after lectures by reworking your notes. Copy them EXACTLY as accuracy is key here.
4. Cover up the **notes** section and recite out loud the meaning of the **key words/concepts** that you did not know.
5. Place a check mark by the **key words/concepts** that you did not know.
6. Review the information that you put a check by until it is understood.
7. Develop a **mathematic glossary** to remember **key words, concepts, definitions, terms, diagrams, graphs, formulas, etc..** Create flashcards to help you study these.
8. Write the page number, lecture number and date on each sheet of notes. File work in an organized binder.

Reworking Your Math Notes

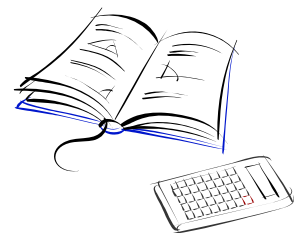
Most forgetting occurs right after learning the material. The following steps should be taken as soon as possible after class to improve your understanding of the lecture:

1. Rewrite the notes that you cannot read or may not understand several days later. You will avoid the frustration of not having this information to help you do your homework.
2. Fill in the gaps. Locate the portions of your notes that are incomplete. Fill in the information that was left out by using your text or reviewing someone else's notes.
3. Place additional key words/concepts in the left hand column. These are key words/concepts not recorded during lecture that are important to mathematics learning.
4. Rework model problems over and over until you can do them without stopping. This is the crucial step that most students overlook. Instead of figuring out what is being taught in the model problem, they jump right into doing homework and end up reworking problems several times!

EXTRA TIP: Before class, review old terms, theorems and formulas referred to in new material. Formulate questions to ask the instructor during class.

HELP WITH READING TEXT

- 1) Briefly preview the material. Get an overview of the content and look at the questions at the end of the chapter.
- 2) Read actively and read to understand thoroughly.
 - a) Formulate questions before (from lecture notes or from previewing) and read to answer those questions.
 - b) Know what every word and symbol means.
 - c) Translate abstract formulas to verbal explanations or graphic representations.
 - d) Analyze the example problems by asking yourself these questions:
 - i) What concepts, formulas, and rules were applied?
 - ii) What methods were used to solve the problem? Why was this method used?
 - iii) What was the first step?
 - iv) Have any steps been combined?
 - v) What differences or similarities are there between the examples and homework problems?
 - e) Further analyze the example problems by using the following procedures:
 - i) Explain each step using your own words. Write these explanations on paper.
 - ii) Draw your own diagrams to illustrate and explain problems.
 - iii) For practice, write down example problems from your books. Close the book and try to work the problems. Check your work with the example to find what concepts, rules, or methods you are having trouble with.
 - f) Check to see how the material relates to previous material. Ask yourself these questions:
 - i) How was the material different from previous material?
 - ii) How was it the same?
 - iii) What totally new concepts were introduced and how were they applied?
 - iv) Where does this material "fit" within the overall structure of the course?
- 3) Stop periodically and recall the material that you have read.
- 4) Review prerequisite material, if necessary.



From Texas State University Student Learning Assistance Center

MATH TEST TAKING TIPS

Before the Test:

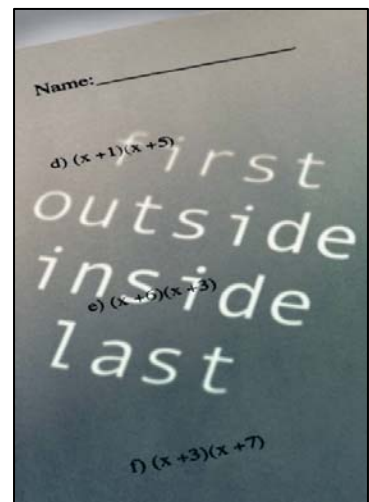


1. **TEST YOURSELF:** Most text have chapter tests at the end of the chapter. Try at least one problem from each section. Go back to the section in the text where you are having the most problems. Go slowly! Reading math text is not like a novel.
2. **DON'T CRAM:** During study sessions you may come up with many questions you would like to ask your instructor. If you cram, you will have no time for this. Study a bit each day and come to class with questions. Ask the instructor about the various types of problems that will be on the test and their differences and similarities.

3. **USE RESOURCES:** Study buddy/group, tutors, math lab, etc.
4. **MATH IS CUMULATIVE:** This cannot be stressed enough. Understand today's material to understand tomorrow's!

During the Test:

1. **GLANCE:** Look over entire test. Get a feel for it.
2. **READ CAREFULLY:** Understand what is asked of you and make sure you do *ALL PARTS* of a problem.
3. **DO EASY PROBLEMS FIRST:** This will build confidence and ensure points! If you struggle with a problem, come back to it later. Concentrate on those problems that are worth more points.
4. **SHOW ALL WORK:** Most instructors give partial credit even if you don't get the correct answer. Never waste time erasing, either. You may end up erasing something that may help you later in the test.
5. **VERIFY:** Does each answer make sense? And if you have time, check your work. Maybe you hit the wrong button on your calculator! Or you read your writing wrong (legibility is imperative!)



Adapted from *Test Taking Tips* by Ellen Freedman & *Math Study Skills*, St. Louis University Math Dept.

Suggestions for Word Problems

1. Read the problem for a general sense of what it is about; sometimes putting it into your own words will help.
2. Then reread it to pick out specific information:
 - a. What you are asked to find? Usually you choose a variable to represent one unknown and other unknowns will be represented in terms of the first.
 - b. What information is given? Make a list, and then organize it into a diagram, picture, or chart.
 - c. What are the relationships among the information given and the information to be found? Sometimes it helps to think of similar problems from arithmetic and the formulas needed there.
3. Translate the information into an equation - get into the habit of doing this for easy problems. The longer problems will not seem as difficult.
4. Solve the equation you have written and label your answer - then find any other quantities to be found.
5. Return to the original problem and check your answer(s). Do they make sense in the original problem and answer the question posed in the problem?

Solving Word Problems

KEY WORDS:

Addition (+): increased by; more than; combined together; total of; sum; added to

Subtraction (-): less than; fewer than; reduced by; decreased by; difference of

Multiplications (*, •, x, 5y, xy): of; times; multiplied by

Division (/ , ÷): per; a; out of; ratio of; quotient of; percent (divide by 100)

Evaluating Algebraic Expressions

P.E.M.D.A.S.

Parenthesis / Exponents/ Multiplication / Division / Addition / Subtraction

1. Perform operations inside parenthesis first
2. Then exponents
3. Then multiplication and division (**left to right**)
4. Then addition and subtraction (**left to right**)

You can also create a little phrase to memorize the sequence: **Please Excuse My Dear Aunt Sally.**

Golden Rule of Studying: For every ONE hour of class time, spend TWO hours studying!

RELAXATION

A Positive Response to Stress & Tension

The Relaxation Process Includes Four Stages:

1. Deep Breathing
2. Cognitive Muscle Relaxation
3. Visualization or Imagery
4. Awakening State

A simple relaxation exercise at your desk

1. Sit straight up in your chair, feet flat on the floor, hands resting in your lap face up and with your eyes closed.
Let the noise in the room pass through your mind but don't focus on it. Let it go.
Take slow deep breathes, in through the nose out through your mouth, feel the air enter and exit slowly. Do this 6 times. Fill your lungs slowly and slowly let the air out. You are slowing down.
2. Starting with your feet, tighten both of your feet, as tight as you can, count to 6 and let go.
Breathe in and breathe out. Move to your calves, then your thighs, your bottom, your stomach, your chest, then your arms and hands. Hold each area tight for 6 counts, then let go. Feel the tingling and relax into it. Pull your shoulders up to your ears and hold for 6 counts and then let go. Scrunch your face up and tighten the top of your head, count to 6, then let go.
Feel the tension leave your body. Relax. Breathe easy.
3. After you have tightened each of your muscles, continue to sit for 3 minutes more breathing gently, letting thoughts pass through and out of your head. Eventually try not to think about anything at all, try to clear your mind of thoughts and just breathe.
4. After 3 minutes slowly bring yourself back into the room and feel the quiet calm throughout your body.



T W E L V E M A T H M Y T H S

1. MEN ARE BETTER IN MATH THAN WOMEN. Research has failed to show any difference between men and women in mathematical ability. Men are reluctant to admit they have problems so they express difficulty with math by saying, "I could do it if I tried." Women are often too ready to admit inadequacy and say, "I just can't do math."
2. MATH REQUIRES LOGIC, NOT INTUITION. Few people are aware that intuition is the cornerstone of doing math and solving problems. Mathematicians always think intuitively first. Everyone has mathematical intuition; they just have not learned to use or trust it. It is amazing how often the first idea you come up with turns out to be correct.
3. MATH IS NOT CREATIVE. Creativity is as central to mathematics as it is to art, literature, and music. The act of creation involves diametrical opposites--working intensely and relaxing, the frustration of failure and elation of discovery, satisfaction of seeing all the pieces fit together. It requires imagination, intellect, intuition, and aesthetic about the rightness of things.
4. YOU MUST ALWAYS KNOW HOW YOU GOT THE ANSWER. Getting the answer to a problem and knowing how the answer was derived are independent processes. If you are consistently right, then you know how to do the problem. There is no need to explain it.
5. THERE IS A BEST WAY TO DO MATH PROBLEMS. A math problem may be solved by a variety of methods which express individuality and originality-but there is no best way. New and interesting techniques for doing all levels of mathematics, from arithmetic to calculus, have been discovered by students. The way math is done is very individual and personal and the best method is the one which you feel most comfortable.
6. IT'S ALWAYS IMPORTANT TO GET THE ANSWER EXACTLY RIGHT. The ability to obtain approximate answer is often more important than getting exact answers. Feelings about the importance of the answer often are a reversion to early school years when arithmetic was taught as a feeling that you were "good" when you got the right answer and "bad" when you did not.
7. IT'S BAD TO COUNT ON YOUR FINGERS. There is nothing wrong with counting on fingers as an aid to doing arithmetic. Counting on fingers actually indicates an understanding of arithmetic-more understanding than if everything were memorized.
8. MATHEMATICIANS DO PROBLEMS QUICKLY, IN THEIR HEADS. Solving new problems or learning new material is always difficult and time consuming. The only problems mathematicians do quickly are those they have solved before. Speed is not a measure of ability. It is the result of experience and practice.
9. MATH REQUIRES A GOOD MEMORY. Knowing math means that concepts make sense to you and rules and formulas seem natural. This kind of knowledge cannot be gained through rote memorization.
10. MATH IS DONE BY WORKING INTENSELY UNTIL THE PROBLEM IS SOLVED. Solving problems requires both resting and working intensely. Going away from a problem and later returning to it allows your mind time to assimilate ideas and develop new ones. Often, upon coming back to a problem a new insight is experienced which unlocks the solution.
11. SOME PEOPLE HAVE A "MATH MIND" AND SOME DON'T. Belief in myths about how math is done leads to a complete lack of self-confidence. But it is self-confidence that is one of the most important determining factors in mathematical performance. We have yet to encounter anyone who could not attain his or her goals once the emotional blocks were removed.
12. THERE IS A MAGIC KEY TO DOING MATH. There is no formula, rule, or general guideline which will suddenly unlock the mysteries of math. If there is a key to doing math, it is in overcoming anxiety about the subject and in using the same skills you use to do everything else.

Source: "Mind Over Math," McGraw-Hill Book Company, pp. 30-43. <http://www.txstate.edu/slac/math/skills/12myths.html>

Student's Math Anxiety Bill of Rights
by Sandra Davis

1. I have the right to learn at my own pace and not feel put down or stupid if I'm slower than someone else.
2. I have the right to ask whatever questions I have.
3. I have the right to need extra help.
4. I have the right to ask a teacher or tutor for help.
5. I have the right to say I don't understand.
6. I have the right to not understand.
7. I have the right to feel good about myself regardless of my abilities in math.
8. I have the right not to base my self-worth on my math skills.
9. I have the right to view myself as capable of learning math.
10. I have the right to evaluate my math instructors and how they teach.
11. I have the right to relax.
12. I have the right to be treated as a competent person.
13. I have the right to dislike math.
14. I have the right to define success in my own terms.