Math Success

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If math is your least favorite subject, STUDY IT FIRST!

We avoid and procrastinate on the subjects we don’t like
Take 5 minutes and “study” (whatever that means to you”) your math notes daily
Make a list of everything you just did in the last 5 minutes
Let’s compare it to my list (according to the researchers)
What does it mean to “study” math?

1. Read the chapter intro and learning objectives first (either online or in hardcopy)
2. Start reading and highlight things that are important to you (if you have the hardcopy)
   - vocabulary words perhaps
3. When you get to examples STOP and go through each step. WRITE DOWN EACH STEP.
What does it mean to “study” math?

Remember: Reading a math textbook can be very difficult. It might take you half an hour to read and understand just one page. Do not skip reading.

4. Mark the concepts and words that you do not know.
5. Take notes from your math book on properties and rules.
What does it mean to “study” math?

6. Add new words to your math glossary. Have a book definition and a definition in your own words.
7. Reflect on what you’ve read.
8. Review your notes and glossary several times a week. 5-10 minutes a day even.
9. Write down anticipated test questions.
What to do if you don’t understand the material

- Re-read the information
- Read ahead to see if that helps to clarify the misunderstanding
- Locate and diagrams, examples, or rules that explain it better
- Read information aloud
- Refer to your notes
- Refer to another book, or video lecture
- Define your misunderstanding and call a study friend
- Contact your tutor or instructor
Time Management

- So when exactly are you going to do all this studying?
- Let’s fill out the Master Plan sheet
Let’s fill out the Weekly Study Goal Sheet

- What hw is due next week for your Math course? Any exams coming up this week?
- When are your assignments due?
- What notes should you be reviewing this week?
- How will you set your goals so that you are pacing yourself rather than cramming assignments or procrastinating?
The nitty-gritty

- Are you sitting in a seat designed for success?
- Where should you sit to optimize success?
- Where should you sit if you have severe math anxiety?

Let’s look at the Seating Diagram!

- Advantages of the P seats?
- Disadvantages of the C seats?
- How can you ensure that you will get a P seat?
Let’s look at some student notebooks!

- Make a list of the things that you thought were good about the notebook
- Make a list of the things that you think were missing in the notebook
- If you felt the notebook could be improved upon, explain how
Note Taking: Active Learning

- Note Header: Topic, Chapter/Readings, Date of class
- Keep a binder with different dividers for
  - Syllabus and other course information
  - Homework problems worked out (spiral notebook)
  - Spiral notebook of notes or loose leaf
  - Exams
  - Other pertinent handouts
Note Taking: Active Learning

- Use a Three-Column System
  - Key words/ topics
  - Outline of Reading
  - Class Notes
Note Taking: Active Learning

- **First:** read the given assignment for the class.
  - Using the text or reading, take notes on this reading in columns 1 & 2 PRIOR to class.
  - Leave enough white space to add information during lecture to complete the note taking on the topic.

- **During class:** use the third column to record the instructor’s emphasis, class discussion, comparisons, etc. This column should record your thinking during the class lecture.
  - This is your active engagement in class.

- **After class:** Review notes. Continue to annotate as you learn more about the topic. For example, star important concepts and draw ?s when you don’t understand.
Take charge of your note taking process. Use it to help you study, not just a way to keep awake in class.

Take charge of your math tests. Use exams as the opportunity to let your professor know what you studied, whether or not you are asked the “right questions.”

Use the internet to support your learning. Decide what is helpful or not for you based upon the subject you are studying and your learning style.
More Notetaking for different subjects

- You should intend to use your notes to study, so they should be legible.
- You will be taking a lot of notes to stay engaged as a learner during a course. Put the class, topic, and date at the top of every page.
- Use separate folders, notebooks, or binder sections for each course.
- For your math class, keep these separate sections:
  - Class notes
  - Homework
  - Glossary of terms and definitions
  - Formulas and equations
  - Practice exam questions (see next slide)

- Course note taking is not a once and done process.
Note-taking as Test Prep

- After every math class, copy any example problems your teacher wrote on the board. Do not include the answer on your practice test, just the problem.
- On a separate page behind the practice test, create a T-note chart for every problem. (See explanation on next slide.) The T-notes will be your answer key.
- Add to your practice test whenever you come across a difficult homework problem or an example in the book that helps you.
- Don’t forget to try your practice exam before the test! It will help you identify your strengths and weaknesses, so that you can get any help you may need.
Use a T-note with problems and processes that you need to understand and remember.

A T-note has the problem example written under the left side of the T and the process used for each step written under the right side of the T.

<table>
<thead>
<tr>
<th>Example</th>
<th>Process to solve</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 = x^2 - 6x + 9$</td>
<td>Steps 1 to 2. Solve a quadratic equation for its zeros. Its form is that of a perfect square with the middle term negative.</td>
</tr>
<tr>
<td>$0 = (x - 3)(x - 3)$</td>
<td>Steps 2 to 3. Same factor is used twice, it becomes the factor squared.</td>
</tr>
<tr>
<td>$0 = (x - 3)^2$</td>
<td>Steps 3 to 4. Solve equation equal to zero by setting one factor equal to zero. Since the factor is used twice, the zero at $x = 3$ has a multiplicity of 2.</td>
</tr>
</tbody>
</table>
Recall 2-3 things important to this topic. Prioritize this list.

Summarize this topic completely in one sentence.

What questions do you still have about this topic?

Connect this topic to previous learning.

How confident are you about this topic?
QUESTIONS? REFLECT. CONNECT IDEAS.
10 Steps to Doing Online Math Homework*

1. Review the textbook material that relates to the homework.
2. Review your lecture notes that relate to the homework.
3. Do your homework as neatly as possible.
4. When doing your homework, write down every step of the problem.
5. Understand the reason for each problem step and check your answer.

6. If you do not understand how to do a problem, refer to these steps:
   - Review the textbook material that relates to the problem.
   - Review your notes that relate to the problem.
   - Review similar problems that explain the concept.
   - Use alternate learning resources: video, animation, etc.
   - Call a study buddy.
   - Skip the problem and get additional assistance from your instructor, tutor, TA, etc.
10 Steps to Doing Online Math Homework

7. Always finish homework by *successfully* completing problems.
8. After finishing the homework, recall to yourself or write down significant learning.
9. Make up note-cards for hard to remember formulas or concepts.
10. Getting behind in math homework is academic suicide!
“I understood it in class, but when I went to do the homework, I was lost”

“I know how to do it, but when I got to the test, I forgot everything”
When you learn information, you store it in your memory at one of these levels:

- **Rote**: Learning the basics.
  - Memorization of terms and formulas
  - Facility with computation

- **Understanding**: Practice and doing homework.
  - Practice problems
  - Homework
  - Reading and comprehending the textbook

- **Analysis**: Success on exams.
  - This level is seeing the whole picture and making connections.
  - Asking the “What if?” questions brings you to this level.
  - Meaning making occurs at this level.
  - Working in groups facilitates analysis development.
  - Thinking critically is performance at the analysis level.
When Memory Breaks Down

- **Short-term memory** will lose information within hours if it is not studied.
- **Working memory** needs information from short-term and long-term memory in order to work.
- **Long-term memory** can lose information if it is not reviewed periodically.
- **Retrieval** (using what you learned) may not be matter if it was stored at the wrong cognitive level.
Elijah came to statistics class ready to take notes but he forgot to outline the chapter first. The teacher talked so fast and used unfamiliar terms, so Elijah could not follow what the teacher was talking about. Elijah worried the class was too tough for him.

- Where did Elijah’s memory break down?
- What should he do differently?
When Leslie studied for her math test, she skipped the chapters that she understood so well that she had tutored other classmates on the homework, but when she took the test, she couldn’t remember the information from those chapters.

Where did Leslie’s memory break down?
What should she do differently?
Jake studied for his math test by memorizing the steps he wrote down in all of his T-notes, but during the test he did not understand how to apply the steps to the exam questions.

Where did Jake’s memory break down?
What should he do differently?
Samantha felt very confident she understood everything in her math class today, so she didn’t worry about reworking her notes. Two days later she could not figure out her homework problems.

Where did Samantha’s memory break down?

What should she do differently?
How do you learn?

Do you think of yourself as...
- Visual Learner prefers
  - Diagrams/pictures
  - Reading/writing
- Audio Learner prefers
  - Hear explanations
  - Use music and rhyme and talk out loud
- Kinetic Learner prefers
  - Hands-on activities
  - Move around while learning
Memorizing the Facts: Start Early

The sooner you know the facts, the sooner you can focus on understanding tough concepts.

Prioritize what you need to know.

- Highlight and color code notes shortly after class
- Immediately rewrite any sloppy handwriting
- Keep separate sections in your binder for keywords, formulas, problem log, and principles or rules.
- Use the textbook’s objectives, key terms, and highlighted boxes to organize what you should be studying, in addition to your class syllabus and notes.
Memorizing the Facts: Note Cards

The more math facts you store in your long-term memory, the better your working memory will function.

Use note cards wisely

- Create note cards throughout every unit – not just at the end
  - They are not just for testing yourself, they are a learning tool!
- Write a phrase on one side and full description on the back
- Can you look at the phrase and explain it in detail out loud?
  - Visualize what the explanation means in math terms.
- Sort cards into three categories:
  - I know well = Review sometimes
  - Sometimes = Keep practicing
  - I don’t know = Ask for help
- Organize cards into “fact clusters” according to relationships
Order of Polynomials

Place terms in descending order of exponents with highest on left to lowest on right, then any constant numbers last.

Visualize:

$4x^3 + 5x^2 + 3x + \text{constant (number)}$

Don’t just glance at the phrase and think that you know what it is. Speaking out loud, explain the term in complete sentences to check that you truly understand and to reinforce it in your memory.
Think of creative ways to remember facts.

- **Mnemonic devices**
  - Please Excuse My Dear Aunt Sally

- **Acronyms**
  - FOIL stands for First Outside Inside Last

When do you need to go beyond memorizing? Always ask yourself the reasoning behind the fact.
Memorizing and reviewing facts will help you store them in your long-term memory, but you will probably need more than definitions to succeed on a math test. When you understand the reasoning behind a concept, it will be easier to apply it to different looking problems.

**FOIL = First Outside Inside Last**
But what is the reason we use FOIL?

$3(2x^2 + x - 5)$

It comes from simple distribution like

$3(3x - 2) (x + 4)$

When you foil below, you are first distributing $3x$ and then you are distributing $-2$.

Now could you solve this one?

$(x + 3) (2x^2 - x + 2)$
Expand to Understand: Add the Textbook to Your Notes

Turn your notes into the best supplemental material you have for the course.

- **Use the textbook to fill in blank or unclear spots**
  - Teacher skip any steps? Unanswered questions? Better examples?

- **Think of the chapter objectives as a checklist**
  - Do your notes cover all the objectives?

- **Translate diagrams, formulas, and problems into words**
  
  \[
  \frac{a}{\frac{1}{b}}
  \]
Your reworked notes should be a mixture of numbers, symbols, diagrams and words.

- Turn any T-notes into flow charts with reasoning
- Speaking out loud, describe all diagrams and examples
- Connect to your own practical applications
- Try to summarize a set of notes into a single mind map

Think about the concepts in different ways.
Expand to Understand: Mind Map of Notes

Example: The Real Number System
Expand to Understand: Practice Reasoning through Problems

Make it a habit to explain your reasoning for every step—write it down or say it out loud. Better yet for your memory, do both!

- Identify the process to solve a problem before you begin
- Don’t spend too much time on a single problem
  - Come back to it later or ask for help
- When you work with a tutor...
  - Make T-notes so you have a reference to use at home
  - Explain your reasoning for every step to the tutor
- Add tough questions to problem log and make it a T-note
- When you are getting most of the problems correct, start asking, “What if...?”
Example: General Strategy for Factoring

- **Common factor?**
  - Yes → **Factor out GCF**
  - No → **Number of terms?**
    - three → **Perfect square?**
      - Yes → **Use perfect square rule**
      - No → **AC method or quadratic formula**
    - four → **Difference of squares?**
      - Yes → **Apply formula**
      - No → **Factor by grouping**
  - two → **Sum or difference of cubes?**
    - Yes → **Apply formula**
    - No → **Prime**
Talking About Math To Ace the Test

Someone who cannot form a sentence about a concept probably doesn’t understand the concept.

Talk with yourself.
What if I added a twist to that problem? How could this problem be asked differently? What are the similarities AND differences?

Talk with your professor.
Imagine yourself having a discussion with your professor about how the new unit relates to your last unit—then go to office hours!

Talk with your classmates.
Leave the calculators at home for one of your study group sessions and try just discussing the objectives in your math book. The conversation may start slow and feel out of place, but it will be worth the extra confidence when you take the math test.

Online Resources
Use resources on the internet.
What to do about math anxiety?

- Like a performer who’s about to make her/his debut, whether it’s on a stage or on a basketball court, treat the test as a chance to “show your stuff”
- For you to show your stuff, you have to actually know your stuff. If you go to class, take meaningful notes, make time to study, and study effectively, that’s half the battle!