

Study Skills Handout

Introduction to Metacognition

While all students know they need to study to learn the material, it is not always clear what is the best way to study. Mathematics is particularly challenging to study for exams, since *there is usually not enough time to rework all homework problems*. Also, what works best for one student may not be as effective for a different student. The purpose of this handout is to cover both note-taking skills and study skills that are best suited for mathematics courses.

To really learn how to learn, ***you have to think about your thinking***. **Metacognition** is the ability to think about one's thinking and to evaluate and change what one is doing and thinking during an experience. The following topics are keys to benefitting from metacognition:

- Reflective learning, how does this relate to what I already know
- "What's the next step" method of studying
- Digging deeper
- Elastic intelligence
- Goal-setting and evaluation of progress



Reflective Learning

Reflective learning is the habit of reviewing what you have learned and trying to organize your thoughts. The following strategies are very effective ways to practice reflective learning:

- Ask questions about your thinking, look for patterns and identify the strategies you use.
- Describe the steps you are taking to complete a task, use your mind's voice, speak the process aloud, write the steps down.
- Become aware of barriers to effective thinking and avoid key tasks at such times (e.g., avoid distractions, don't make key decisions when you are tired).
- Try alternative strategies to stimulate ideas. Draw a picture, type, speak your ideas, use a list or a mind map, use a different color to take notes or for homework, go for a walk.

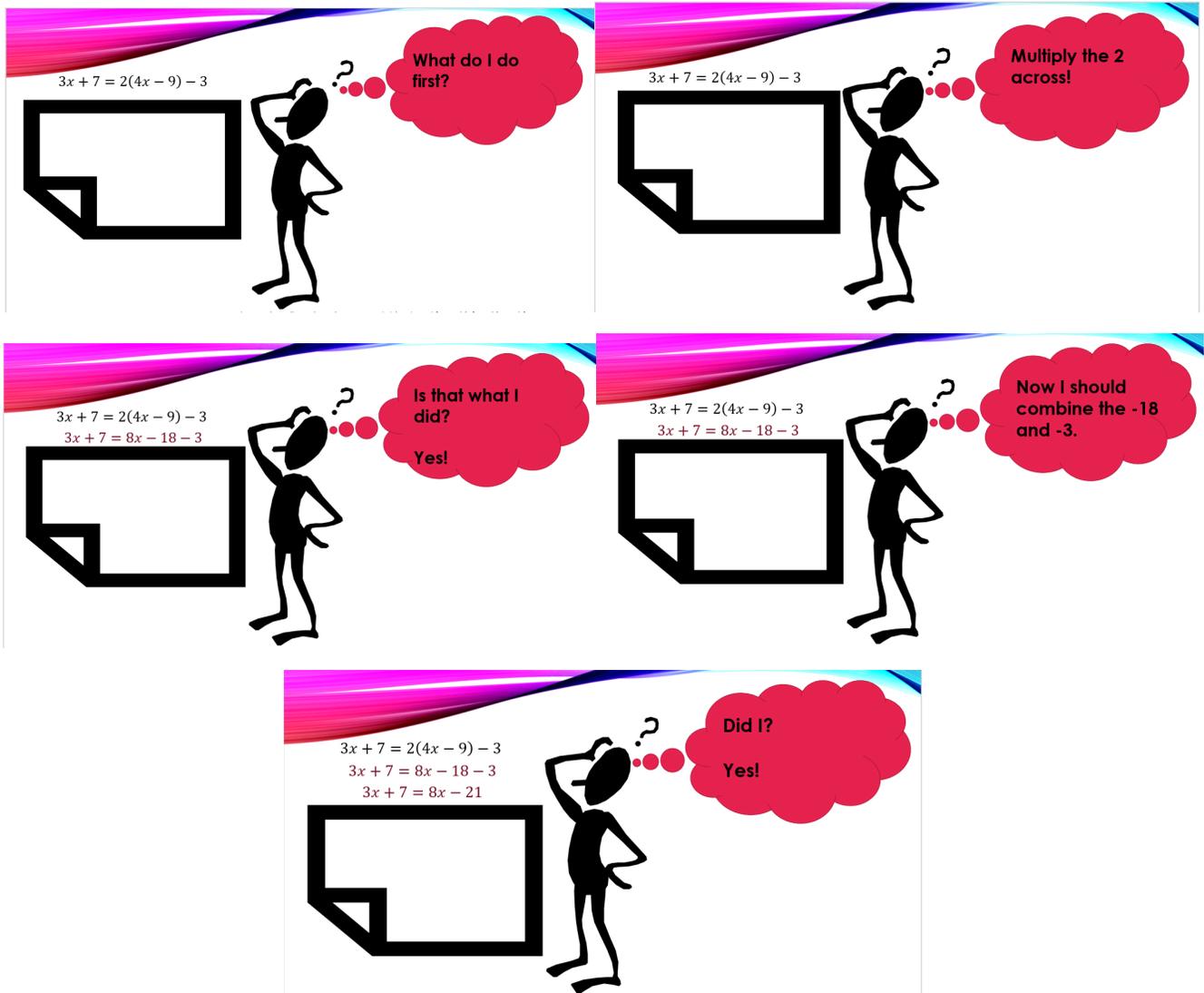
Using Reflective Learning and Next-step Studying to do Homework or Study for an Exam

Since there is rarely enough time to rework all homework assignments before an exam, you will need a faster, more efficient way to prepare for exams. **Next-step studying** can help you organize your thoughts and figure out if you are ready for an exam. It is also a good method to practice while doing homework problems. Here is how *next-step studying* works:

1. Get out the homework assignment you would like to review or study.
2. Cover up all work but the problem.
3. What should you do first?
4. Uncover one line. Is that what you did? Why or why not?
5. What should you do next?
6. Repeat until you reach the end of the problem.
7. If you can accurately predict the next step all the way through, you are ready!

Sometimes it helps to visualize the professor solving a similar problem. What steps did they take?

Next-Step Studying Graphic



Dukesy68/sandbox. (2016). *Man scratching head* [Graphic]. Retrieved from <https://commons.wikimedia.org/wiki/File:Man-scratching-head.gif>

Notice that ***you do not actually have to do the calculations.*** You just need to know that that's the next step!

Questions to Use While Studying that Promote Reflective Learning

What makes me say that?

What makes me think that?

How do I know that?

What makes me value that?

What has changed about my thinking?

What changed my mind?

What questions does that raise?

What question would a sceptic ask?

What evidence do I have?

What is the weak point in my argument?

Who would agree with me? - Who would disagree with me?

What do I still need to know?

What else?

What is missing?

Where do I go from here?

What part of the problem is left?

What am I certain about? Why?

What do I understand least?

Coutts, N. (2014). Metacognition: Thinking about your thinking. In *RediQuest*. Retrieved from <http://www.rediquest.com/metacognition/>

When you get started thinking about your thinking, you realize that it can be a complicated topic! We all bring ideas from our upbringing, personal beliefs, and environment into our thinking, even when we aren't aware of it. These biases, perspectives, beliefs, and perceptions color what we think and how we think.

You are now ready to reflect on the best studying and thinking environment for you.

Reflection on Studying/Learning/Thinking

What is your preferred environment for thinking?

Where do your ideas come from? What inspires your best ideas? What were you doing when you had that great idea?

What's the difference between studying and learning?

For which task would you study more?

- Make an A on the test
- Teach the material to the class

Study Skills

Distractions

Most students learn better in a quiet space, such as a library or the Math Lab. To get the most out of your study time, **put your phone on silent, then put it out of sight. Turn the radio down** to a very low volume and **turn off the TV**. Classical music improves critical thinking, rock music tends to impair it. If you remove some of the distractions in your environment, your brain will be able to focus better on the material, store it more efficiently, and be better able to recall it later. It's not rocket science, it's neuroscience!

Taking Notes – Possible Strategies

- *Use different colors* or highlighters for notes (Ex. orange = theorems, blue = definitions, black = examples).
- *Indent* under major theorems or definitions.
- *Underline* key concepts.
- *Skip 1-3 lines* between different concepts/problems/theorems so you can add information later.
- *Rework notes as soon after class as possible*, preferably within 2 hours (you'll forget too much if you wait longer). Fill in more detail. Mark unclear sections to ask about later.
- When copying example problems, *put the math on the left and the reasons* (i.e., the Why?) for each line *on the right*. (See below.)

Left side: The math

$$3x + 7 = 2(4x - 9) - 3$$

$$3x + 7 = 8x - 18 - 3$$

$$3x + 7 = 8x - 21$$

$$3x - 3x + 7 = 8x - 3x - 21$$

$$7 = 5x - 21$$

$$7 + 21 = 5x - 21 + 21$$

Right side: The why

The problem

Distributive Property

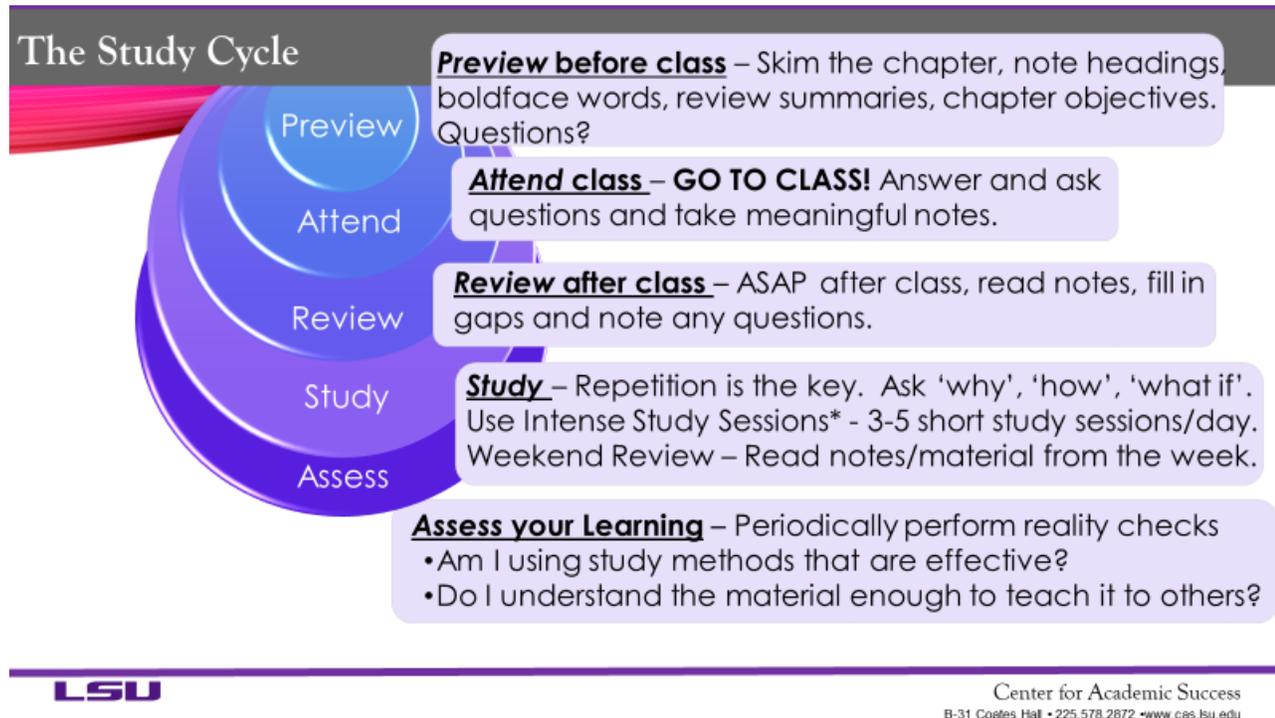
Subtraction of like terms

Move 3x by subtraction

Move 21 by addition

The Study Cycle

Louisiana State University has a very nice graphic of what the **Study Cycle** is. Study the graphic below.



Top 5 Reasons for Making an A...or not

Top 5 Reasons Students Give for Making an A on an Exam

- Did preview/review for every class
- Did a little of the homework at a time
- Used the book and did the suggested problems
- Made flashcards of the information to be memorized
- Practiced explaining the information to others

Top 5 Reasons Students Give for NOT Making an A on an Exam

- Didn't spend enough time on the material
- Started the homework too late
- Didn't memorize the information I needed to
- Did not use the book
- Assumed I understood information that I had read and re-read, but had not applied