Achieving Algebra

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Chapter 1 Time Management

You **<u>can</u>** learn algebra. The question will be;

Can you learn algebra fast enough?

If you had unlimited time, and no other commitments, it would be easier to earn an A in algebra. In the real world though, you have limited time. How much time should you set aside to study algebra? Here's a way to get a good first estimate.

Calculating homework hours per week

To get an estimate for the number of homework hours outside of class we'll use the number of course credits, the length of time since your last successful algebra course (a B or better), and a difficulty factor. Let's start by gathering your personal information.

1. How many credits is your current math course? _____

2. How long since your last successful algebra class?
   2 years or less = 1.5-2
   over two years = 2
   never had a successful algebra course = 4 _____

3. Course difficulty
   Introductory algebra = 1
   Intermediate algebra = 1.5
   College algebra or another college level math class = 2 _____

To find your total hours per week outside of class multiply the results for questions 1,2, and 3. _____

For example, say you never had a successful algebra class and you're signed up for a 5-credit introductory algebra course. You should probably schedule 20 hours outside of class per week.

1. How many credits is your math course?	5
2. How long since your last successful algebra class? 2 years or less = 1.5-2 over two years = 2 never had a successful algebra course = 4	4
3. Course difficulty Introductory algebra = 1 Intermediate algebra = 1.5 College algebra or any other college level class = 2	1
To find your total hours per week outside of class multiply the results for questions 1,2, and 3.	20

Or, say you've recently completed a successful algebra course and you now have a 4-credit college algebra class. You should schedule 12-16 hours per week outside of class.

1. How many credits is your math course?	_____4_____
2. How long since your last successful algebra class? 2 years or less = 1.5-2 over two years = 2 never had a successful algebra course = 4	____1.5-2____
3. Course difficulty Introductory algebra = 1 Intermediate algebra = 1.5 College algebra or any other college level class = 2	_____2_____
To find your total hours per week outside of class multiply the results for questions 1,2, and 3.	_____12-16____

Notice if you've never had a successful algebra course the minimum time commitment outside of class for a true 4 credit college level math course would be 32 hours per week, which speaks to the importance of being prepared for college level math. **Please complete your hours worksheet now.**

Where will this time for homework come from? That's what we discuss next.

Building a time management matrix

I had a big misunderstanding when I started college. I thought you fit college into your life. I discovered you fit your life into college. Let me say this again;

You don't fit college into your life; you fit your life into college.

If you want to succeed in algebra (and college in general) you must build a schedule and stick to it. Here's how. The last page of this packet contains a time management matrix. (An Excel version you can change is available at eamath.com under the Resources tab.) Tear if off now and fill in your life for the rest of the semester. For example, I've filled in what some of Monday might look like

	Sunday	Monday	Tuesday	Wednesday
5:00 AM		Sleep		
5:30 AM		↓		
6:00 AM		Shower		
6:30 AM		Breakfast		
7:00 AM		Algebra HW		
7:30 AM		Chemistry HW		
8:00 AM		Drive to school		
8:30 AM				

Make sure you fill in every cell. I know it may be uncomfortable to constrain yourself like this but, and I say this in the gentlest way, **if you are not ready to live this life then it may not be time for college**.

If you find your other obligations don't allow you enough time for your college obligations, then you need to reduce your credits or give up the activities in your life that aren't directly related to college. It's better to give up things now and maximize your credits then to drop classes later in the semester.

Now that you have time to study algebra here's the best way to maximize your study time.

Chapter 2 Using Your Study Time Efficiently

How not to study algebra.

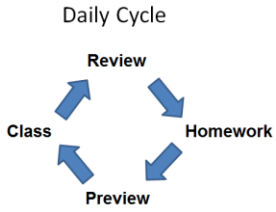
When I started college I thought the way to study math was to go to class every day, take notes on the topics the instructor covered and then do the homework for those topics. Most days the homework would start off o.k. but pretty soon my answer, and the textbook answer, didn't match. When this happened I'd usually;

1) write the textbook answer down and start screwing around with my work trying to make the answer come out right.
2) look at the textbook examples or my class notes and try to find a similar problem whose process I could copy.

I knew something was wrong as I found myself spending 20-30 minutes on a single problem. I had to find a better way to study mathematics. Here's a few ideas that helped me be a better student.

How to study algebra.

The picture to the right shows the daily cycle for studying efficiently. We'll begin at the bottom of the cycle with previewing.



Preview

Always read any section(s) that you will be covering before you go to class. You don't have to understand everything you're reading but you will naturally start generating questions about the material. Pay particular attention to each **worked example**.

Class

Because you've previewed the material, and you're now seeing the material for the second time, you'll find that it's much easier to be actively engaged in class. Your notes will be more about clarifying points you found confusing during your pre-reading and less about passively copying down what the instructor is saying.

Review

After class, and before beginning your homework, always spend 10 to 20 minutes reviewing for tests. The process for getting ready for tests is described in the next chapter.

Homework

Most textbooks have chapters, which are divided into sections that are built from topics. For instance the chapter on expressions might have a section on integers with a topic about adding integers with like signs. Usually each section of your textbook will follow the same pattern. The author will discuss the intent of each topic and include **worked examples** to help make their point(s). Then there will be a number of homework problems that are tied to the topic.

Start your homework by re-reading (remember you've already pre-read the material) the authors explanation, write down the first worked example question and try to do the worked example on your own. If you can't finish the problem, read how the problem should be done, write the problem down again and repeat the process. Once you can successfully complete the worked example write down the problem one last time and pretend you are tutoring someone on how to do this problem. Actually

verbalize the process the imaginary student would need to follow. If you can't talk someone through the problem you don't "know" the problem yet. You do know when you're confused though, it's where you became uncomfortable explaining the process. Once you're successful with worked example 1 begin the process again with worked example 2. **Only start the homework for a topic after you've completed the worked examples for that topic**.

After learning the worked examples you'll find the homework goes much faster. That's because most, if not all, of the homework problems are similar to the worked examples.

Every semester I begin with a number of students who go to class every day and do all (or most) of the homework but don't do well on tests. I appreciate how frustrating this can be so early in the semester I begin talking to them about this very important point.

Doing homework will not help you get ready for tests.

How do you get ready for tests? That's what the next chapter is about.

Chapter 3 Getting Ready for Tests

The differences between homework and tests.

Although doing homework is important for doing well on tests, homework doesn't help you **get ready** for tests. Here are some important differences between homework and tests;

Order of the questions

When doing homework students often tackle similar questions in order. They do question 1 from a section then question 2 from the same section etc. Contrast this to a test where questions are more random and question 1 often has nothing to do with question 2.

Comparing vs. contrasting

When you do homework you're **comparing** each problem to what was discussed that day in class or what you've just read in your textbook. You're asking yourself, "How is this problem **like** the others?" On a test you're usually **contrasting** each problem. You're asking yourself, "How is this problem **unlike** the others?" Students who don't practice contrasting, **every day**, often feel like they "blanked" on a test or that, "the test questions weren't anything like the homework." Only by contrasting problems will you maximize internal cueing.

Cueing

Cueing is the ability to decide which technique(s) apply to a specific problem. Homework cues are usually supplied externally. For example, you just had a class where the proper techniques were discussed or you can look for an example in your book or notes. Contrast this to a test where you need to cue yourself internally as to which process(es) to use. Homework often relies on **external** cues while tests rely on **internal** cueing.

Rate

When doing homework you determine how long to spend on each problem. On a test the instructor has determined how long you should spend on each problem. For instance when writing an exam the instructor might think, "Since 45 minutes are available, and each question should take 5 minutes, I should have 9 questions on the test." Here the instructor has set the rate at 5 minutes per question.

Time pressure

Students usually do homework at a leisurely pace while a test has to be done quickly.

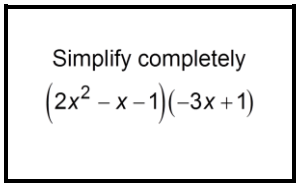
Taking a test is a lot like playing a sport. To get ready for the "big game" you need to practice under the same conditions.

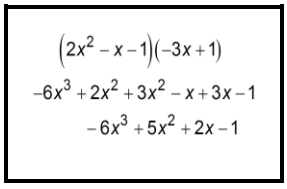
> **To get ready for tests you should contrast random problems, at a set rate, under time pressure, using internal cueing**.

Here's one way to put yourself in a testing situation every day.

Self-Testing techniques

For self-testing you'll need a pack of note cards and a timer. Use the note cards to write down good questions. Good questions come from a variety of sources. Besides textbook worked examples some common places to find good problems are in-class problems, difficult homework problems, missed test or quiz questions and vocabulary. On the front of each card write a single question. **Make sure to include the instructions**. On the back you will either write the solution process and the solution or just the solution. If the problem came from a textbook worked example there's no need to write down the whole solution process, just put the page number where the problem came from. If the problem is from a different source put both the solution process and the solution on the back. Here's an example.





Next get some kind of countdown timer. Most cell phones for example have some type of clock app. After you have at least 20 cards, (most students end the semester with at least 300 cards), set 20 minutes aside for review **every day**. Shuffle your cards and deal yourself 10 to 20 cards, (20 minutes at 1-2 minutes per card is between 10 and 20 cards), then start your timer. If you know how to do the problem quickly, do it. If you aren't sure how to proceed, set the card aside and try the next one. After completing the cards you could finish quickly, return to the cards you found difficult and work until time runs out.[1] You have now contrasted 10-20 random problems under time pressure at a rate of 1-2 minutes per problem using internal cues. In short, you have practiced taking a test. Only after the time is up should you check your answers and review the problems you are not automatic at.

This process will help identify whether you "understand" the mathematics you've been working on. You understand a problem when you can correctly complete the question in 1-2 minutes. If it takes longer than 2 minutes, you don't understand the problem.

I've given you a few ideas that helped me to be a better student. Every semester you should be finding other strategies that improve your personal performance. You'll be much more open to these strategies if you practice internal attribution.

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[1] Students who don't follow this strategy, and instead only move to the next test question after finishing the previous question, often never get to questions they could have answered because they, "Ran out of time.". If you can't do a question in 2 minutes you don't know that question. Move on, finish the questions you do know, and come back to the confusing questions later.

Chapter 4 Attribution

It's common when you're learning algebra for your performance not to match your expectations. For example you might receive a test grade lower than you expected. Improved performance will be easier if you consider the type of attribution you use.

Attribution - to explain by indicating a cause.

In a very general way we explain our performance to ourselves using either external or internal attribution.

External attribution

People who use external attribution see the cause of their performance occurring outside themselves. If you ask someone who practices external attribution why they had a bad test they might answer;

External attribution

I was late to the test because my car wouldn't start.
The bus I usually take didn't show up on time.
I had family obligations.
Daycare wasn't available.
I have a bad teacher.
The textbook doesn't make sense.
The test was only the hard questions.
The class is moving too fast.

With external attribution the "fault" lies outside yourself. It's the cars' fault, the families' fault, the teachers' fault, the textbook's fault. People who practice external attribution often see their performance tied to luck. With good luck (car that starts, better teacher) things will be O.K..

The problem with external attribution is that there's no way to do better in the future. If performance is about luck, and being lucky is outside of our control, then doing better next time is also outside of our control.

Internal attribution

If you ask someone who practices internal attribution why they had a bad test they might answer;

Internal attribution

I was late to the test because I hadn't planned an alternative way to get to school.
On test days I need to take an earlier bus, just in case.
My family has to understand that, for now, college comes first.
I need to find a backup daycare option.
I need to create more options for understanding the material.
I need to actually use my study cards, not just make them.

With internal attribution the "fault" lies inside yourself. You're in control and there are changes you will make so the issue isn't repeated. Students who practice internal attribution are constantly improving as students. If your performance doesn't match your expectations, behave like a successful student and use internal attribution to find alternative strategies.

What's one good way to find alternative strategies? Start a group, outside of class, where you can practice with other successful students.

Chapter 5 Working in Groups

One of the oldest and most consistent research finding s is that adult students who work outside of class in groups, **engaged with difficult problems**, do better. They develop more options, both mathematically and personally, for success. Unfortunately the default strategy for group work seems to be that everyone works on a problem separately and then gets together to share information. Instead, make processing problems like an expert the goal of group work. Here's one successful strategy.

When a novice looks at a problem like

$$\text{Simplify } 3\left(x^2-4\right)-\left(2-x^2\right)$$

they attend to the 3, the 4, the 2 the *x*'s and the parentheses. When an expert looks at the same problem they begin a process more like this;

1. What is it?	⇒	2. What's the type?	⇒	3. What's the outcome?	⇒	4. What procedure or process should be engaged?
a) Expression b) Equation c) Inequality d) Function e) Etc.		a) Polynomial b) Radical c) Rational d) Exponential e) Logarithmic f) Etc.		a) Simplify b) Solve c) Graph d) Etc.		a) Order of operations b) Solving a linear equation in one unknown c) Two column table. d) Etc.

To begin processing more like an expert have everyone write down a single **difficult** problem (your study cards are a good source). Next, have one group member read off the heading for the first three steps one at a time, ("What is it?, "What is the type?", "What's the outcome?") and **everyone** discuss the answer. Don't move on to the next step until **everyone** in the group agrees on the answer for the previous step. After the first three steps are done read the heading for step 4 and start generating a plan. By the end of step 4 either everyone will agree on how to proceed or they won't. If everyone agrees have everyone carry out the plan on their own. If not everyone agrees have everyone in each subgroup carry out their plan on their own. **Make sure everyone has a step by step written record of what's, "In their head".** Last, if answers vary, go through the steps one by one deciding which group member(s) made the right choice.

As I mentioned at the beginning of this paper I began college going to class, taking notes and doing homework. What I didn't mention was that using this strategy I got mostly A's (and occasionally a B) in my math classes. I knew in my heart though, that even though my grades were "good", I still had too many holes in my learning. That too often I hadn't seen the bigger picture. Using these ideas I l was better able to identify and remediate the holes which allowed me to more often see the bigger picture.

This handout is my attempt to give you, the processes I wish someone had given me, when I was where you are today.

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
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