Homework Advice for Algebra 1, Geometry, and Algebra 2 Courses

A *traditional* math homework assignment might typically consist of 10-20 problems, all devoted to practicing a procedure or a concept that was covered in class that day. There might be some variation in format but the problems, by and large, will be very similar.

Bellarmine uses the College Preparatory Math (CPM) Program for its Algebra 1, Geometry, and Algebra 2 courses. An important facet of the CPM program is the use of "Mixed, Spaced, Practice," when assigning homework. So, a typical homework assignment for our Algebra 1, Geometry, and Algebra 2 courses at Bellarmine is about 5 - 8 problems long. In the text, homework problems are called "Review and Preview". Within a single homework assignment, some of the problems might pertain to the concept that was discussed in class that day, some might pertain to a topic that was covered earlier in the course (or even in a previous course), and some might preview a topic that hasn't been covered yet. Understandably, such homework assignments might generate several really good questions from a student or parent new to the course…such as:

- Why don't all of the homework problems pertain to the concept that was covered in class that day?
- Why aren't there more than a few problems? If homework is supposed to be practice then shouldn't there be more problems to practice?
- Why does the homework include a problem on a topic that hasn't been covered yet? Is the student expected to teach himself?

This document attempts to answer these questions and to explain the benefits of structuring homework assignments the way we do.

Designing Homework for Optimal Learning

The Problem with Massed Practice

Traditional math courses employ "massed practice," which are homework assignments consisting of lots of similar problems to be practiced all at once. Massed practice creates the illusion of mastery. As the CPM course developers state, "*Students believe they have learned what they were supposed to learn because they can follow a pattern, and teachers believe that they have taught it because they see students getting the right answers. So everyone is happy on that day. The problem is that the effect fades away quickly."* At Bellarmine, we have often seen this problem manifest itself when a student is asked to apply a method or a concept to a new or slightly different problem. He either cannot recall a method or does not recognize that the problem before him is presenting an opportunity to use the method. ***This problem is particularly prevalent in our upper division courses, which rely on a student's ability to apply and extend foundational knowledge from algebra and geometry.***

Mixed, Spaced, Practice

Mixed, Spaced practice is more challenging than traditional massed practice, but there are clear benefits.

The Benefits of Mixed Practice

Based both on the research and on our teachers' experience, mixed practice, or the interweaving of different types of mathematics problems (from different class lessons) in a single homework assignment, improves students' ability to pair a problem with the appropriate concept or procedure. This is a key problem-solving skill and a key success factor in our upper division courses and beyond. It's not sufficient for a student to have a collection of mathematical tools in his toolkit. He much also know how and when to use them when problem-solving. With massed practice, a student is never asked to practice this skill—the procedure he is being asked to practice is clear. But with mixed practice, he is asked to draw on his previous knowledge of concepts and procedures and select which one to apply. Sometimes he may choose incorrectly the first time and get stuck or reach a wrong answer. This in itself presents a great learning opportunity. We tell students not to get discouraged (practice resilience), to try a different approach (practice persistence), and to use all of the resources available to them, such as the homework help web page, the textbook, the student notebook or asking a question in class or during office hours (practice resourcefulness).

As it happens, resilience, persistence, and resourcefulness are among the key success factors for college. Homework is not graded based on right or wrong precisely because it is practice. But we want it to be meaningful practice, not just the rote implementation of a procedure. We want students to be practicing the skills they will need to succeed in our more advanced math courses and to thrive in college.

The Benefits of Spaced Practice

Most people are familiar with the case of the student who "crams" for a quiz, urgently storing facts in short-term memory that are quickly forgotten once the quiz is over. Similarly, we have found in math, when a student practices a procedure or a concept only once and then moves on (massed practice), his retention is low. Spaced practice involves spreading a collection of problems pertaining to a particular concept across multiple homework assignments over time. According to educational and professional training studies, spaced practice improves long-term retention by reinforcing ideas held in memory. Simply put, spacing provides review that improves long-term retention.

Homework Advice for Students

It is true that mixed, spaced, practice requires more time, energy, and thought than traditional, massed practice. For this reason, we try to assign fewer problems. CPM also recommends fewer problems, citing research that shows learning is more efficient when mixed, spaced practice is used. Because this approach to math homework is new to many students, we'd like to offer a few pieces of advice, which we hope will help:

- You can do it. Teachers will not assign any problems that depend on material you haven't yet seen, either in your current class or your previous class. The problems that preview new material do so in a way that asks students to recall tools they already have and apply concepts they already know.
- Don't get discouraged if you initially don't recognize a problem or aren't sure where to start. There are hints to help get you started at homework.cpm.org. You can also utilize your textbook

as a resource (e.g. the Math Note boxes summarize key concepts from previous lessons). The class lecture notes in your class notebook may also help.

- If you spend more than 30 minutes on a homework assignment (***focused*** time…no social media or other distractions) then stop there and write down what you tried and where you got stuck. Bring your questions to class and if your teacher can't answer them there then he/she will be glad to answer them during office hours. Either way, make sure to get them answered soon, rather than waiting!
- Additional problems are available in the parent guide for students who want more practice. The problems in the parent guide are arranged in a more traditional format so it's clear which section of the text to which they belong. The parent guide for each course can be accessed for free using the links below (it can also be purchased in hardcopy for $20 at shop.cpm.org):

    - Algebra 1 Parent Guide: http://cpm.org/cca-parent-guide
    - Geometry Parent Guide: http://cpm.org/ccg-parent-guide
    - Algebra 2 Parent Guide: http://cpm.org/cca2-parent-guide

- Homework is practice, it is graded based on effort and completion rather than right/wrong. It is also essential preparation for graded exams later on. Solving homework problems (not just looking over solutions) is an excellent way to prepare for an exam.
- **Check your answers!** Answers to some homework problems are posted on the homework help page and your teacher also posts answers to all problems on Canvas. Take advantage of these resources to make sure you're on the right track as you solve homework problems.
- Make sure you are using all of the resources available to you! Check the "Math Resources for Students and Parents" section of the Math Department Web Site [INCLUDE LINK]
- **When preparing for an exam**, we recommend doing the review problems your teacher provides. ***"Doing" means actually working out the problems from start to finish*** to prove to yourself that you understand the problem and the concept behind it. Just reading over a problem or even a solution to a problem isn't good enough. Without actually doing the problem it's easy to deceive yourself into believe that you know it when you don't.

Homework Advice for Parents

- ***Parent Guide***

  For more information regarding the key concepts covered in your son's class, we recommend consulting the parent guide for that class. The parent guide is also a good source of example problems, and extra practice problems, organized by chapter. The problems in the parent guide are arranged in a more traditional format so it's clear which section of the text to which they belong. The parent guide for each course can be accessed for free using the links below (it can also be purchased in hardcopy for $20 at shop.cpm.org):

    - Algebra 1 Parent Guide: http://cpm.org/cca-parent-guide
    - Geometry Parent Guide: http://cpm.org/ccg-parent-guide
    - Algebra 2 Parent Guide: http://cpm.org/cca2-parent-guide

- ***Questions to Use When Working with your Son***

While not a complete list, here are some questions you might use to help your son move forward with a homework assignment and/or remind him of the resources that are available to him.

- What have you been doing in class or during this chapter that might be related to this problem? Let's look at your notebook, class notes or Learning Log.
- Can you contact your study partner or someone from your study team?
- Have you checked the online homework help?
- What have you tried? What steps did you take?
- What is unknown? What do you need to know to solve the problem?
- Which words are most important? What does this word/phrase tell you?
- Can you draw a diagram or sketch to help you?
- Have you tried making a list/table or looking for a pattern?
- Does your answer make sense?
- **Have you checked your answer to make sure it's correct?** (Using the homework help page of the answers that your teacher has posted in Canvas)
- If you don't understand this one, can you try another problem in the homework assignment first and come back to this one?

- **Math Resources Web Page**
  Make sure your son is using all of the resources available to him! Check the "Math Resources for Students and Parents" section of the Math Department Web Site [INCLUDE LINK]

- **Parent Tips Web Page**
  CPM publishes weekly tips for parents that explain aspects of the program and suggestions for ways in which to help students. The Parent Tips Web Page is located at http://cpm.org/tips