# Math For Everyone™

## MathForEveryone.com

# Teacher's Edition

**Nathaniel Max Rock**

**Math For Everyone: Teacher's Edition**



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*This book is printed on acid-free paper.*

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Dear Student (included in teacher's edition),

I have been teaching math in public schools since 2001. During that time, I have witnessed some disturbing trends. The first trend is massive math student failure. In almost all of the classes I have taught from 7th Grade Math to Calculus, a 60% failure rate is common. I use the term *common* to mean that this massive failure is typical of math student, class level and math teacher—across the board. It is unreasonable to believe that such a massive math education problem can be addressed simply through curriculum. Nonetheless, curriculum seems to have some role to play in the situation.

On the curriculum front, although state and federal governments have tried to get involved in the design of curriculum through the promotion of content standards, their efforts have remained impotent. Curriculum design and implementation has been and still remains within the domain of large educational textbook publishers. Educational publishers maintain control of curriculum design and implementation because of the massive amounts of money involved in developing and maintaining a textbook manufacturing business. In order to maintain a stranglehold on the multimillion dollar textbook publishing business, large textbook publishers produce large textbooks, usually consisting of 700 to 1,000 pages—or more. The number of math topics contained in a typical large publisher textbook is mind-boggling. If a school year is 40 weeks (2 semesters at 20 weeks each), then the typical math class would have to cover twenty pages of the textbook each and every week to cover the textbook. In my experience, this is very unrealistic with the typical 12 to 18 year old math student.

Additionally, large textbook publisher texts are physically very heavy, weighing (seemingly) ten pounds or more. It is the rare student who can lug such a brick of academic material back and forth to school each day. Is this a ploy of the large textbook publisher to get schools to purchase a class set and a homework set for students, effectively doubling sales? In lower socioeconomic school districts where only a single student copy of the textbook can be afforded, this translates into students simply abandoning their textbooks. Students leave their textbooks in their locker or at home and it is a struggle to get them to bring their books to class each day. Some teachers use a set of textbooks as a class set. Class set textbooks get abused and create a classroom management issue which I personally find annoying. Surely the weight of the textbook is not the only factor affecting emerging public school trends but the weight of the book cannot be helping this matter any. I personally remember at a very young age thinking, "This book is very heavy, the content matter must be heavy too, I will definitely want to avoid this subject (math) at all costs."

The large textbook publishers are right, purchasers of curriculum are much more willing to pay a heavy price for a heavy book. Many a curriculum purchaser has suggested that my curriculum is surly overpriced because of the few number of pages contained. But anyone who has tried to make a long and complex subject brief and concise has spent far more time and effort than the producer of the "comprehensive" version. I have personally produced longer curricula too and those who "want their money's worth," can purchase those with weighty confidence. But for those who care about student success within the subject and field of math might be wise to consider a more concise alternative.

As I see it, there are really only 5-7 key concepts for each of the six math classes in high school (7th Grade Math, Algebra I, Geometry I, Algebra II, Math Analysis and Calculus). By concisely focusing students on these key concepts for each of the six classes, student success can

be more widely experienced resulting in more students moving into higher level math educations and careers. Furthermore, as one who enjoys math and the applicability of higher level math to the development and maintenance of human comfort infrastructure (the automobile, modern transportation systems, retail distribution systems, electronic communication systems, etc., etc.), I have a strong desire to see more "normal students" reach the level of calculus with success and confidence.

To better understand the difference, let me bring up another trend emerging in math education which I do not like. Many curricula specifically promote the student becoming a "mathematician." A mathematician is a person who appreciates math for math's sake. I personally am not a mathematician and do not intend to become one. I am an engineer. An engineer appreciates math for what math can do. Math can be used to maintain the biomass in a wastewater treatment plant. The flock of bugs which literally eat waste must not be too many and not too few. The bugs reproduce at exponential rates given unlimited resources. Alas life has limits and therefore the flock is controlled along calculus lines akin to what is often called "logistics" problems. If the reader thinks that wastewater treatment is a boring subject or has nothing to do with the comfort of life, then just take a trip to a country which doesn't know how to employ math to deal with ongoing issues of human existence. This is the difference between a mathematician and an engineer. I would greatly prefer math students become engineers than mathematicians because there is far more use for engineers in terms of developing and maintaining human infrastructure. We definitely need mathematicians too but I would argue to the reader that these individuals will pursue math entirely on their own. The common math student, however, needs a firm foundation of 5-7 key concepts per math class to understand what math is for and how it can be employed.

Another disturbing trend is the spread of math phobia. Math phobia is the feeling or self-perception that, "I am not good at math and never will be. In fact, I hate math!" As I have written elsewhere, I have had the displeasure of sitting in parent-teacher-student conferences where the parent proclaims, "My father was not good at math, I am not good at math and my son (or daughter) is not good at math…." This is what I refer to as math phobia and the condition is spreading according to my informal observations. Not only is it ok to be bad at math but it is even popular. A former school principal of mine regularly proclaimed within the hearing of teachers and students an ongoing math deficiency spiced with trepidation. Something must be done to reverse this affective trend. Attitudes toward math must be improved. I would propose that one step in the right direction is greater student success in math classes. Certainly the idea is not to reduce the level of concept difficulty but to produce more focused success on key concepts.

Yet another emerging trend in math curricula is the prerequisite boggle. A prerequisite is something required for success in an upcoming topic. For example, Algebra I is required before Algebra II because prior concepts will be built upon. As one of the counselors at my school wisely asked me, "Why is it that on the occasion that students have to be programmed into Algebra II before passing Algebra I, they often pass Algebra II?" The answer is that there are many "lower-level" math concepts which are far more conceptually and procedurally challenging than "higher-level" concepts. For example, students of all ages and math levels find adding fractions through the finding of a common denominator far more challenging than finding the slope (the derivative) of the tangent line to a curve (calculus). I personally find calculus far simpler in concept and procedure than sixth grade math. I feel that in many instances, the entire

math curriculum should be reversed—students should learn calculus first and then proceed to learn whatever background knowledge is required. On many occasions I have taught my Algebra I students how to find the slope of a tangent to a curve by taking the derivative. They understand it fine but struggle with the straight lines of Algebra I. My theory is that the struggle is based on student experience. Straight lines are very hard to understand because nothing in life is a straight line! Life is made up of curves (ups and downs, highs and lows, sometimes steep, sometimes shallow, etc.)—the concepts of calculus are far more relatable to real life and prior knowledge than 7$^{th}$ Grade Math and Algebra I.

I am often asked, "What are the 5-7 concepts for each course which you include?" Actually a better question is, "What have you excluded?" This is the crux of the matter and the reason that an 80 page curriculum is worth far more than a 700 to 1,000 page textbook. I have done the hard (and controversial) work of excluding concepts which I felt were not absolutely essential to long-term student math success. But exclusion of non-essential concepts is only the beginning. The work continues with assessments which actually measure the core concepts we are trying to measure. Finally, there is the overriding work of tying the courses together so that they make a cohesive set, one course flowing to the next.

I ask you, which would you rather do, learn a tiny bit about a thousand things or actually know something about a few key concepts? You will have to study hard to learn what is in this book, but you will have the rare privilege of retaining what you learn and using it all through your successful math career.

Sincerely, N. Max Rock

Dear Math Teacher,

First, let's be honest with each other, the vast majority of all math teachers do not believe that math is for everyone. My informal surveys put the number at close to 9 out of 10 math teachers who do not believe that math is for everyone. Most math teachers I have met believe that only the best math students should take calculus and that making Algebra I a requirement for high school graduation is ludicrous.

Regardless, I like math and I want more regular education students to make it up through calculus in high school. So let's discuss the philosophy behind this curriculum. If you disagree, then we can just agree to disagree. Here are the top three purposes of the Math For Everyone curriculum.

**#1 Allow more regular students to take up through calculus in high school.** I personally didn't find much value in math until reaching calculus. The reality is that while algebra is not directly applicable to the problems of life, calculus is, and algebra is required to do calculus. So I would like to share the power, simplicity, elegance and practicality of the most awesome math ever known to mankind, calculus, with as many students as possible.

**#2 Address the high math student fail rate by allowing more students to enjoy math learning success.** The official numbers on student fail rates within math classes is a little hard to get at so we will have to do some estimating. Nonetheless, the background to this issue includes my belief that a student who earns a D in a math class is failing. I have had students who earned D's in prior year's math classes and their knowledge and procedural skills are not sufficient. Next, we should consider the fail rate I am talking about as applying to the first time through a math class. In other words, taking Algebra IA in the fall of eighth grade is a student's first attempt. This is the time for success. Many fail rates do not include students who pass the class in summer school even though having failed twice during the year. To me, these are fails. If we look at the number of students who receive a C or higher in their first time through a math course in the proper time to take the math class, fail rates on this basis are very high in my experience. Fail rates as high as 60% are what I have seen typically. What is more, I have been witness to this fail rate continuing in each consecutively higher math class. Geometry I on the same basis as above has a 60% fail rate across the board in my experience. This is regardless of teacher or level of class (regular or honors) and definitely includes Algebra II, Math Analysis and Calculus. This process is clearly a 'weeding-out' process of 'non-math' students. I have talked to many math people (math teachers, engineers, computer scientists—technically minded individuals), and have heard many times that even technically minded individuals were weeded-out by this process. The 'weeding-out' process is obviously contrary to the philosophy of this Math For Everyone curriculum.

I believe that such a massive fail rate contributes to the spread of what I call math phobia. I have mentioned my experiences with this growing phenomenon. Math phobia includes students, parents, even society, fearing and hating math. This is an attitudinal issue. In education we speak of the affective aspects of school, curriculum and education. I have had very few students earn A's in math and then say, "I hate math." The majority of students who succeed academically in math have at the very least no opinion in regard to math. Most, however, have favorable impressions of math. This widespread negative attitude toward math must be addressed.

**#3 Not reduce rigor, rather, focus students on key concepts.** It might seem quite obvious that any curriculum which states as its main purpose getting more students up through calculus in high school is Not out to reduce rigor. If anything, such a curriculum is working to push what are commonly considered higher level math concepts down into lower level math classes. It is my argument that many "higher level" math concepts are simpler in concept and even procedure than many "lower level" math concepts. I personally take issue with math teaching decisions based on, "this is what I learned and the way I learned it," or the pre-requisite boggle, "students must have this knowledge to acquire that knowledge," or the textbook as math god concept, "if it is in the textbook, I had better cover it." If these curriculum-deciding reasons had any validity, then why can my lowest level students find derivatives and understand slope as a tangent line or a rate even of a complex curve? The point is Not to reduce rigor but to focus students on the few key concepts they will need to succeed up through calculus in high school.

Above are the top three purposes of this curriculum. But there are a slew of other benefits as a result of this curriculum which include but are not limited to things like helping high school head counselors with master schedule problems due to the high fail rates of math classes. Or, reducing the summer school math class 'flow-through' problem (English teachers teaching math during the summer). There are other benefits too but we will have to save them for later.

If you agree with the philosophy behind this curriculum then we can move on with how to implement this curriculum. If not, we will have to agree to disagree. Regardless of our perspectives, I wish you happy math teaching.

Sincerely, N. Max Rock

# How To Use This Curriculum

## Curriculum Purposes

In light of the following topics, here is a summary of the discussion of the curriculum purposes from above.

**Curriculum Purposes Summary**

- **Allow more regular students to take up through calculus in high school.**
- **Address the high math student fail rate by allowing more students to enjoy math learning success.**
- **Not reduce rigor, rather, focus students on key concepts.**

## Curriculum Setup

This curriculum is composed of a student curriculum handbook for each of the six math classes in high school (I'm including 7th Grade Math because it is a launching pad for high school math and is significantly different from sixth grade math) and a teacher's edition. The student curriculum handbook is to be owned by the student. This means the school has to give a copy to the student or have the student purchase a copy. The student curriculum handbook is to be kept from year-to-year as future math classes will continually return to the prior years' student curriculum handbook.

As a start, it might help to discuss what the student curriculum handbook was Not designed to do. The student curriculum handbook is Not meant to be a textbook in the traditional sense and is Not meant to be reused. Furthermore, the student curriculum handbook is Not a workbook like a traditional "consumable." The student curriculum handbook is definitely Not meant to be self-help math book like the Math For Dummies series.

Students are to keep their student curriculum handbook, taking it home and to class every day. If it can be arranged (public schools obviously have their challenges with this), students who purchase their own copies of the student curriculum handbook are more likely to manage them more responsibly. The student curriculum handbook is designed to be the mediation tool of the math teacher and support for the assessments and performances which will be given.

Curriculum Setup Summary

- Students each own a copy of the student curriculum handbook.
- Students will use their student curriculum handbook from prior classes in future classes.
- The student curriculum handbook supports math teacher mediation.
- The student curriculum handbook supports assessments and performances to be given.

## Implementation

Within implementation there are two issues. The first is how the curriculum is intended to be implemented and the second is how a teacher (or school or district) might test the curriculum to see if it achieves its stated purposes.

Designed implementation is that each student starts into the curriculum in the 7th grade and works in their own student curriculum handbook, taking them home and bringing them to class everyday and retaining them from year-to-year for use in all math classes up through calculus. Assessments and performances are to be repeatedly given to students. In Math Analysis, for example, students are still responsible for 7th Grade Math assessments and performances. This book you are reading, the Teacher's Guide, is both a resource of tests and answer keys to be implemented throughout all the years of high school math and a guide on implementation of the curriculum.

The curriculum is articulated. That means that while each year of math might be called a curriculum in itself, the entire six year set is actually the curriculum. For this reason, sometimes I will refer to the six year set as a program. Articulated means that each year is designed to build on and scaffold each year prior to achieve the already stated purposes of the curriculum. This means that on day one of future school years, work can begin immediately, assessments can be given and students who are familiar from the prior year know exactly what to expect. Valuable adjustment time is turned into instructional time.

There is a concept embedded in this curriculum which allows for students to come along in their own time. In other words, an Algebra I Math For Everyone student will most likely not fully comprehend the full ramifications of the coordinate plane just as traditional curriculum students might not. But because assessments and performances are repeated year-to-year, the Math For Everyone student has the opportunity come to a more complete Algebra I understanding in later math years. The brilliance of this is that by remaining in math classes up through calculus, the opportunity to learn more math or missed math exists. The alternative is students leaving math after Geometry I or Algebra II (and hating it). This 'math mercy' aspect of this Math For Everyone curriculum is a significant aspect of achieving its stated purposes and included by design.

Implementation Summary

- The curriculum starts in the 7th grade.
- The curriculum is articulated which makes the program a single curriculum.
- Students are responsible for the prior years' assessments and performances up through calculus.
- This curriculum is merciful, allowing student math understanding in the student's time

**Testing The Curriculum**

Testing the curriculum to see if it holds true to its stated purposes can be done on various levels. One of the minimal tests which can be done is to carry on math class as usual but to select 7 to 10 students who are willing to participate in the curriculum test. These 7 to 10 students have, in addition to their traditional textbook, the student curriculum handbook and participate in the work of both. The implementing teacher has to be a little concerned for the extra work of these test students which limits the selection of test students to a volunteer basis which might result in somewhat more motivated students participating in the test of the curriculum possibly skewing the curriculum test results in favor of Math For Everyone. Skewing curriculum test results against Math For Everyone is the math class year in which the test is conducted. The higher the level of math class, the less valid the curriculum test may be for any number of reasons. Entering

Geometry I students into a Math For Everyone curriculum test may be unfair because students lack the Math For Everyone foundation assumed by the program from the 7th grade. Entering Math Analysis students into a Math For Everyone curriculum test may be unfair depending on the students. Honors students might make the program look very good as the material might be quite easy for them. On the other hand, Math Analysis former honors students might be a really good test of the Math For Everyone curriculum program. This is one of the groups I have tested the curriculum on. I taught a Math Analysis class filled with former honors math class students. They were the weeded-out students who were not going to take any more math because they had been at the bottom of the group. They had been convinced by their counselor and parents to take one more math class, a regular education Math Analysis class. They were a great Math For Everyone curriculum testing group because all had begun to develop math phobia. Math Analysis was going to be the last math class of their lives because they had been so beaten up by traditional math class curricula. These students were, for the most part, technically minded students who now hated math. Sample work from this group can be seen on the website under the Student Work link.

Of course the best test is to take a whole 7th grade class and have them use the Math For Everyone curriculum exclusively for a year. Then compare this group with a whole 7th grade math class who used the traditional curriculum. Considerations might include: how many students of each type of curriculum received C's or higher for the year? How many students of each type of curriculum consider themselves good at math? How many students of each type of curriculum are going into Algebra I in their eighth grade year? How many students of each type of curriculum are excited about going into Algebra I? How many students of each type of curriculum believe they will make it up through calculus in high school? If the Math For Everyone curriculum is doing favorably in comparison to the traditional curriculum, then continue the test into Algebra I.

Testing the Curriculum Summary

- Test curriculum on students in lower level math classes.
- Test on intervention students in higher level math classes.
- Take a whole 7th grade class and test in comparison to anther 7th grade math class using a traditional curriculum.

**How I Tested The Curriculum**

My strategy for testing the curriculum is very similar to what I have suggested for others above. I found 7 to 10 students in my existing math classes who were willing to agree to three things. First, in addition to their textbook, they would use the student curriculum handbook as their guide, workbook and notebook (what I am calling a 'handbook'). Second, at the end of the test they would give their student curriculum handbook back to me to keep (I wanted samples of their student work). Third, that at the end of the test, they would take a comprehensive survey of their experiences using the curriculum. I have an advantage in testing the curriculum because I use all of the curriculum assessments and performances as the assessments in my math classes already. (It was my students' success at these performances which drove the production of this curriculum.) So for me the testing was more in regard to how students would react to the student curriculum handbook, how articulation would occur between the years of math classes and how student attitudes toward math might be altered.

How I Tested the Curriculum Summary

- Students agree to use the curriculum.
- Students agree to take a comprehensive survey.
- The assessments and performances of the curriculum use for whole class.

**What About Content Standards?**

One of the other curricula I have written is call Standards Driven Math (see more about this curriculum at StandardsDrivenMath.com). I am very familiar with one of the nation's most rigorous sets of state content standards (California). I believe whole heartedly in content standards. However, I also believe that many states have not gone to the trouble which I have of desiring math success for their students. Does Math For Everyone cover content standards? Absolutely. But content standards writers are not willing to design a curriculum which is focused on key concepts for each of the six high school math classes and push away all of the interesting but unessential math distractions. Your state's educational department does not have the will to take such a bold step and so state content standards remain a laundry list of math topics—just like the textbooks of the large publishers against whom I rebel. I assert to the reader again, getting more regular education students up through calculus in high school cannot be done by avoiding rigorous content, but by focusing students on the key concepts which really matter for student success.

Now is a good time to expand on what I call 'interesting distractions' in math. There are literally dozens of topics in math which are very interesting but have nothing to do with prolonged math success along the lines of the stated purposes of this curriculum. Take the concept of irrational numbers. There is absolutely no reason why this subject is essential in the $7^{th}$ grade (or any grade, for that matter). Even though I personally love this topic, it is simply not necessary to cover this topic in high school. Or, it is not necessary for students to be successful at this topic in high school. What is more, the advanced math student can easily and quickly pick up this topic in later years. The concept of slope, however, is a deal breaker. Slope must be covered in all of the six high school math classes and has historic implications on the usefulness of math to mankind. I can hear the feathers being ruffled as I write, "irrational numbers are what I call an interesting distraction." They are simply not essential to math student success in high school. This is where this curriculum earns its money. The common textbook writer and math teacher simply cannot leave irrational numbers out of their curriculum. And so starts the slide toward the laundry list of topics which textbooks, math teachers and curricula cover which directly results in the average students' inability to survive in high school math.

So emerges another related topic, that of state approval. This curricula will not appear on any state approved list by design. These are the very systems against which I rebel as a teacher and as a curricula developer. These systems are cesspools of everything to everybody attempts at legislating education which results in the very symptoms this curriculum is written to combat. If state approval worked, then we wouldn't have the high math fail rate or math phobia. You don't need state approval, you need a brain to think through what students need and then work tirelessly to supply it. That is the principle upon which this curriculum is based.

What About Content Standards Summary

- Content standards are covered.
- I insist on the ones that really matter for long-term math success.

- Interesting distractions should be avoided or presented to students as such.
- State approval and the legislation of education does Not work.

**What About Standardized Test Scores?**

I have to be honest with the reader. I do not care one lick about standardized test scores. There isn't a single shred of evidence that such tests having any positive impact on math education whatsoever. They are a fad of our day and a terrible idea for those who might like to turn human beings into lifelong learners who love to learn.

The purposes of this curriculum are clearly defined. The fact that the reader did Not see, "Raise standardized tests scores," as one of the stated purposes is not an oversight. Standardized tests are a colossal waste of educational time, money and most of all, effort.

What About Standardized Test Scores Summary

- Test prep is not a curriculum in this author's opinion.
- This curriculum's purposes are clearly defined.

**Grading—General**

This curriculum does Not endorse the traditional accumulation and averaging of student grades. This curriculum advocates for a greatly reduced grade averaging period and the replacement of older, lower grades with newer, higher grades. This might be quite unusual but is a key feature in enticing students to not only keep trying but to not forget what they have learned. A typical application of this feature is shrinking grade average periods to the period between progress reports, for example. If a semester of Algebra I is 20 weeks and there are four grade periods or progress report periods within this 20 weeks, say every 5 weeks, then the grade averaging period is shrunk to five weeks. So the recording of student performance on assessments are restarted every five weeks. Students who performed well are required to again perform and students who did not perform well are reset for maximum encouragement to work harder (or to start working) now.

There is some limited 'blow-back' from such a system in the form of students who say, "If my grades restart every five weeks, then I will just wait till the last five weeks and do my work then." Certainly this attitude of students may be one of the most frustrating of all attitudes. Students with this attitude often do nothing in whatever grading system they are in. Or, on occasion students with this attitude are mentally advanced for the course and literally are bored out of their mind. The saving grace of this curriculum with this type of student is that they often find it enjoyable to repeatedly do well on similar assessments which is another motivational feature of this curriculum. I always advise students against this attitude explaining that my experience is that by they time they decide to begin working, it will be too late, they will not be able to catch up quickly enough with the bulk of work of the curriculum. There is some adjustment to the methodology of this curriculum required. In other words, the methodology of this curriculum is quite unusual and students often go through an adjustment period where they work to test the intentions of the curriculum. On the occasion that these students did repeat with me, the second time around they do not waste the opportunity presented by the curriculum and perform quite eagerly from day one. These students often become advocates for telling the rest of the class to get moving quickly.

Advanced students developing bad habits are also often spotlighted by the resetting of grade averaging on a shorter time basis. For example, honors students will often quickly devour a semester's worth of content and initially ace assessments and performances. But these same students will do poorly on consecutive assessments and performances because they have never been asked to retain math knowledge long-term before. So their achievement will often wane in-between semester starts and ends. These students must be encouraged to drop old bad habits and shift math knowledge from their short-term memories to their long-term memories. Once enlightened to this bad habit, most students respond very favorably to the new requirement because they can see the long-term benefits of retained math knowledge in making future years easier.

Additionally, there is a benefit to my grading system which allows students to replace older lower scores with newer higher scores on the same assessment with the short grade averaging period (5 weeks in my case). For example, let's say a student takes the Algebra IA Handwritten Assessment and scores an F. In the same 5 week grade averaging period we take the test again and the student gets a B. The F is replaced with the B.

Likewise, as long as it is in the same 5 week grade averaging period, the student can keep their initial score on a test and opt not to take the same test in the same grade averaging period. For example, say a student got an A on the Algebra I Handwritten Assessment the first time it was given during the 5 week grade averaging period. This student can decide to Not take the same assessment again during that 5 week grade averaging period. There are some caveats here. First, the student must manage this system. If a student asks me, "do I have to take the test today?" I always answer that if you have to ask, you had better take the test. I don't discuss individual grades during class time, the student has to come see me at lunch or nutrition. Second, the student must bring quiet work to occupy themselves while others take the test. Any violation of test rules zeros their original test score. I recommend silent reading a book from their English class. By the way, cleaning out notebooks or working on craft projects or anything distracting to other students is a violation of test rules. Care has to be taken to emphasize that relief from taking the same assessment is limited to the 5 week grade averaging period. I document this system on my website and go through a PowerPoint to help students grasp all their options (see RockMath.com). Most students are quite pleased with the system once they understand it.

Grading—General Summary

- Restart grade averaging every grade period, five weeks, for example.
- Successful students must retain knowledge to repeatedly re-pass assessments.
- Repeated assessments encourage struggling students.

**Assessments & Performances**

There are three forms of assessments as part of this curriculum. The first is multiple choice tests which are used to assess facts, definitions and low-level concepts (procedures). In other words, vocabulary is an important aspect of math curriculum. But vocabulary is an issue of whether a student knows what a word means or not. This can accurately and easily be assessed via multiple choice tests. The same thing goes for low-level concepts. For example, how many radii are in a diameter? The answer is two. This might be a definition. But when put like this, which of the following is the proper relationship? Choices: $\frac{r}{2} = d$, $2d = r$, $\frac{r}{d} = 2$, $2r = d$, and

$\frac{d}{2} = r$. We are now dealing with a low-level concept. It is conceptual to understand that the diameter and the radius are related by a factor of 2 and therefore may be represented by a simple but powerful equation. One step up in low-level concept might be, given a circle with diameter 6, what is the area? Now the student has to apply the area formula for a circle and get the radius right as half of the diameter. For these simple problems, there is no better testing method than multiple choice tests. Remember, any curriculum must take into account teacher workload as part of its implementation. To assume that a math teacher in high school (with 120-170 students) has time to hand grade test questions like this is unreasonable and completely unnecessary.

However, it is important to see a student's actual work in math. The handwritten quizzes or performances are hand graded by the teacher. The rubrics set up for these assessments are made to be simple so that the student can understand them and the teacher can grade quickly. The handwritten assessments are an effort to see a student performance.

The performances might be contrasted with application. Application is to be encouraged but in my experience, it is impossible to force. What is more, application is something that must come from within a student when the student is ready. So although a teacher or a curriculum sets up opportunities for application, a teacher or curriculum cannot force application. This is what the application projects are all about. They allow a student to write about math in sentence and paragraph form. But any teacher who has been a teacher for a short while knows that the second an assignment leaves the classroom, there is no way to know who is doing the assignment. I have had parents, siblings, friends, other teachers, etc. all do work on behalf of my students. In a lot of ways, this is the point of a project. While we do not necessarily want others to do our students' assignments, collaboration takes many forms and interaction regarding an assignment is important.

All of these issue are issues which teachers must work out for themselves. The curriculum works to address all these issues through three forms of assessment, multiple choice tests for both vocabulary and procedures, handwritten quiz performances and written application projects. (The student curriculum handbook becomes much like a portfolio but this is a side benefit.) It is enough for students to do these to move from one math class to the next.

Assessments and Performances Summary

- Facts, definitions and low level concepts (vocabulary and procedures) are tested through multiple choice tests.
- Handwritten quiz performances assess actual student work.
- Application written projects provide the opportunity for application.

**Assessments in this Book**

Some of the tests in this book are printed in a smaller font then should be used. This is because many tests had to be shrunk down to fit printing page size requirements. This is rectified by enlarging tests to 115-135% when photocopying. My practice is to make a class set which I can re-use. I make sure to get back all of my class set copies by numbering the class set of tests. I distribute the tests in order and collect them back the same way.

The instructions for the multiple choice tests are to *select the best math answer*. That means there can be multiple correct answers. The best answer may require some level of

judgment. There are also additional tests like the Euclidian Geometry IA tests provided. While I believe almost all of Euclidian geometry to be an interesting distraction in high school math, this is such a large part of all curricula that I include these tests especially for my honors students. By memorizing a hundred and fifty or so postulates and theorems, all of Euclidian geometry can be mastered.

Assessments in this Book Summary

- Enlarge tests when printing a class set.
- Number class set tests so they can all be collected and reused.

**Testing Protocol**

The nature of students (humans?) and repeated assessments opens the door to student cheating. I am convinced students cheat simply because it is a little excitement in an otherwise dull day. Regardless, it is important that assessments be the work of the student whose name is on the assessment and that the work on the paper be from the student's head (not from a small piece of paper in their lap). I use the following testing rules to help control these issues. I explain to students they need to practice for taking the SAT and other tests like it so they might as well get used to my testing rules. The following testing rules are just that, rules, violation voids their test and its score.

I ask students to remain in their seat during testing. Of course I always have assigned seats in my classroom. Students cannot talk during a test and any talking or sound making is a violation of test rules. If students have questions, they can raise their hand and I will come answer their questions. Any test answers in their proximity, whether used or not, are a violation of test rules. Being helped *Or* helping others is a violation of test rules. Because unknowingly helping others (another student looking at an answer sheet of another student) is a violation of test rules, I require every student to have a cover sheet. A cover sheet is a blank sheet of paper which can be used for scratch work but must be used to cover an answer sheet. Failure to use the cover sheet to cover one's answer sheet is a violation of test rules. I wont even start a test until all who are taking the test have a cover sheet out. When students are done with their test, they are to turn their test over an remain under the same test rules until all tests and answer sheets are collected. I offer a small bonus to students who will silent read a chapter book until the end of the test. I have had the enjoyable occasion of a class completely finishing a test and then silent reading to the end of the period. Keep in mind the overwhelming evidence supporting the importance of silent reading in a student's development. Students have to be reminded that cleaning out thief folder or working on craft projects or working on anything which distracts other students is a violation of test rules. Students should hold on to their test cover sheet and only throw it away after tests and answer sheets have been collected. I often send a student around with the trash can after the test is done to collect trash.

I do not collect tests or answer sheets until all are done with the test. The test duration is as long as the last remaining student taking the test or the end of the period, whichever comes first. If there is time after the period (like lunch), I will allow students who desire to continue working. The kicker of my testing rules is that I do not have to tell the student at the time of the student's violation that their test and its score are voided. This is to avoid the very confrontations that are completely contrary to one of my main reasons for having testing rules, keeping a quite and calm environment within which students have the most opportunity to do well on

assessments. I simply keep notes of situations and students and usually call them up to my desk right at the end of the period or just after the period end bell. Depending on the group of students I definitely give zeros in the beginning of the semester. Usually this is an initial adjustment period where students are testing my testing rules to see if I am serious. Because I repeat assessments and restart averaging periods every five weeks (repeated short periods), most students take given zeros in stride and discontinue the behavior which resulted in their zero.

small bonus for silent reading

Testing Protocol Summary

- Test rules are strict.
- Violation of test rules results in the voiding of the test and test scores.

**Grading—Specific**

When it comes to weighting of grades, the Handwritten Assessments are the most valuable to me an therefore should carry the most weight of student grades. Next should be the multiple choice assessments of vocabulary and procedures. Lastly should be the grades for projects. If project grades are heavily weighted, then most likely work turned in will Not be the work of the student. A breakdown of percentage weighting goes like this: 50% for Handwritten Assessments, 30% for multiple choice tests and 20% a mixture of project grades and anything else the teacher would like to promote. For example, if you feel the need to grade work done in the student curriculum handbook then 10% (half of the project 20%) could be put to this effort. Or sometimes it is necessary to give a materials check grade so that students will be encouraged to bring their materials (student curriculum handbook, pencil, paper, calculator, etc.) to class. If I have a lot of trouble with tardiness, for example, then a grade can be assigned to this also (see RockMath.com on how to attach a grade to behavior like tardiness).

As far as a grading scale is concerned, I use the standard (90% A, 80% B, 70% C,…) with some modifications. For example, I really do not like D's. I have already stated that I believe a D in a math class to be failure and students passing math classes with D's are in trouble in future math years. To limit D's, I have often made the D portion of my grading scale from 68-69%. Additionally, if I am going to do the work of making a subject as streamline as possible by only focusing on the 5-7 key concepts of each class, then I can expect my students to completely master that limited amount of information. So I am always pushing my students to not be satisfied with a B or a C. If a teacher has gone to the trouble to break a subject into its most clear and accessible parts, then the only real grade is an A or B. At different times, I have required a 90% or better on vocabulary and procedure tests to record the grade. That means that a zero remains until a 90% is reached. But I have based these detailed grade decisions on the class and group of students. This should remain within the judgment of the classroom teacher. Just remember to communicate clearly with students what is expected of them. This will head off any trouble with parents or administrators in the future.

With that said, let's talk for a moment about true test scores. There are times when my tests do not measure what they are intended to measure. (Even professional testing companies like ETS struggle with this issue.) To deal with this test error rate, I will often skew a test grade by taking the correct out of a slightly lesser number than the total of the test. For example, if a test has 25 questions, I will grade the test out of 24 or 23 because of poorly written test questions, answers, or just questions which do not test what I am trying to test. This is not a

curve because a curve is based on student performance. This is a test error rate correction. Of course, overall, the effect is that of a curve. But the purpose for this curve is ultimately to be fair to the student. We have all taken tests where after reading the question we ask, "huh?"

My district is way behind the times but all student grades should be accessible to the student and their parents or guardians through a password protected internet website. I would design my own but I just don't have the time. Hopefully the reader's district is more progressive than mine.

Grading—Specific Summary

- Weighting: 50% Handwritten Assessments, 30% multiple choice vocabulary and procedures tests, 20% projects or 10% projects and 10% other.
- Grading scale for mastery, discourage D's: 90% A, 80% B, 70% C, 68% D.
- Take multiple choice test grades out of less than total to account for testing error.

**Recommended Intervention**

Lately, some schools have been on a non-stop math intervention effort. The only intervention I have personally seen to have any impact on student math performance is giving students two math periods a day. One is in their regular scheduled math class with their math teacher and the other is in a Carnegie computer math lab with a math computer lab teacher. The intervention I have seen work uses the Carnegie computer program but is Not what the Carnegie company recommends. The two classes are run completely separately with separate teachers and class grades. Students work to move through the units of the computer program. As long as the computer lab is managed well (as in students only on the Carnegie math program), students will spend hours working through hundreds of math problems. This intervention additionally deals with students who will not (or cannot) do homework. Math work is done on the computer in class during the school day and therefore even with neglected homework, students can better understand what is going on in their regular math classes. The computer lab math teacher is their to help guide and instruct students with problems but the program is quite interactive keeping the focus on the student and the program and Not on the math teacher (a welcome characteristic for many struggling math students).

Recommended Intervention Summary

- One period regular math class with regular math teacher.
- Additional one period with Carnegie math computer program and Carnegie math computer lab teacher.

**Recurring Themes**

It might help the math teacher working with this curriculum to consider the recurring themes of the curriculum. Considering these dominant themes might help the math teacher to let go of many interesting distractions until time and opportunity permits. Here are the dominant recurring themes.

The number one theme of this curriculum is slope on the Cartesian Coordinate Plane. This is the most dominant concept of modern day math and the basis of calculus. The only difference between $7^{th}$ Grade Math and Calculus is that slope is the tangent line to the complex

function in Calculus. The concept of the limit is introduced so that we can apply the very same slope formula used in 7th Grade Math to a complex curve in Calculus.

Next is the Pythagorean theorem. The Pythagorean theorem takes on its importance in its ability to be used to manipulate and analyze slope. Following closely on the heals of the Pythagorean theorem are the trig functions. Again, for the same reason that the Pythagorean theorem is so important, trig functions are used to understand and analyze slope.

Finally is the relationship between length (distance and perimeter), area and volume. These three are important because the geometric expansion of each (the increase of the multiple of change to the power one, two and three) sets very significant limits on the physical universe. In other words, length, area and volume are where slope can be applied.

Recurring Themes Summary

- Slope on the Cartesian Coordinate Plane.
- The Pythagorean theorem and trig functions.
- The relationship between length, area and volume.

**Additional Support**

The assistance readers may find most helpful are the 12 PowerPoints covering the 12 Handwritten Assessments of the six years of math offered for the reader's use on the website MathForEveryone.com. Teachers are welcome to modify these or make their own. These can be very valuable for in-class instruction and for students and parents to review at home with an internet connection and Microsoft's PowerPoint software.

Additionally, details regarding the other curriculum I have written can be found on StandardsDrivenMath.com and details regarding many aspects of my math classes can be found on RockMath.com

Additional Support Summary

- See 12 PowerPoint Lessons for the six math classes on MathForEveryone.com
- Additional details can be found on StandardsDrivenMath.com and RockMath.com

**Pricing and the Cost of Curriculum**

Educators are paid pitiful amounts in this society. When compared to even the lowest paid sports stars, the sports star will make more in one year than the educator in an *entire career*. Even at their low pay, an educator will be paid $3,000 to $5,000 for a month's work. Is it so unreasonable to spend $3,000 for the curriculum for a class-full of students for a year? If this curriculum delivers what it promises, it is worth every penny.

Pricing and Cost of Curriculum Summary

- Curriculum is expensive to develop.
- Curriculum which meets its goals is worth every penny.
- Don't impose society's warped value of education on this curriculum.

## Conclusion

Do you believe math is (or at least should be) for everyone? Are you willing to let go of the dozens of interesting distractions of math to focus students on the key concepts which will allow them to be successful up through calculus? Are you able to put aside societies low valuation of educators and their curricula? If your answer is yes to these three questions, then this curriculum is for you.