*Dr. Del's*

# *Golden Rule Math*

### for

# **All God's Children**

**21$^{st}$ Century Technologies and Tools**

**Revolutionizes and Transforms**

**21$^{st}$ Century Math Education**

**for All of Our Wonderful**

**21$^{st}$ Century Math Students**

Delbert Craig Hane, Ph.D. (Math) aka Dr. Del
Founder and CEO, Triad Math, Inc.

# Table of Contents

# Introduction

Math for All of God's Children?

Yes, no matter how old you are you can learn the math you need to help you achieve your goals in life.  We are All God's Children, aren't we?

You will need to learn the Decimal Number System first, and you should get some adult to teach you this, especially if the adult studies my Uncle Jack Series which teaches a parent the way my Uncle Jack taught me.

Indeed, if you read my story you will learn how this launched me on a "Success Path" even though I was very poor in many other mental and physical skills.

OK, let's say you are, or have been, or are going to be, a math student.

You will be successful, and enjoy it, if you are taught utilizing the Four Essential Ingredients you will learn in Part 1.
1.  SPIKE Pedagogy
2.  Proper Math Content
3.  Great Teacher
4.  Great Coach

There are several categories of students depending on their current situation and their future goals.  These are discussed in Parts 2 – 6.

Struggling Students can easily be converted into Successful Students thanks to modern 21st Century Technologies that empower the Four Essential Ingredients of a successful math program.

Successful Students can continue to be successful for the same reasons.

With the old 20th Century Math Programs it was not unusual for Success to become Failure.  Chapter 3.2 gives such an example, me, Dr. Del.

Then some students will want to go to college, and some will not.  Each group needs different Math Topics, as discussed in  Parts 4 and 5.  Big difference.

Then if You should become interested in some STEM subjects Part 6 will give you indispensable 21st Century Information that will be "life transforming".

Part 6 explains why 21st Century Math Education is Vastly Superior to 20th Century Math Education.  This is a MUST READ for any STEM student.

Part 7 is something Dr. Del believes any student should learn.  "Invest in Yourself" will literally empower you to achieve great success in any career path you select.

Finally, Part 8 is simply one application of math (and science) that Dr. Del likes to share with any of God's Children.

Please share this book with any parent or student you know and care about.

Enjoy!

Oh, and be sure to take advantage of a Special Offer if you are interested in learning some math for any reason.

# Part 1:
# Essential Ingredients
# of an
# Optimal Math Program

# Chapter 1.1:  SPIKE Pedagogy - Essential Ingredient #1

**Pedagogy** means:  "The method of teaching a subject"

SPIKE Pedagogy is wonderful for delivering an optimal math education to any student, *if you can do it.*

Any good math tutor knows this.

SPIKE Pedagogy is practically impossible to practice in a group environment.

Fortunately, parents can easily deliver SPIKE Pedagogy for each of their children thanks to a modern 21st Century Math Program.

Any experienced math teacher or tutor will tell you there are five ingredients of good pedagogy for math expressed by the acronym SPIKE.

**So, what is SPIKE Pedagogy?    S   P   I   K   E**

> **S** – Self-paced
>
> **P** – Proper content
>
> **I** – Interactivity
>
> **K** – Keeping score
>
> **E** – Empathy and humor

**<u>Self-pacing.</u>**  Each student will learn math at his or her own pace which is determined by many factors.

It is difficult, usually impossible, for a student to have self-pacing in a group environment where the math is being taught on a schedule.

Any good math tutor realizes this, and this is one reason why rich parents use good tutors to teach their children math, especially when they are struggling with math taught in a classroom to a group of students.

Indeed, that is how I made a good living during my school years from ages 15 – 27, high school thru graduate school, and learned the value of SPIKE Pedagogy

**Proper content.**  A student should be taught math in a sequence of topics so that the student always has the necessary pre-requisite math knowledge for each new topic.

Furthermore, it is desirable that the math topics chosen are of interest and relevance to the student.

This is a horrible failure of our current Standard Math Curriculum taught in most math programs which include many obsolete manual tools and a lot of premature theory.

An essential ingredient of proper motivation is to explain to the student how a given topic will serve the student well in the future given the student's long-term potential interests in life.

Just realize that math is a HUGE subject.

No single human understands or knows all the math there is.

Different people need different math topics depending on their broader interests in life.

**<u>Interactivity.</u>** Math is like a sport or game.

To learn math you must do math.

You must practice math.

You will make a lot of mistakes.

You will struggle to overcome hurdles.

Fortunately, with the right attitude math can be one of the most fun and rewarding sports or games you can ever play.

This is why the psychology of the student is so important.

The student must enjoy the sport or game of math.

This is why having both a great teacher and a great coach is so important.

The teacher explains the math and selects the proper topics for the student.

The coach guides and encourages the student.

Mistakes are celebrated as evidence of effort, just like in a sport.

Personal achievements are celebrated as the student climbs the ladder of math topics.

The coach must be sure the student doesn't miss any rungs of the ladder.

The coach must be sure the student practices.

## **<u>Keeping score.</u>**

It is very important to keep score of a student's progress and recognize the student's progress and achievements, just like any game or sport.

This is an important responsibility of the coach.

Keeping Score is a powerful motivator for a student.

It is like ranks and merit badges in scouting.

Or, playing a game with one's self.

Climbing the ladder of success.

It is important to create and maintain a good psychology for the student.

Math can sometimes be frustrating for most any student.

So says Dr. Del.

"I have a Ph.D. in Math, but I can tell you that many, many times I was frustrated.

I probably have made more mistakes in math than anyone you know.

Remember, Babe Ruth was the Strikeout King, as well as the Home Run King.

The Proper Math Content will vastly improve most students' lives.

Keeping score will prove this when you compare it to the student's other achievements, especially those that depend on a good math foundation.

**<u>Empathy and humor.</u>**

A good math student will practice a lot, and make a lot of mistakes.

When I make a mistake, I just chuckle a little and correct it and go on.

If I make a big mistake I laugh out loud.

Life is funny if you approach it right.

In your life you will make a lot of mistakes.

It is up to you to decide how to deal with them.

This is very important if you want to maintain a good psychology.

"I would not have earned a Ph.D. in Math IF I had not learned to laugh at myself and my mistakes." confesses Dr. Del.

So, Math Student, when you make a mistake, chuckle or laugh, and realize you are making progress and learning from you mistakes.

**Summary:**

OK, SPIKE Pedagogy is necessary for a good math education.

The facts are that it is very difficult to deliver the SPIKE Pedagogy for each student in a group setting of many students which is how math is still being taught in many of our schools.

That is why Homeschool Math can be superior to Classroom School Math.

In a typical classroom, the teacher will be going too fast for some students and they will fall behind and FAIL.

Any grade less than an A is essentially failure.

**You either understand a math topic or concept or tool, or you don't.**

And, the teacher will be going too slowly for some students and they will become bored and frustrated. That's bad for them, too.

Grading on the bell curve is a HOAX.

Math performance is essentially bi-modal.

Either you understand a math topic, or you don't.

So, if a teacher tries to slow down as much as possible to keep fewer students from failing, this then makes the math boring for the good students.

Boredom with a subject again creates bad psychology and bad ultimate results.

Indeed, often the primary "motivation" for a good student in a math class is to just get a good grade by scoring high on the bell curve.

**Conclusion:**

**Deliver math education to your students utilizing SPIKE Pedagogy.**

# Chapter 1.2: Proper Content - Essential Ingredient #2

This is the proper content for post-elementary math students, whether they have been successful in their math studies, or not.

If a student doesn't understand the decimal number system, have your parent teach it to you following the Uncle Jack videos.

Once you understand the decimal number system, learn to use the TI-30Xa Scientific Calculator to do your arithmetic calculations and be sure you understand the Rules of Arithmetic.

This is all covered in Tier 1 of Triad Math's Online Program.

Most students find this very easy and fun, and do it in a couple of weeks.

It is self-paced and will take various amounts of time for different students.

When completed the student will have a skill possessed by very few USA adults.

And, the student will be well prepared for Practical Algebra, Geometry, and Trigonometry which will now be easy to learn in Tier 2.

Tier 1 is a prerequisite for Tier 2.

This alone makes the Triad Math Online Math Program quite different from any Standard Math Curriculum Program, and in our judgment, vastly superior.

[Parent: Pay close attention to the Coaching Principles and Guidelines, Chapters 1.3 and 1.4. You will be using them for all of the Tiers to come.]

Now, on to Tier 2:

First, learn Practical Algebra              Tier 2  10 Lessons

Second, learn Practical Geometry       Tier 2  19 Lessons

Third, learn Practical Trigonometry   Tier 2   7 Lessons

"Wow, all of this in only 36 Lessons!" exclaim most students and parents

Most students are able to complete Tier 2 in two or three months if the student will work a little on most days, say 30 minutes to an hour five days a week.

Dr. Del's advice to a student: Read Chapter 1.4 and learn to coach yourself!

You will watch the tutorial videos to learn the topics and how to do the exercises.

Stop, back-up, re-watch the video until you understand the topic.

You are the boss on your own self-paced time schedule.

You control the tutorial video.

You add to your notes that the video is following.

It's best to have your notes printed out from the PDFs before you watch the video.

You can get them printed by Amazon cost-effectively if you don't want to print them yourself.

**Then, do the exercises.**

**That's where you really master the topic.**

Most of your time will be spent doing exercises and reviewing.

If you have watched a tutorial video several times and still cannot do an exercise, go to the Student Forum, ask a specific question, and get some help.

Then, take a short quiz to be sure you have mastered the topic.

Your ONLY grade will be an A.

Oh yes, go back and review a topic many times in the future until you really remember it.

After all, "Here today, gone tomorrow", is a problem for us all!

After you master Tier 2, you will know more math than most adults in the USA and be ready for the military or technical workforce or to study any technical field.

Here is my one question 'test' you will be able to answer that you can use to prove this!

It just might impress some of your family and friends.

My one question test, which will prove you are now "Matherate" for the practical technical workforce, is you will be able to calculate, in less than one minute, the area of a triangle with sides of 8.3 in, 10.4 in and 15.4 in.  You will be able to calculate the area of any other triangle.

The solution involves most of the things you have now learned, including Practical Trigonometry and the TI-30Xa Scientific Calculator. Easy peasy!

Very few people can solve this practical problem!

It's a great way to challenge a "wise guy" with a friendly bet.

Let them choose the lengths of the three sides of the triangle.

Then find the area!

Have FUN!

(Answer: 40.5 sq in)

Note: A successful math student may already understand many of these topics.

Great, then this is a good review and will go very fast.

But, it is imperative that the student know all of the topics and not miss any rungs on the math ladder.

A common way for a successful student to become unsuccessful is to try to understand a math topic that the student does not have the prerequisite knowledge required for this topic.

**Immediate Action Plan**

See the Special Offers and take advantage of one of them.

The parent can be the coach. See Chapters 1.3 and 1.4.

**Dr. Del can be your teacher available via the tutorial videos and Learning Management System 24/7 for less than $1 per day, maybe much less.**

# Chapter 1.3: Teacher and Coach - Essential Ingredient #3

To learn math, a student needs both a teacher and a coach.

The teacher selects the appropriate topics for a student, explains each topic, and gives the student exercises and feedback via a quiz.

The coach monitors the student's activities and gives the student motivational feedback with both "carrots" and "sticks".

The "sticks" might be requiring the student to spend a certain amount of time studying math with the teacher.

The "carrots" are giving the student positive feedback in the form of compliments and rewards for efforts and accomplishments.

Mistakes are unavoidable when learning math, just like any sport or skill.

The coach should acknowledge the student's mistakes as good efforts and progress in learning the math concepts and skills.

DO NOT ever let a student feel s/he is a "failure" because of some mistake s/he makes. Celebrate mistakes as a sign of effort and progress.

A coach should be able to come up with various "rewards" for a student's progress and efforts.

**Recognition and sincere compliments are often the best rewards.**

A coach must be present in a student's life, care about the student, and make persistent and consistent efforts to give the student these positive feedbacks.

And, a "kick" when needed.

A coach must be prepared to encourage the student to make efforts even when these efforts seem to not be producing good results.

All successful people go through periods of "doldrums".

Any successful person in the development of any skill will make many "mistakes".

That's life!  We all live it.

The coach must be sure the student understands this and appreciates this.

Compare math to some game, sport, music, or any other skill the student likes.

We all make mistakes.

The more we practice the more mistakes we make, and the better we become.

The better we become the fewer mistakes we make, but we will always make mistakes.

The more we learn the more mistakes we will have made.

The coach should try to help the student see where learning the concepts and skills of math will help the student in other areas of interest to the student.

If a student is interested in any technical field s/he must realize the value of math in this field.

The coach should be sure the student is aware of this.

**The coach does not have to be the teacher.**

The coach does not have to know much math.

The coach will work with the teacher.

It is possible that one person can be both the coach and the teacher. But, this is usually impossible.

**I, Dr. Del, can be the teacher thanks to modern technologies**

**You can be the coach.**

Any parent must find a local person to be the coach since this requires a continual presence and a personal relationship.

Sometimes the student can be his or her own coach.

To learn more about becoming a Great Math Coach read Chapter 1.4.

# Chapter 1.4:  How to be a Great Coach - Essential Ingredient #4

### Motivators and Learning Techniques

**Motivators:**

### Intrinsic vs. Extrinsic

**Intrinsic Motivation** . . . is when a student studies and learns math simply for the internal satisfaction and enjoyment.

It is what usually motivates a person to play a game or sport.

Once a student starts to learn math and gain confidence and self-esteem Intrinsic Motivation often sets in.

This is what we want as a coach and teacher.

However, for many students this takes some time.

In the meantime, a coach can use extrinsic motivators.

**Extrinsic Motivation** . . . is when a student wants 'something' that the study of math will provide. That 'something' is an extrinsic motivator.

For example, if a student wants to study some STEM subject then that is an extrinsic motivator since Math is necessary for virtually any STEM subject.

If a student wants to enter any technical field in industry or the military, then practical math is necessary and that is an extrinsic motivator.

Triad Math's Tiers 1 and 2 provide this necessary math and also are a great foundation for future math studies.

If a student wants to excel on the SAT, then Triad Math's Tier 3 program will satisfy this need.

Of course, other extrinsic motivators can include any type of rewards.

These can include grades, praise, privileges, money or many other things the student might want including the avoidance of some type of punishment.

However, we find that when the Proper Content and SPIKE Pedagogy are utilized by the teacher, then usually the student becomes intrinsically motivated since most of us enjoy anything that is challenging and we succeed at.

Okay, let's assume that your student is motivated enough to study math.

It is imperative that the math be taught in such a way that the student is successful. Only success will lead to intrinsic motivation.


**Learning Techniques.**

To successfully learn math, a coach should teach the student to engage in certain practices.

This is different than teaching the math itself.

That is why a coach and teacher are two different necessary components of a good math learning experience.

I recommend Dr. Barbara Oakley's great book, *"A Mind for Numbers – How to Excel at Math and Science (Even if You Flunked Algebra"* for an elaboration on what I am going to recommend to you as a coach and to any student. It's what I use as a coach.

**First**, be sure the student studies topics in a proper sequence so that the student always has the necessary prerequisite knowledge for the topic at hand.

In other words, Proper Content. See Chapter 1.2.

Have the student fill in any deficiencies you can identify.

Follow the Six Tiers if you utilize me as your teacher.

Do not skip any lessons, and review a lot to be sure you, the student, don't forget what you have learned.

**Second**, be sure the student studies a new topic with a focused approach by studying the notes with the tutorial video and then working on the exercises.

Concentrate with no distractions. That's focus.

Do this for a reasonable length of time until either the student understands the topic and how to do the exercises, OR until the student gets confused and tired.

15 to 30 minutes usually good for one session

Then STOP. Take a break!

**Third**, have the student engage in various activities so his or her mind can go into an Unfocused Mode.

The Unfocused Mode is when and where the sub-conscious mind processes the focused activities.

# How to be a Great Coach

We don't understand how this really works, but it often does.

Usually the Unfocused Mode involves some routine task or habit that requires little thought.

Do some routine boring chores.

Watching entertaining videos or playing games may not work.

You want the mind relaxed.

Who knows?

Try various things and see what works for the student.

**Fourth**, have the student then engage in another focused session and work on the same topic.

Now, usually the topic seems more understandable and the confusion lifts some.

It's pretty amazing how often this works.

Persistence will yield success.

No one to my knowledge knows just how and why this really works, but it does often work.

Your subconscious mind is a great mystery and miracle.

Many great thinkers have confessed this is how they often solve a problem or discover a new concept.

It certainly works for me, and I use it all the time.

Try it.  Give it a chance to work.

It is important for a coach to explain and convince a student that s/he will succeed if s/he practices and tries hard enough and perseveres.

I can remember many times when as a student I struggled with a new concept, and then after several focused and unfocused sessions it finally fell into place.

That's how I wrote my thesis for my Ph.D. in math.

Sometimes, after I mastered a topic I wondered why I ever had a problem with it in the first place.

Often, you have to try many things and go down many blind alleys before you achieve the understanding and solve the problem.

The more you believe in your capabilities the more success you will have.

Yes, you will have failures and frustrations.

Sometimes you may just want to 'give up'.

I did more than once.

The more difficult the problem or concept the more you will experience this.

But, the greater the reward and satisfaction will be when you achieve the breakthrough and achieve success.

A good coach will explain these things and encourage the student.

Celebrate mistakes as progress too.

Success does breed confidence and more success.

But, failure should also be a sign of progress in ultimately achieving success.

Success usually is built on the back of many failures.

A student must "learn to learn" and a coach can greatly facilitate this.

The coach and teacher must work in tandem.

Eventually, the student should become the student's own coach.

AND, the student should be able to apply the same techniques to learning other subjects too!

**Learning Math will also yield the "Learn to Learn" ability.**

**And, this is one of the keys to success in life!**

# Part 2:
# Struggling Math Students

# Chapter 2.0: A Typical Homeschool Story

A frantic call came in to Dr. Del from Ruth, a homeschool parent.

"Dr. Del, I'm a homeschool parent with my child, Jacob, he's 12 and is struggling with math.

"I have been able to teach him some basic elementary math, but I am way over my head going forward.

"We have used several different math programs, and frankly nothing is working for him.

"Can you help me?" asked Ruth.

"Yes, I believe so, but first a question. OK?" answered Dr. Del.

"OK…" replied Ruth.

"Can Jacob play games of any kind or work on puzzles of any kind or build things, or play a sport, or do anything that requires some skills?" asked Dr. Del.

"Oh yes, he's pretty good at playing various games, and he loves to play them," replied Ruth.

"Good news then. Jacob can learn math. Math should be treated like a game or sport." stated Dr. Del.

"Really?" asked Ruth.

"Oh, YES! Really!" said Dr. Del.

"This book will show you how and why this is the case, and most importantly, how you can cause it to happen.

"I'll be the teacher, you'll be the coach, and Jacob will enjoy and succeed in learning math.

"The 'secrets' are SPIKE Pedagogy and Proper Content," explained Dr. Del.

"That's what you will learn from this book," said Dr. Del.

"Wow, that's wonderful. Thanks so much!" exclaimed Ruth.

"We'll both know how Jacob is doing as you will learn," replied Dr. Del.

"Keep up the good work, and on to math success for Jacob!"

Dr. Del has had similar conversations and experiences with many other students.

See Grace Libman's story in Chapter 2.3 and Craig's own story in Chapter 3.2 for other student experiences.

Then, be sure to take advantage of one of the Special Offers to begin to help your own struggling math student.

Indeed, many a struggling student turns into a successful student, and some into potential STEM students.

# Chapter 2.1:  Struggling Students

Dr. Del had a discussion with Mary about her child Frank, who dislikes math and perhaps is afraid of math.

"You did tell me he does understand the basic number system with fractions and decimals, right?" asked Dr. Del.

"Yes, I think so.  But, he really hates doing arithmetic problems like division and fractions.  He wants to know why he can't just use a calculator or his phone," responded Mary.

"Good for him!  Good question.  What is, or was, your answer?" asked Dr. Del.

"Well, we were using a math program that taught the manual techniques and didn't teach how to use a calculator." answered Mary.

"Wasn't that the right thing to teach?" asked Mary.

Dr. Del's response is: "In my judgment, the answer is No!

"No modern employer or technician or engineer or scientist will do arithmetic problems manually will they?

"That would be like drilling a lot of holes in wood with an old manual brace and bit instead of a modern electric drill.

"It's time-consuming, error-prone, difficult to learn, expensive, etc.

"What do you think?" asked Dr. Del.

"Hmm. I sort of see what you mean.

"So what do you teach or recommend?" asked Mary.

"The first thing I teach a post elementary student is how to use a scientific calculator to perform ALL arithmetic calculations.

"This method is MUCH easier to learn and to do, and less error prone.

"And, perhaps most important, it will be fun once you learn and practice it.

"Like a sport," said Dr. Del.

Dr. Del then explained:

"We first teach your students how to use the TI-30Xa Scientific Calculator, costing less than $10, and it's a really great calculator that would have been worth a million dollars a century ago or even in the early 1940's on the Manhattan project.

"It is fun and easy.

"We call it Tier 1 and most students do it in just a couple of weeks or so.

"Our training is self-paced and helps build confidence and self-esteem toward math. It uses SPIKE Pedagogy. (See Chapter 1.1).


"This is very important, maybe most important. Good Pedagogy!

"Then we review all the rules of arithmetic in what we call PreAlgebra to be sure the student is ready to move forward. This is also part of Tier 1.

# Struggling Students

"The student will be given written notes and a tutorial video for each lesson.

"And, also exercises, with the answers, of course.

"You really learn math by doing math, not just reading about it or watching a video.

"The notes and tutorial video explain how to do the exercises.

"The student really learns and masters math by doing the exercises.

"And, the student can re-watch the tutorial video as many times as needed to understand the topic.

"This happens on the student's own schedule!  Very important. Self-paced.

"Then, there will be a quiz consisting of more exercises.

"There's nothing tricky or unexpected.

"The quiz just lets the student, parent, and coach know the student is ready to move on to the next topic or lesson.

"This is kept track of in a Learning Management System so the student, parent, and coach can monitor the student's progress.

"Just like climbing a ladder one step at a time.

"This is how we start ALL of our students.

"Those who already know the lessons will go through it quickly, just like a review.

"We also recommend the parent provide a coach, which is quite different from the teacher, who is me. (See Chapter 1.3)

"Most parents become the coach. (See Chapter 1.4)

"We have some training on Coaching for the Parent," explained Dr. Del.

Read it again to be sure you understand it if you have a struggling student in your family.

The notes and exercises come in a PDF you can print out, or they can be purchased in book form on Amazon, pretty inexpensively thanks to Amazon's Print on Demand books program.

Be sure to see the Special Offers and try it out.

# Chapter 2.2:  Math? Help!

This chapter contains advice for a parent with a child who is struggling with math.

So, here are two questions the parent might have, and eight questions the student might have.

The answers to these questions should help both the parent and the child/student.

I will give you my quick answers below.

And then, tell you what to do in the following chapters.

If you want more in-depth answers, then there is also a 24 page eBook, *Math? Help!*, for parents with a child who is struggling with middle or high school level math that I wrote some years ago that gives my answers to these questions in quite a bit of detail.  You may get a free PDF copy of it, too.

Go to www.HomeschoolerToday.com and click the Free Resources tab.  Then, click on the Educational Tab at the top, and then select eBooks.  Now you can download the *Math? Help!* eBook in PDF format.

I suggest you think about what you, the reader, think the answers are for these ten questions for both you and your child.

Then, look at my short answers below or in the eBook *Math? Help!* for a more in-depth discussion.

Ultimately, you must come up with answers you believe, and then act on them in the best way you can for your child.

1 and 2 are for parents, and 3 – 10 are for the student.

   1   Why is my child struggling with math?

   2   What can I do about it for my child?

   3   What's math all about?

   4   Why is math hard for me?

   5   Is it MY fault, or am I "stupid"?

   6   How can I understand math?

   7   Can math be EASY for me?

   8   Can math be FUN for me?

   9   What good will math do ME?

  10  So, what should I do, RIGHT NOW?

My very short answers.  More details in the *Math? Help!* Book.

1   Why is my child struggling with math?
     Poor Pedagogy and Improper Content

2   What can I do about it for my child?
     Deliver Proper Content (Ch 1.2) with SPIKE Pedagogy (Ch 1.1)

3   What's Math all about?

  Numbers and Geometry and

  Modern TOOLS to solve problems

  The Modern TOOLS make learning Math much easier too!

4   Why is Math hard for me?

  See #1  Parent can explain.

5   Is it MY fault or am I "stupid"?

  NO!  Math is no harder than your games you are good at.

6   Can I understand math?

  YES!  In fact, you can get good at it.

7   Can math be EASY for me?

  YES!  When taught properly to you.

8   Can math be FUN for me?

  YES!  Math is a great Game.

9   What good will Math do ME?

  Math can transform your life.

  Math will empower you to pursue many different careers and learn many things that might interest you either for a hobby or job.

  Math will teach you how to: Learn to Learn

10   *So, what should I do, RIGHT NOW?*

  Take advantage of a Special Offer and become a Successful Math Student.

# Chapter 2.3:  Grace's Story

**My journey as a struggling math student:**

I started public school in kindergarten like any other American child.

However, problems started to arise as early as first grade. I was having immense issues with mathematical concepts, and simply understanding the subject in general.

My first grade teacher tried her best to help me amongst her limited amount of time and the responsibility of 20 other students.

It wasn't enough.

She taught me little tricks here and there to at least get me to understand the homework, which I did find somewhat helpful.

Unfortunately, none of the concepts were ever fully mastered.

Since she didn't have much time or attention to offer me, she would buddy me up with another student, who was basically a genius for our age at the time. Like my teacher, he wasn't very helpful either.

Second grade, I am afraid, was not any more successful than the first.

My teacher that year was less patient than the previous ones and couldn't afford to spend any time tutoring me one on one.

# Grace's Story

I remember crying in the bathroom in between classes because of all the red Xs on my math homework.

She would punish the whole class by taking away recess and using that time instead to help me understand the math lesson.

My classmates ended up hating me, and my extreme dislike and basically hatred for math began.

My mom took me out of public school shortly after due to horrible math grades and because the teachers could do nothing further for me.

I struggled for eight more years, trying several different math curriculums and understanding very little, which just ended up in arguments with my mom.

My attitude towards math over the years grew so poor that I would skip lessons and lie about doing math like I was supposed to.

I would hide my lack of understanding math from my friends due to extreme embarrassment.

It wasn't until my sophomore year in high school that I took the ACT and realized there might be a chance of failing it simply due to math.

In all honesty, I excelled at every other subject except math and saw my ACT grade being very low just because of my lack of mathematical understanding very upsetting.

I reached out to a counselor from my umbrella school and she told me about Triad Math.

She explained it would teach me principles I needed to know to graduate and for basic life applications.

After some research and hearing successful testimonies from other struggling students, I gave it a shot.

## My Experience with Triad Math - Success at last!

Immediately after starting the Triad Math program, I could tell this program was nothing like anything else I had done before.

The first 12 lessons were dedicated to learning the functions and proper use of a TI-30Xa Scientific Calculator, which is completely unlike any other math curriculum out there on the market.

I had the belief that calculators were not acceptable to use and were in fact, bad. I had been taught that manually solving problems was the correct and right way instead.

Dr. Del teaches the invalidity of that belief and how the calculator is a power tool that needs to be utilized.

He goes on to teach pre-algebra, algebra, geometry, and trigonometry in short, concise, and easily understood lessons without making me feel dumb or incompetent.

I was allowed to learn at my own pace, which was so helpful especially as someone who needs constant review and struggles with understanding mathematics in general.

I was not given any of these opportunities in public school or with any standard math curriculum I studied at home.

Triad Math has helped me since then grow in not only my knowledge of math, but also become more confident than any other math program.

Before Triad Math, I was embarrassed, never talked about math, and avoided it at all costs.

Now, I am not immediately frightened by a math problem and have a more open and healthy attitude towards mathematical concepts.

Honestly, I do not love the subject of math, but I am more confident and feel less inferior thanks to Triad Math.

Every struggling math student needs to invest in a better education with Triad Math.

Grace Libman

**Dr. Del's comments:**

Grace's story is pretty extreme since she suffered from the very beginning.

Many students do well in math for some time, and then meet a class where for some reason they struggle and "fail".

Then, they develop a fear or dislike of math.

Perhaps not as extreme as Grace's, but bad enough to cause them to cease to do well in their future math studies.

This can happen at any stage in a student's career. See Chapter 3.2 for another story. This story tells of a student, Craig - me, where the student did well in math until taking a bad class, in this case 9th grade in high school.

Craig's story had a "happy ending" due to two very good teachers Craig was fortunate to have. Most students have not been so "lucky".

Thanks to modern technologies, any student today can enjoy similar "good luck" thanks to Triad Math and Craig aka Dr. Del.

# Part 3:
# Successful Math Students

# Chapter 3.0:
# A Typical Homeschool Story

A call came in to Dr. Del from Claudia, a homeschool parent.

"Dr. Del, I'm a homeschool parent with my child, Cody. He's 13, and he's been successful with math so far.

"I have been able to teach him math up to this point, entering 7th grade.

"But, I am way over my head going forward and I'm really worried about going forward.

"Personally, I have never liked Algebra or other more advanced math subjects very much.

"I am looking at several different math programs, and don't really understand any of them.

"I'm afraid I might hurt Cody if I'm not careful.

"Can you help me?" asked Claudia.

"Yes." answered Craig.

"I'm really glad you haven't led Cody down the wrong path and turned him into a struggling student, as often happens post-elementary.

"This book will tell you what you can, and should, do to keep Cody successful.

"You will be Cody's coach.

"Someone else will be his math teacher.

"Maybe it will be me.

"But, whoever it is, it is very important that you teach Cody the Proper Content and teach with what I call SPIKE Pedagogy.

"Thank God, today with some wonderful 21st Century Technologies, this is possible.

"So read this book, especially Parts 1 and 3, and then do the right thing for Cody," was Dr. Del's full answer.

# Chapter 3.1: Success?

Success?

What is "success" in some subject?

Here is some "food for thought".

In school, success might be defined as getting a high grade in a subject.

A high grade is what I call an Extrinsic Motivator.

Read Chapter 1.4 to understand Extrinsic and Intrinsic Motivators.

Suppose you are studying a subject you do not enjoy, and also do not see any value in for your future interests or endeavors.

Then a high grade certainly is an Extrinsic Motivator.

If you enjoy learning a subject, then that is an Intrinsic Motivator.

If you believe learning a subject will be of value to you in pursuing your other interests, then you may define that to be a "good" Extrinsic Motivator.

"Good" Extrinsic Motivators are great.

However, I believe Intrinsic Motivators are even greater, and desirable.

What if you get a good grade by simply scoring higher than your classmates, but don't really understand the subject.

Is this success?  Absolutely not by my definition given below.

But, it did satisfy your Extrinsic Motivator.

I call it a "bad" Extrinsic Motivator, all too common in some schools.

You must decide which Extrinsic Motivators are desirable or not.

You have to decide what Motivators you value and will work for.

**Dr. Del's Definition of Success in Studying Math.**

**First**, there will probably be 'good' Extrinsic Motivators.

The one I think is best is the student's belief that the math s/he is learning will be of value in learning other subjects the student is interested in.

It is the teacher and coach's job to teach that to the student in addition to teaching the Proper Math Content to achieve that goal.

For example, Practical Math will be valuable in pursuing many technical subjects, either for careers or hobbies.

Consumer Math will be valuable for many things in life.

STEM Math will be valuable, indeed necessary, to learn various STEM subjects.

All "good" Extrinsic Motivators to learn certain appropriate Math Topics.

Success?

**Second,** Intrinsic Motivation is the best of all.

That means the student enjoys learning and doing math for satisfaction like the student would get from some sport or game or music or any activity the student likes to do just for enjoyment and satisfaction.

For this Proper Content and SPIKE Pedagogy are both quite necessary.

We usually enjoy an activity where we are successful after putting in various efforts.

In the chapters on Proper Content (1.2) and SPIKE Pedagogy (1.1) I explain how 21st Century Technologies make both of these possible.

WARNING! Just because a student is successful in math right now, is no guarantee that won't stop IF the student hits some future math barrier.

Indeed, that happens to many students at some point in their educational career due to some Improper Content OR some Improper Pedagogy.

Indeed, it happened to Dr. Del in the 9th grade and Grace Libman in the 1st grade, Chapter 2.3

For Dr. Del's story, read Chapter 3.2.

No student or parent wants that to happen.

To be sure that does not happen always teach Proper Content to your student, and practice SPIKE Pedagogy.

For most parents that becomes quite challenging after elementary school, if not before.

This Golden Rule Math book explains how to never let that happen.

There is one Online Math Program this book will tell you about where the parent can be a great coach, and Dr. Del can be a great teacher. See Chapter 1.2.

You may test it out for free, or no risk, by using one of the Special Offers pointed to below.

**Proper Content and SPIKE Pedagogy are the two Key Ingredients.**

And, thanks to some 21$^{st}$ Century Technologies this math program is also quite inexpensive, both in terms of both the parent's and student's time, and money.

So, be sure to take advantage of one of the Special Offers you will receive with this book.

Math is no longer a barrier or a problem for homeschoolers.

Indeed, math will be fun for the student.

More importantly, prepare a student for 1001 Career Paths and Hobbies.

Obviously, this is what all parents want for their children.

Today, in 2021, it is now possible.

# Chapter 3.2:
# Success → Failure → Success

Sometimes a story can help a parent or student to understand the dual concepts of success and failure.

It is not uncommon for a student to experience both success and then later, failure.

Unfortunately, that is often where the story ends.

Fortunately, it doesn't have to today, thanks to what you are learning in this book.

However, it does take some kind of serious intervention.

Here is Dr. Del's story, and how very fortunate he was, for which he gives God thanks every day.

Delbert Craig Hane, aka Dr. Del, aka Craig Hane, Ph.D. (Math) was born in Greencastle, Indiana November 30, 1938.

His family moved into a small bungalow on the banks of Deer Creek, five miles south of Greencastle, in the woods.

No running water, no central heat, no phone, no TV, but did have electric lights, a radio, a manual water well pump, and an outhouse.

The only neighbors were Craig's Uncle Jack and Aunt Inez, a short path away in a log cabin his Uncle Jack had built five years earlier.

There were lots of pets and wild life of all kinds.

Life was wonderful for Craig!

Play in the creek and take long walks in the woods, read books, and listen to the radio.

Craig's parents both worked.

Dad worked in a war factory in Indianapolis, and Mom worked in a beauty shop in Greencastle.

Craig spent a lot of time with his Aunt Inez and Uncle Jack.

Uncle Jack was a barber and builder.

He had built his log cabin in about 1933 during the Great Depression.

Uncle Jack knew a lot of practical math needed for life and building.

Uncle Jack became Craig's homeschool teacher of basic practical math – numbers and practical geometry.

He taught Craig how to count with the decimal number system using Cheerios, dimes, and pennies when Craig was 4 and 5 years old.

Homeschooling!

Craig was enrolled in the first grade at age 5 in a four-room school with eight grades in Putnamville, about 3 miles away by a short school bus ride.

He was the youngest student in the first grade and the least mature.

His poor teacher, Miss Bernice Lewis, worried since he couldn't skip, sing very well, or color right since he is color-blind.

Dumbest kid in first grade!

Then one day she started teaching the first graders to count.

None of them had been taught to count yet.

Most couldn't get past 10.

But, thanks to Uncle Jack's homeschooling, Craig could count to 100 and beyond.

Wow!

Miss Lewis was surprised and impressed.

So, Miss Lewis had Craig help her teach his older more mature classmates how to count, and begin to add, too!

This might have been the most important psychological thing to happen to Craig in his whole life.

Confidence and self-esteem!

Respect from his peers for the first time.

Craig also then learned the second grade math, too, since they were in the same room.

So, by age six Craig was well ahead of his classmates in math.

Thanks to more math from his Uncle Jack, Craig stayed at top of his class all through the 8th grade.

Not only good with numbers, but practical geometry a builder knows too!  (See the Uncle Jack videos for parents.)

Craig's family were all working folks.

His dad had an 8th grade education.

No one in his entire extended family had ever gone to college.

College was considered the passport to great success, and Craig was always told by his family that HE would someday go to college and have success more than any of them had achieved.

Ooops!

A horrible set back occurred in Craig's freshman year, 9th grade, in Greencastle High School.

Algebra 1!  With a teacher, Mr. H.H.

Algebra was beyond anyone in Craig's family, including Uncle Jack.

Even Craig's 8th grade teacher wondered what  x meant.

No help now from homeschooling.

Craig struggled and didn't like Mr. H.H. since he couldn't understand him and get his questions answered.

And, Craig always made a lot of careless errors when taking a timed test.

The result?   A bad grade in Freshman Algebra.

Craig's GHS counselor and principal BOTH told Craig he should take "shop" since he was not "college material" like the upper-class kids and would obviously be a "working man" like his dad and family.

Wow! No college.

Craig was pretty depressed all summer before the 10th grade.

Then, in the 10th grade Craig had an amazing teacher, Miss Madonna O'Hair, for Geometry.

Prove theorems logically, sort of like his Uncle Jack approached practical math.

Craig loved it and excelled and got an A.

On top again.

Then, Mr. H.H. in the 11th grade for Algebra 2.

Now, things were different.

Craig became a very disliked student since he now asked questions and demanded logical answers that Mr. H.H. wouldn't give him.

To be fair, Mr. H.H. probably didn't know the answers.

A bad student?  Or a bad teacher?

A bad grade again.

Craig went to Miss O'Hair for advice.

DePauw University is in Greencastle and only the most successful GHS graduates could go there.

Success as measured by grades, of course.

Miss O'Hair suggested to Craig that he go to DePauw his senior year as a special student and take Algebra there and just see how it went.

Mr. McCammon, the GHS principal, strongly objected, "Craig, you'll embarrass GHS. You will not do well in Algebra since you didn't do well in Algebra twice here."

Craig's dad, Delbert, had a talk with Mr. McCammon and Craig was given permission to embarrass GHS.

So, 16-year old Craig enrolled in College Algebra at DePauw as a special student.

Mistake!

This was for DePauw sophomores.

He should have been enrolled in Freshman Intermediate Algebra.

So, Craig was in a class with 19 and 20-year old DePauw sophomore students who were going on in math.

The Professor was Dr. Clint Gass, who was the DePauw Math Department Chairman.

Long story short, Dr. Gass was a great teacher like Miss O'Hair, and Craig got an A.

Dr. Gass became Craig's mentor too.

In the second semester, Craig took Trigonometry at DePauw with Mr. Johnson and got an A there, too. A good teacher again.

In Craig's junior year at GHS he tutored the captain of the football team, Fred U., in Geometry, and was paid to do so by Mrs. U. Wow!

Getting paid for something he loved to do. Amazing!

Then, in the second semester of his senior year, Mr. H.H. was teaching Trig to the juniors and seniors at GHS, and Mr. H.H. got the flu.

Miss O'Hair was asked to teach the Trig class for a week.

She said she would only do so IF Craig could teach it.

After all he was learning Trig at DePauw and was a couple of weeks ahead of GHS. And, he had just earned an A in College Algebra!

So Craig got his first experience teaching a whole class.

The topics were Trig Identities and all the GHS students learned them in the following week.

When he returned Mr. H.H. told the class that identities were not important and there would be no test, so no need to review or ask questions about them!

FYI, Trig Identities are extremely important for Calculus.

Mr. H.H. was probably a typical H.S. math teacher at that point in time, incompetent.

Miss O'Hair was an exception.

Craig was extremely fortunate to first be homeschooled by Uncle Jack, then taught by a wonderful, good teacher, Miss O'Hair, and then a wonderful college professor, Dr. Gass.

Craig had a mediocre GPA in high school.

He worked about 20 hours per week from 7th grade on, and saved all his money. No time for wasting it anyway.

By the end of his senior year, Craig had saved enough money for four years tuition at a private school like DePauw.

But, Craig wanted to escape Greencastle and go to a college like DePauw, but with no Greek fraternities or sororities.

Oberlin College was a few hours away on the Pennsylvania Railroad, and Craig visited and loved it.  So he applied.

Craig was accepted to Oberlin College, the No.1 Liberal Arts College in the USA in 1956 (thanks to the huge endowment by Charles R. Hall who founded Alcoa).

Craig believes this was due to Dr. Gass's recommendation.

Craig now had self-confidence in math and did well at Oberlin.

He also taught math to his classmates as a paid Problem Session Instructor.  Very successful.

Craig used what he now calls SPIKE Pedagogy.

Then, after graduation in 1960, he taught all four classes of math for one year on a temporary license at Western Reserve High School in Wakeman, Ohio, 20 miles west of Oberlin.

That was the most wonderful year as a teacher in Craig's life.

And, he fully came to believe that high school math education in most of the USA was truly horrible.

Most of his successful fellow math majors at Oberlin had been to private schools or wonderful public schools in New York or some large city.

Graduates of ordinary high schools had little chance for success in math.

Craig believed he had just been incredibly lucky to have Miss O'Hair, and then Dr. Gass, as teachers.

Home for the summer and visiting Dr. Gass as usual, Dr. Gass invited Craig to teach math at DePauw the second semester in 1962 while he, Dr. Gass, went on sabbatical.

Dr. Gass also suggested Craig enroll in graduate school math at Indiana University the first semester to see what it was like.

Craig did both and loved them both.

He then received his Ph.D. in theoretical math from I.U. in 1966.

Just imagine.

"You are not college material due to your Freshman Algebra 'failure' in 1952 at GHS" to teaching math at DePauw in 1962.

Then, getting a Ph.D. in Math at Indiana University in 1966, and on to Associate Professor of Math at Indiana State University, teaching the most advanced math subjects for three years.

Then, Associate Professor of Math at Rose Hulman Institute of Technology teaching the most advanced math subjects like Topology and Functional Analysis, for four more years.

Then, Craig decided to have several business adventures, one of which was to found an industrial training company in 1980, which taught thousands of skilled tradesman technical subjects for 25 years.

Visit: [www.HaneTraining.com](www.HaneTraining.com) to see them.

Craig always wanted to see math education reformed, but had no practical way to help do this, until 21st Century Technologies appeared.

In 2008, Craig began to create a modern 21st Century Math Program and was amazed when in 2009 Wolfram Alpha arrived on the scene.

The rest is history.

In the next chapter, you can learn about the Six Tier Math Program Craig created that is the first 21st Century Math Program to appear.

It is vastly superior to the current Standard Math Curriculum Programs in both Proper Content and SPIKE Pedagogy.

Be sure to try one of the Special Offers to prove it to yourself and your children, like Grace Libman, and many others have.

You have nothing to lose, and much to gain!

# Part 4:
# Non-College-Bound Students

# Chapter 4.1:
# Non-College-Bound Students

There are two categories of students who do not go to college:

    I.    Students who might want to pursue a technical career or job or who are interested in some technical subject.

    II.    Students who are not in category I.

We recommend all students should learn the math in Tiers 1 and 2.

This covers Practical Algebra, Geometry, and Trigonometry and how to use a TI-30Xa Scientific Calculator for all arithmetic calculations.

Neither Type I nor II students need to study certain math topics needed to excel on the SAT or ACT tests.

We recommend Type I students also study Quantitative Reasoning or Workforce Math.

This is math that will be necessary and valuable for many technical subjects.

If a student does this, then the student will be well prepared mathematically for the military or an apprentice program, or a technical school for many technical subjects.

Practical Math is the key to success in any of these technical fields.

For Type II students, we recommend Consumer Math after Tiers 1 and 2.

Consumer Math is valuable for both Type I and II students since it applies to all sorts of real world math situations.

These math programs will be available in the Tiers 1 – 6 Program consisting mostly of some topics from Tiers 3 and 4.

# Chapter 4.2:
# Workforce Math – Tiers 1-2

This is the Proper Content for any math student, whether they have been successful in their math studies, or not.

If a student doesn't understand the decimal number system, have your parent teach it to you following the Uncle Jack videos.

Once, you understand numbers, learn to use the TI-30Xa Scientific Calculator to do your arithmetic calculations and be sure you understand the Rules of Arithmetic.

This is all covered in Tier 1 of Triad Math's Online Program.

Most students find this very easy and fun, and do it in a couple of weeks.

It is self-paced and will take various amounts of time for different students.

When completed the student will have a skill possessed by very few USA adults.

And, the student will be well prepared for Practical Algebra, Geometry, and Trigonometry which will now be easy to learn in Tier 2.

Tier 1 is absolutely a prerequisite for Tier 2.

This alone makes the Triad Math Online Math Program quite different from any Standard Math Curriculum Program, and in our judgment, vastly superior.

[Parent: Pay close attention to the Coaching Principles and Guidelines.  You will be using them for all of the Tiers to come.]

Now go on to Tier 2:

First, learn Practical Algebra          Tier 2  10 Lessons

Second, learn Practical Geometry       Tier 2  19 Lessons

Third, learn Practical Trigonometry    Tier 2   7 Lessons

"Wow, all of this in only 36 Lessons!" ask most students and parents.

You, the student, probably will be able to complete Tier 2 in two or three months if you will work a little on most days, say 30 minutes to an hour five days a week.

See Chapter 1.4 and learn to coach yourself!

You will watch the tutorial videos to learn the topics and how to do the exercises.

Stop, back-up, re-watch the video until you understand the topic.

You are the boss on you own self-paced time schedule.

You control the tutorial video.

You add to your notes that the video is following.

Best to have them printed out before you watch the video.

Then, do the exercises.  That's where you really master the topic.

Most of your time will be spent doing exercises and reviewing.

Then, take a short quiz to be sure you have mastered the topic.

Your ONLY grade will be an A.

Oh yes, go back and review a topic many times in the future until you really remember it.

After all, "Here today, gone tomorrow" is a problem for us all!

When you master Tier 2, you then will know more math than most adults in the USA and be ready for the military or technical workforce or to study any technical field.

Here is my one question 'test' you will be able to answer that you can use to prove this!

It will impress many of your family and friends.

My one question test, which will prove you are now "Matherate" for the practical technical workforce, is you will be able to calculate, in less than one minute, the area of a triangle with sides of 8.3 in, 10.4 in and 15.4 in. Or any other triangle.

The solution involves most of the things you have now learned, including Practical Trigonometry and the TI-30Xa Scientific Calculator. Easy peasy!

Very few people can solve this practical problem!

It's a great way to challenge a "wise guy" with a friendly bet.

Let them choose the lengths of the three sides of the triangle. Then find the area!

Have FUN!

(Answer: 40.5 sq in)

There will also be a supplemental course called Quantitative Reasoning that will also help prepare you for a technical career or job training.

There will also be a supplemental course called Consumer Math which will help you with many of your future life's challenges.

These two courses will consist of some topics out of Tiers 3 and 4.

Get started with one of the Special Offers.

# Part 5:
# College-Bound Students

# Chapter 5.1: College-Bound Students

I recommend studying the math topics in Tier 3 to prepare for the math portion of the SAT.

The SAT is a test designed to result in a Gaussian distribution of scores, i.e. fit into a bell-shaped curve.

So, it is a timed test that contains some very easy questions, some reasonably hard questions, and a few very difficult questions, unless you have prepared for them.

In Tier 3, we try to get the student ready for the difficult questions.

You may view the syllabus for this in the Appendix.

It is best to take a few sample SAT tests and learn how to solve all the questions there, and then hope that will prepare you for the current SAT.

The ACT test is similar. There you may also need some math from Tier 4.

In my opinion, the SAT and ACT don't prove much, other than how much the student prepared for the tests. There are quite a few SAT and ACT prep programs available.

Finally, suppose a student scores a perfect score on the SAT or ACT test. Is the student now well prepared for a top notch STEM program at a good university?

Amazingly, NO.

See Part 6 to find out what Math a STEM student needs to learn. It's quite amazing in this 21st Century.

# Chapter 5.2: Tier 3 – SAT or ACT Prep

Some of these topics are good for Consumer Math.

Some of these topics are good for Quantitative Reasoning.

Some of these topics are just good for tricky questions on a test like the SAT.

Most students take about a year to master Tier 3.

Part 1 of Tier 3 should prepare you for a standard test you will need to pass to graduate from high school.

Part 2 of Tier 3 will teach you additional mathematics you will need to excel on the SAT and ACT and other exams.

Part 3 is SAT Prep – how to prepare and how to take such an Exam.

Ok, this will help you get into a college by scoring higher on the SAT or ACT tests.

See the syllabus for Tier 3 in the Appendix.

But, will it mean you are prepared for a STEM subject in college?

No.

You will need a lot more math to be well-prepared for a STEM subject and to compete with other students who have been properly educated with STEM math.

See Part 6.

# Chapter 5.3: College with No Debt

OK, you have decided to go to college or university.

If someone else, family or scholarship, etc., is going to pay for it, then be sure you don't waste your wonderful opportunity.

If you know what you want to study, and which university or college you want to go to and what you want to major in and learn, then go for it.

Otherwise. . .

You might want to follow some of the advice I am going to give you below, assuming you have to pay for it yourself.

If you have to pay for it, or most of it, then I advise you to first read and study Chapter 7.1 about "Invest in Yourself", before you go to college.

Learn how to make $25/hour or more, working part time.

In either case, here's my first piece of advice.

If you are interested in "college", but aren't ready to go into debt and aren't sure what you want out of college, then just go to a "college town" and work there part time with your $25/hour skill. Easy and fun!

Or, if someone else will pay for it, great. It's much less expensive than paying for college until you are really ready for it. Just ask any parent whose child flunked out of college the first year or two.

First, select a university or college you think you would like to go to, then go to that city or town.

Establish a residence there, especially if it is not in your current home state.

Now, you can associate with college students, perhaps audit some college classes, and participate in the college scene as you mature.

Then, if after spending some time in the college life you decide you want to go to college to acquire some credential or specialized advanced knowledge, you may very well be able to earn a scholarship.

If not, go to some good state school with relatively low in-state tuition.   It can be in any state, if you do it right! Here's an example how.

Suppose you want to go to the University of Illinois in Champaign, which is a really top school in your field of interest.  But, you live in some other state today.

Go to Champaign and work part time for a year and establish Illinois residency.

If someone is supporting you, this will be a good investment and much less expensive than having you enroll.  And, I suggest you work part time.

Remember, you can earn $25/hr or more if you have Invested in Yourself.

Get your Illinois driver's license.

Learn all about the U of I and be sure it is the school you want to attend.

Enjoy the college life as described above.

Mingle and associate with U of I students and meet some professors and audit come classes and go to various events.  Get to know the school and be sure it is what you really want to attend.

Now, if you are sure you want to enroll in this university, do so now.

Enroll as an Illinois resident and pay in-state tuition.

Remember, in the USA you can become a resident of any state in about a year.

Simply research the requirements for the state.

You then should be able to pay your way through college with part time work during the school year and full time work in the vacation times.

Do the math!  If you can't do this, you are not ready for college.

You will want to get into the advanced classes in your chosen major field ASAP.

Audit the beginning courses during your initial stay there, and then sign up for the advanced courses when you enroll as a regular student.

Yes, this is doable.  Here's how.

When auditing these courses you should meet and befriend some of the leading professors.  This is probably easier than you think.

Observe the psychology involved.

They love motivated students with good questions.

That's how I got a Ph.D. in Math at Indiana University!

Just stay after a class and ask them some "good questions" you should have researched first, or visit them during their office hours, or go to department "teas', etc.

Ask your 'dumb' questions to other more advanced students.

ONLY ask the professors 'good' questions.

This will impress the professors and you should soon be able to gain waivers to enroll in advanced classes since professors 'rule the roost' so to speak and will give you permission and required waivers.

After a year or two you probably will be able to get a scholarship or some type of paid internship in your chosen field.

**Your goal is to graduate with a degree, credentials, and great recommendations in your chosen field with NO school debt.**

It might take you two or three extra years, but you will also have much more maturity and probably much better recommendations.

And, NO DEBT!   Think how proud your family will be of you!

And, your future will be much better financially and you will have more freedom to pursue any career paths you choose going forward.

It's amazing how often a graduate then has to take a job or pursue a career path the graduate now doesn't like just to pay off the debt.

But, for right now be sure to read and think about Part 7, Invest in Yourself.

# Part 6:
# STEM Students

# Chapter 6.0: A Homeschool Story

A call came in to Dr. Del from Ruth, a homeschool parent.

"I have been able to teach my son, James, basic elementary math. But, I am way over my head going forward.

"Can you help me?" asked Ruth.

"Yes, but first tell me a little more about James," answered Dr. Del.

"OK, James is 11 and likes math and science, and is easy to teach, but I don't know what will be best for him," responded Ruth.

"Well great, you have a wonderful opportunity to do some great things with James. And, I want to tell you how I believe you can take full advantage of it.

"It's a new Math Program we call Golden Rule Math," said Dr. Del.

**"What IS Golden Rule Math? I never heard of it,"** interrupted Ruth.

"Good question. In a nutshell, it the way we teach math to any student.

"You do know the Golden Rule don't you?" chuckled Dr. Del.

"Yes, of course. *Do unto others as you would have others do unto you.* Any Christian knows that, right?" responded Ruth.

"Yes, And you don't have to be a Christian to live by the Golden Rule.

"This is a 'Rule' anyone should live by if they want to have a really good life.

"Right?" said Dr. Del.

"Sure, I guess so," said Ruth.

"So, why do you call your Math Program, *Golden Rule Math*?" asked Ruth.

"Because I teach my students math the way I would want a teacher to teach math to me, if I were a student in today's world.

"Does that make sense?" said Dr. Del

"I guess so.

"But I still don't understand what makes your math program different from any other math program," responded Ruth.

"Right. This is now where the 'rubber meets the road', so to speak, and this is what you need to understand about my Golden Rule Math Program," said Dr. Del.

"As you may know, I have been learning math myself and teaching math for many decades.

"I have a Ph.D. in advanced math, and have taught all levels of math from 7th grade through graduate school for over 50 years.

"Here is what I know it takes to successfully teach any student math.

**"First, you must use SPIKE Pedagogy.**

"Chapter 1.1 explains this in detail.

"SPIKE is an acronym for Self-paced, Proper content, Interactive, Keep score, and Empathy and humor.

"This is very difficult to do in a group setting like a classroom.

"All students are different, and each student must be taught at his or her own space and with the Proper Content the student is ready for and will find valuable.

"Historically, this could only be done with a good math tutor, one-on-one.

"Tutors were expensive, and very difficult to find. Very few students could have this necessary resource. Only rich parents could afford it.

"Thank God, several new 21st Century Technologies make this possible today, and I use them in my Golden Rule Math Program.

"It's actually better than a live tutor.

"James will go at his own pace.

"It's like climbing a ladder and not missing any steps.

"And, you will be like his coach and give him praise for each step he climbs.

"This builds a student's confidence and self-esteem.

"Math is like a sport, as you will learn.

**"Second, Proper Content is critical too.**

"A student must be ready for each new math topic.

"Golden Rule Math does this too.

"Furthermore, the math topics must be relevant and interesting for each student," was Dr. Del's response.

"The Golden Rule books explain this in much more detail.

"Now, for James, who is interested in STEM you will see what is best in the following Chapters in Part 6.

"Finally, be sure to look at the Special Offer and Free Resources.

"Remember, our mutual missions are to give your children an optimal 21st Century Math Education."

"Great, this is such a relief," sighed Ruth.

# Chapter 6.1:  STEM Students

Dr. Del's answer to Ruth about James' need to pursue a STEM education applies to any student who might be interested in some STEM subjects.

"Now, James has a real challenge <u>and</u> opportunity.

"Math for STEM is totally revolutionized in the 21st Century thanks to an amazing Modern Math Tool called Wolfram Alpha, unleashed on the world in 2009.

"Wolfram Alpha <u>revolutionizes</u> how you learn and do STEM Math like Precalculus Algebra, Trigonometry, Analytical Geometry, Calculus , and Differential Equations.

"Thus, we teach the student how to use Wolfram Alpha in Tiers 4, 5 and 6.

"This is radically different that the current math programs given by our schools and in the current math textbooks.

"It is unlike any math program I am aware of today. Vastly superior!

"IF James goes through Tiers 4, 5 & 6, he will be prepared for any STEM program in any university, like MIT, vastly better than any student who is still doing the Standard Math Curriculum taught in practically all schools today, both public and private."

**Most impressive of all, is that all of this math, Tiers 1 – 6, can be available for all of your family's students for less than $1/day via the Succeed with Math Crusade.**

Indeed, it might be even less than this if you can help us spread the word to other families and students.

To more fully understand this, read on.

Finally, be sure to check the Special Offer at the end of this book.

# Chapter 6.2:
# Wolfram Alpha and the SupraComputer

The SupraComputer was introduced to the world in about 2017, and will do things no ordinary computer will do.

It is based on the Raspberry Pi computer out of the United Kingdom. It has a very secure Linux operating system, and is the size of a deck of cards, and thus very easy to transport and totally secure since you can remove the SD card, which powers it and contains all of your data.

The SupraComputer does many things for children and adults of all ages.

However, what makes it vastly superior is that it comes loaded with Mathematica, Wolfram Language, and a pro version of Wolfram Alpha.

So, you can solve any math problem with Wolfram Alpha AND save it in a Notebook for future review. This you can't do with a regular computer.

Also, you can write incredible programs with the new Wolfram Language.

To fully understand it simply go to:

https://supracomputer.org/

Once a student gets to Tier 4, the SupraComputer will be a great asset.

Not only can Wolfram Alpha solve the problems, it also will now give the student a step-by-step explanation of how to do it manually, if the student wants to know.

This can be of great value if the student is taking a 20th Century Math Course, where the student must master the old manual techniques.

So, when any student decides to study STEM math starting in Tier 4, it would be wise to investigate the SupraComputer.

Of course, it is not necessary, but it amplifies a student's productivity.

# Chapter 6.3:
# The Whole STEM Math Story

This chapter is for parents of a child who might be interested in some STEM subject like science or engineering.

Chapter 6.3 will be challenging to anyone who doesn't know much STEM Math.

However, I think you can probably understand the main ideas and themes even if you don't understand the math details.

If someone you know is a STEM person, you might want to have him or her read this chapter and discuss it with you.

There are two approaches to learning math, heuristic and rigorous

A **heuristic** technique is an **approach** to problem solving, learning, or discovery that employs a practical **method** not guaranteed to be optimal or perfect, but sufficient for the immediate goals.

A **rigorous** technique is an **approach** which involves proving a meaningful statement is true with a series of **logical deductions** from a well-defined set of assumptions, called axioms, postulates, or previously proven lemmas or theorems.

Modern mathematicians, and some math educators, often try to teach math with a rigorous approach which can be very tedious, boring, and DIFFICULT to understand. Difficult to teach too!

Classical mathematicians usually utilized a heuristic approach to learning, teaching, and discovering mathematics, which can be easier and quite enlightening.

Heuristic is the approach I believe we should take when teaching math at the high school level.

The wonderful 20th Century math teacher, Dr. George Simmons, agrees with this heuristic approach as demonstrated in his wonderful book, *PreCalculus Math in a Nutshell*, which is the only textbook I utilize in my Six Tier Program.

Any parent or teacher should at least read George's Preface and the three Introductions to his three chapters on Geometry, Algebra, and Trigonometry.

https://www.amazon.com/Precalculus-Mathematics-Nutshell-Geometry-Trigonometry/dp/1592441300

It costs about $20. I wonder why it isn't adopted by our high schools?

By the way, Dr. Simmons wrote what I consider the best Calculus and Differential Equations books before he wrote the PreCalculus book.

And, Dr. Simmons wrote the best *Topology and Modern Analysis* book first, which is how I learned about him when I taught this subject as a professor.

This is the math like Hilbert Spaces behind theoretical physics subjects like Quantum Theory.

George Simmons was a Great Math Teacher.

OK, so what should we be teaching our high school STEM students that will get them optimally prepared for a great 21st Century University STEM education?

**Numbers:** Real Numbers, HyperReal Numbers, and Complex Numbers.

We need to teach these number systems heuristically, not rigorously.

Real Numbers correspond to all of the points on a straight line, and are expressed by the decimal number system.

Subsets of the Reals are Natural Numbers, Negative Numbers, Integers, and Rational Numbers, all of which a STEM student must understand heuristically.

Non-repeating decimal Real Numbers are called Irrational Numbers with Algebraic and Transcendental subsets. These are ONLY of interest to Theoretical Mathematicians and not needed for science or engineering.

Complex Numbers correspond to all of the points in a two dimensional plane.

Complex Numbers are easy to understand heuristically and involve Trigonometry Functions and Infinite Series.

Euler's Complex Number Equation is the most important math equation for science according to the great physicist, Richard Feynman.

I agree. And it is key to really understanding Complex Numbers. I teach this in Tier 4.

Complex Numbers are vital and necessary for many STEM subjects

HyperReal Numbers include the Real Numbers and Infinitesimal Numbers. These are very important for a heuristic approach to Calculus.

Our ancestors approached numbers heuristically until the mid-19th Century.  Then, they began to approach numbers rigorously with an axiomatic approach.

This is a much more difficult approach to numbers and should probably not be taught until a student decides to become a theoretical mathematician.

Indeed, there was a great split between Applied Mathematician and Scientists and Theoretical Mathematicians in the mid-1800's that was not resolved until 1966, coincidentally the year I earned my Ph.D. in Math.

Here's the story of what happened.

Mathematicians, starting with the best ancient Greek mathematician, Archimedes, used infinitesimal numbers to solve many wonderful math problems, such as relating the area of a circle to the ratio of its circumference and diameter, (i.e. A = (D/2)x(C/2) = PixRxR).

Euclid had not done this in his famous Euclid Elements, the first attempt at rigorous math.  See the Archimedes Tombstone Lesson in Tier 2.

The creators of Calculus like Leibniz (1600's) and Euler in the 1700's utilized Infinitesimals in the wonderful creation of Calculus and Differential Equations.

BUT ALAS, when theoretical mathematicians began to make the Number Systems rigorous in the mid-1800's, they could not figure out how to include Infinitesimal Numbers in their Axiomatic Number Systems.
SO, what did they do?

# The Whole STEM Math Story

They BANNED THEM.

Wow. A bifurcation in STEM mathematics.

Infinitesimal numbers make the understanding of Calculus heuristically much easier than the rigorous approach mathematicians adopted in the 1800's.

Applied Mathematicians and Scientists went their own way and continued to use Infinitesimal Numbers heuristically.  They are so wonderful and useful!

Unfortunately, the theoretical mathematicians wrote our 20th Century Calculus books and went a rigorous and difficult way.

No more infinitesimals!

This was a horrible setback for STEM math education.

Then guess what?

In 1966, Abraham Robinson figured out how to make Infinitesimals and HyperReal Numbers rigorous and they are back in!

"Whoopie!  Now STEM Math is easier again," so I thought in 1967.

Ooops!  Unfortunately, our Calculus books have not caught up yet.

I wonder why?

Could it be the huge investment in the current Calculus books?

But, of course, I use Infinitesimals extensively when I teach Calculus because they are a very good heuristic way to understand Calculus.

BUT, the story gets much, much better in the 21st Century, in 2009, to be exact.

So, just read on. The math education plot thickens.

## What are the ingredients of STEM Math?

Real Numbers, Complex Numbers, Infinitesimals, Algebra, Geometry, Analytical Geometry, Trigonometry, Calculus, Differential Equations, which depend on. . . .

**Functions**.  Polynomial, Trigonometric, Exponential and their Inverses.

**Infinite Series**  These are like infinite polynomials.

**Math Tools** for analyzing functions and Solving STEM math problems.

**Graphing a Function** to get a visual picture of its behavior.

**Calculus** which are the tools for analyzing the behavior of functions, and understanding their visual representations called graphs and the area under their graphs.

**Differential and Integral Calculus and The Fundamental Theorem of Calculus, the most important theorem ever, are the reasons we are here today.**

**Differential Equations** which is how STEM physical math models are created and how new Special Functions are discovered.

Diff Eqs as they are called, have been historically very difficult to solve.  Today it is very easy with Wolfram Alpha.

I realize that most people have difficulty understanding what this all means.

For what it's worth, many current high school teachers do, too!

**But, this is the math a student must learn to master STEM subjects.**

Math is the foundation of all STEM subjects, which essentially are based on functions, which are used to build STEM models, which then are used to understand STEM topics and subjects.

Any homeschool parent with a STEM student must deal with this situation, and now it is possible, as you will learn!

**THE FUNDAMENTAL PROBLEM with the Standard Math Curriculum**

Wonderful manual tools were developed to deal with all of the above math topics by our ancestors, who essentially only had pencil- and paper-type tools.

Unfortunately, these manual tools are very difficult to learn, master, and use!

It's the main reason so many students develop an intense fear and dislike of math, and then many students do not pursue a STEM career.

Don't blame them. It was a great struggle for me, too.

One has to deal with numbers and arithmetic calculations.

Manual algorithms were developed for addition, multiplication, division, and square roots of real numbers.

They are time consuming and error prone, hard to master.

Logarithm, the inverse of the exponential function, became a wonderful tool for performing arithmetic.

Then the slide rule, or slip stick, based on logarithms, became a wonderful tool used by all scientists and engineers for centuries.

Trigonometry tables also were created and were indispensable in solving many math problems.

Calculus was invented in the 1600's, which was the foundation of our modern science and technology world.

Newton's Physics started it.

Calculus is used to analyze functions.

Manual tools were developed by Liebniz, Euler, and others.

Wonderful tools, but very difficult to learn, master, and use.

Then, we had to learn to solve Differential Equations which often result in what are called Special Functions, i.e. Infinite Series, as solutions.

If you wanted to become a STEM professional you had to first learn these concepts and manual tools.

**The math concepts are actually pretty easy to learn heuristically.**

**Unfortunately, all of these manual tools are very difficult to master and use.**

**They create a great barrier for STEM students!**

**Until the 21st Century, 2009 to be exact.**

As I said above, the math concepts are pretty easy to learn and understand.

Intelligence was necessary, but even more important was a lot of very hard dedicated work to master these manual tools.

Math was TOUGH and was often an insurmountable barrier to STEM subjects.

The manual tools, not the concepts, were really the barrier and the challenge.

So what? Why am I telling you this?

Our math programs are still teaching these manual tools! That's why.

Integral Calculus flunked many kids out of engineering schools since it was the first really difficult manual tool that had to be mastered.

It is called Techniques of Integration and involves finding anti-derivatives of functions in order to apply the Fundamental Theorem of Calculus.

It is much more difficult than the manual tools that led up to it.

**Then Miracle #1 happened in 1972.**

**The first scientific calculator, the HP-35, was unleashed on the world.**

Log tables, trig tables, and the slide rule were obsolete.

Now, a STEM professional could do all arithmetic calculations very quick and easy, AND the scientific calculator was an order of magnitude easier to learn and to use to solve math problems.

Needless to say this was a crisis for math educators.

Many of their math textbooks and courses were obsolete!

Students rejoiced.

Many teachers were depressed.

Much of what they had been earning a very good living teaching for all their lives was now in the dust bin of history.

They had to adapt to the new technology and reality.

Many textbooks were obsolete.

But, Calculus and Differential Equations, the workhorses of STEM, were not affected very much. Still, the old manual techniques were all we had.

So, for advanced STEM math not much changed.

**Until 2009!  Miracle #2**

A massive Educational STEM Math Earthquake more significant than the 1972 Scientific Calculator Miracle #1 happened.

Some background first. A very interesting story. Then Miracle #2!

Computers were developed shortly after WWII, and really took off in the 1950's.

By the 1970's a sophisticated computer algebra program, Macsyma, which could solve math problems numerically, was developed at MIT.

A teenager in the UK, Stephen Wolfram, used Macsyma to solve physics problems, and soon went to the greatest physics graduate school in the world at Cal Tech, and earned his Ph.D. in physics at age 20 in 1978.

Wolfram won the MacArthur Genius Award.

Wolfram then wanted to create a more powerful tool than Macsyma, and in 1988 introduced Mathematica to the world.

Mathematica was an incredible programming language unlike anything before.

Steve Jobs incorporated Mathematica into the Next computer and this system was used to create the World Wide Web, by Tim Berners-Lee at CERN.

**OK!  Miracle #2 which revolutionizes STEM Math Education**

**Stephen Wolfram in 2009 introduced an incredible Tool to the world:**

**Wolfram Alpha**
https://www.wolframalpha.com/

Mathematica became more and more powerful, and after 30 years Wolfram was able to create Wolfram Alpha.

Wolfram Alpha is a very sophisticated Mathematica program that is hard to believe it is so powerful.

Guess what?

Wolfram Alpha will solve any Calculus or Differential Equation Problem immediately, including problems that cannot be solved with the Classical Manual Techniques.

And much, much more!  Truly amazing!

Solve STEM math problems in a minute or so that would take hours, if you could do them at all, with the manual tools still being taught.

Wolfram Alpha is MUCH more revolutionary for STEM Math than the scientific calculator was four decades earlier in 1972.

Now, starting in middle school we can teach math to students that is practically impossible to teach with the old, now obsolete, manual tools.

Thus, Triad Math has developed a new 21st Century Math Curriculum that utilizes this amazing modern tool to teach most all STEM Math, starting in Tier 4 with Algebra and Geometry, like Conic Sections, and Trigonometry and Complex Numbers.

Then, we go on in Tier 5 with Calculus, which can now be learned in about one semester, very easily.

Then, in Tier 6, learn to solve Differential Equations quickly and easily.

Orders of magnitude easier than the old manual tools.

**The Great Math Barriers of Integral Calculus and Differential Equations have been eliminated.**

Now, STEM math is no longer an impediment to learning a science or engineering subject.

It's like a modern automobile replacing a horse and buggy for traveling.

A student can now learn all the STEM math needed for science and engineering in a very small fraction of the time and effort needed for the classical approach.

High school math textbooks are now obsolete.

# The Whole STEM Math Story

All calculus books are obsolete, too.

Why?

They are loaded with all the very difficult manual tools, which are now obsolete, yet very difficult to learn and master and use.

No modern STEM professional uses them anymore.

Indeed, you don't really need a book to learn Calculus and Differential Equations.

Just some notes, exercises, and tutorial videos, and Wolfram Alpha.

All delivered with SPIKE Pedagogy.

Easy and inexpensive!

Unfortunately, the Math Education System doesn't want to give up a multi-billion dollar set of products developed over the last several decades.

I can't blame them any more than I could blame the engineering professors who didn't want to abandon slide rules and log and trig tables in 1972.

But, that's the world we live in.

It's just like smart phones replacing land lines and many other classical obsolete technologies.

The Standard Math Curriculum is like teaching carpentry with the manual tools of the 1700 and 1800's.

Just visit a museum and imagine how difficult it was to use the manual tools.

Compare that to modern electrical tools.

Here's an analogy.

The concept of "a hole in a piece of wood" is easy to learn.

How do you solve the problem of creating a hole in a piece of wood?

Without any tool it is probably impossible.

First, you could create a hole with a nail or spike and hammer. Of course, it was difficult and you could split the wood.

Then, along came a wonderful manual tool, the brace and bit.

This is how I was taught to create a hole when I was a boy in the 1940's. It took a lot of effort to learn it and a lot of practice to master it, which I never really did.

And, it took a lot of slow physical effort.

And, it was often impossible to drill a hole where I wanted one due to the limitations of this tool.

Then, along came the electric drill.

WOW! Much easier to learn and to use.

Much faster and less physical effort.

And, you could drill holes in more inaccessible places.

Wow! Brace and bit, obsolete.

The electric drill with a battery. Even easier to use.

OK, analyzing a function with algebraic and manual graphing techniques is like making a hole with a hammer and nail.

Analyzing a function with the manual techniques of Calculus is like a brace and bit, hard to learn and difficult to perform.  But, much better than a hammer and nail.

Analyzing a function with Wolfram Alpha is like a battery-powered electric drill.  Easy peasy.

Now, any student can learn STEM math and apply it very quickly and easily.

Manual Calculus and Differential Equation techniques are OBSOLETE!

**Math is NO LONGER a Barrier to learning a STEM subject.**

That is why 21st Century Math Programs are vastly superior to 20th Century Math Programs.

That is why homeschool math can be vastly superior to public school math.

Eventually, public and private school math will catch up, I HOPE.

But, a multi-billion dollar industry will have to transform.

Math teachers will become coaches.

Math will be delivered with SPIKE Pedagogy.

The next chapters will give you more details about one program that achieves these 21st Century goals.

Furthermore, an amazing new tool was invented in 2016, the SupraComputer.   This tool makes STEM math even easier to learn.  See Chapter 6.2.

Be sure to check the Special Offers too!

# Chapter 6.3: Tiers 4-6

### PreCalculus Math – Tier 4

Algebra, Geometry, Trig, and Complex Numbers are the PreCalculus subjects.

Now, a STEM student must learn these subjects at a much deeper level.

Historically, this was very difficult because of the manual tools.

Wolfram Alpha is the wonderful 21st Century Tool (2009) that transforms that.

In Tier 4, I introduce Wolfram Alpha in lesson A5 in Algebra, and then use it from then on.

We use Dr. Simmons' *PreCalculus Math in a Nutshell* when we can, and then custom notes otherwise.

Of course, this book does not use Wolfram Alpha, since it was published in 1988, two decades before Wolfram Alpha appeared.

But, I use Wolfram Alpha along with Dr. Simmons' book.

He explains the concepts very well.


No other math textbook does this nearly as well, so far as I know.

Actually, a STEM student can now go back and review Tier 3 topics and apply Wolfram Alpha there, too.

Unfortunately, you can't use Wolfram Alpha on the SAT or ACT, and that is why I didn't introduce it in Tier 3. Now, the student has a taste of how wonderful it is compared to the old manual techniques.

Complex Numbers are necessary for STEM. They are very easy to understand when taught properly with Euler's Equation and Trigonometry.

So, that is included in Tier 4, too.

Go study the syllabus for Tier 4 and compare it to any math textbook you might be using or interested in.

## Calculus, Differential and Integral - Tier 5

If you don't understand or know Calculus, go to Chapter 6.3 for more details.

If you do, then you know there is Differential Calculus, or Calculus 1, which empowers you to analyze functions and their Graphs: Max, Min, Inflection Points, Concavity, etc.

It uses the concept of the derivative of a function, i.e. rate of change.

It is pretty easy to find the derivative of a given function using the manual tools like the Chain Rule and the Leibniz Rule.

It is often very difficult to then find the zeros or roots of the derivative function, which you must do to analyze the function.

Indeed, many times it is impossible or impractical to solve a problem with manual tools.

Wolfram Alpha solves all such problems in about a minute, and, indeed, does things no one does manually that help you understand the function.

In Integral Calculus, you find the area under the graph of a function from points a to b in the domain by using the Fundamental Theorem of Calculus, FTC.

This is very easy to do IF you can find what is called the antiderivative or the indefinite integral of the given function.  All you have to do is evaluate the antiderivative at the points a and b and subtract them.  Voila!

The FTC was discovered in the 1600's by Newton in England, and Leibniz in Germany.  Newton used it to derive Kepler's Planetary Laws of Motion from the simple Gravitational Principle.

This was published in his *Principia Mathematica* in about 1687.   It launched modern science and technology.

Leibniz actually did things differently using infinitesimals, and his approach to Calculus was conceptually easier, and better, than Newton's.

Leibniz's math students ending with Euler then developed Calculus the way we understand and use it today.

So what's the problem?

Finding the antiderivative of a function can be very difficult, and sometime impossible, in terms of any known functions.

This is called Techniques of Integration and probably flunks more students out of a STEM career than any other topic.

Just ask any STEM pro you know about their experience with Calc 2.

Well, guess what?

Wolfram Alpha finds the antiderivative in less than a minute for any function.

Indeed, if it does not exist in terms of the well-known functions, it will find it in terms of a Special Function of an infinite series. This is so difficult it is not taught in most Calculus courses.

Yet, this is what you must do for STEM.

Integral Calculus goes from an 8 in difficulty on a 1 to 10 scale down to a 1 or 2.

And, you can learn the concepts much better now by doing lots and lots of examples that would be impractical to do manually.

Manual integration is like a horse and buggy.

Wolfram Alpha integration is like a Tesla car.

Which would you want to learn?

Do you have to become an expert in horse and buggy technology to then learn to drive a modern automobile?

In Tier 5, we teach the student how to drive a Tesla.

OOPS, I mean how to use Wolfram Alpha to solve Calculus problems.

## Differential Equations (Diff Eq) - Tier 6

A differential equation has a function as a solution.

A differential equation is used to create a math model for some physical process, i.e. in all STEM subjects.

Solving a differential equation is even more difficult than finding anti-derivatives in Integral Calculus.

Indeed, an antiderivative is the solution of the simplest of all Diff Eqs.

So, most students who survive Calculus 2 can make it through Diff Eq.

Just more effort and struggle.

Until now, in the 21st Century.

Believe it or not, Wolfram Alpha solves any differential equation quickly and easily, and often better than can be done manually.

Even those that are impossible to solve manually in any reasonable time, like the ones whose solutions are what are called Special Functions, which essentially are what are called infinite series.

We teach a STEM student how to use Wolfram Alpha to solve differential equations in Tier 6.

Now, in about one semester, a STEM student can learn how a scientist or engineer can solve a Diff Eq, quickly and easily.

Sort of like going from a horse and buggy to an airplane for long distance travel.

# Part 7:
# Invest in Yourself

# Chapter 7.1:  Invest in Yourself

Question:  What kind of a life do you believe an adult could have IF s/he could earn $25/hour or more in a modest cost of living area in the USA in 2020?

My belief is that if the adult is single, then the adult could work part time for about 20 hrs. per week ($500/week) and live a pretty good life from a financial perspective.

Two such adults could room together with a combined budget of about $4,000/month.  Pretty good life from a financial perspective?

Or, an adult could live with some older person as a tenant and help out and live a pretty comfortable life for $2,000/month.

Either way, the adult could do many other things of interest in the remaining 148 hours in the week.  Do you agree?

Suppose you are earning $500/week for 20 hours of part time work.

You will find out that you can learn many other things very quickly if you are free to use the library and all the myriad online sources, and learn from other students, and even teachers.

Many teachers are eager to help an eager student learner even if the student is not enrolled in the class.

If the adult is the 'bread winner" in a family, then it would take about 40/hours per week ($1,000/week) to provide a comfortable life for the family.

The other parent would be free to raise the children.

Notice, by "adult" I mean any male or female no longer a child.

To achieve a $25/hour income legally, an adult will need to learn some skill that others will pay $25/hour for this skill.

Obviously!

So, my advice to any student is to plan to learn such a skill ASAP.

How? . . . . Invest in Yourself

**First,** try to figure out what kind of skill you think you would enjoy learning and practicing.

It can be any type of service or activity people pay for. There are many such skills.

Brainstorm and talk to people who have such skills.

Find someone who has this skill and offer to work as an assistant to learn this skill, which probably will take a few years.

Work for free, if necessary at first, and then the skilled person will begin to pay you more and more as you become more and more valuable as an assistant.

You might find a company that will do this, too.

But, more than likely it will be some small company or independent worker.

In order for this to work out, you must "learn to learn".

You must have discipline and a long-term view for your life.

The harder you work, the faster you will master the skill.

Many skills can be learned in a year or two of really dedicated effort. But, three or four years is fine, too.

Now, suppose you decide to choose some technical skill you want to acquire. The challenge will be to get someone to hire you as an assistant.

The chances are that you will need to know what I call Workforce Math in order to understand the things you will need to learn about this technical skill.

So, the first thing you should do is learn practical Workforce Math.

If you are in high school and your school will teach you Workforce Math, great! Go for it!

Unfortunately, most schools don't teach Workforce Math.

In learning Workforce Math, you will be 'learning to learn' as well as learning math.

This is called gaining "workforce maturity"!

If your school won't, or can't, teach you Workforce Math, then you will need to "homeschool" yourself, hopefully with an adult "coach" to help you.

Thanks to modern technologies, you will be able to do this is in just a few months and <u>for a very low cost</u>.

Mostly, it will be your efforts as you learn math and learn to learn. Here's how!

Simply take Tiers 1 and 2 as described Chapter 4.2.

Then, you will be ready to apprentice in practically any technical field and will know more math than most high school graduates.

You will also be ready for a great military career if that's your ambition.

Many career paths now will be open for you.

See the Special Offers and get started.

# Part 8:
# Math and Science Application

# Chapter 8.1:  A Short History of Science

Historically, all scientific theories have explained a limited number of phenomena and have been inadequate to explain others.

Galileo started modern science, whereby we validate our scientific theories and their math models via experiments and observations, until modern String Theory that is.

Kind of ironic, I think, as does Roger Penrose.

Newton's physics, the first modern scientific theory, was created in the 1600's, about 400 years ago, and covered gravity and other laws of motion, and was the beginning of our modern technological civilization.

It was great for explaining a wide variety of phenomena.

But, it knew almost nothing about electricity and magnetism.

Maxwell's Theory of Electro/Magnetism in the 1800's was inspired by Faraday's brilliant experiments and led to the modern electricity we all take for granted.

Newton had no concept of this whatsoever, nor did any *Homo sapian* at that time.

Newton was pretty humble, and did believe in the religion of the day.

Then, Einstein's Special Relativity Theory overthrew Newton's Theory in 1905, so far as our concept of space and time are concerned.

Time is not the same for everyone!

The faster you travel, the slower time will be for you.

Indeed, time stands still for a photon traveling at the speed of light, c, which is constant no matter who measures it.

And you, or any physical thing, can never reach the speed of light.

This totally contradicts Newton's theory in the extreme cases, but is very close in most cases that we deal with in our technologies.

In 1915, Einstein created the General Theory of Relativity, which totally overthrew Newton's Theory involving the meaning of gravity.

It also showed that time is affected by gravity.

Your watch speeds up as you climb a mountain, for example.

Indeed, we could not have the technology of GPS today without the two corrections in time that Einstein's two relativity theories demand.

Then, along came Quantum Theory, culminating in Quantum ElectoDynamics, QED, our most successful theory that explains practically all non-nuclear effects, such as chemistry and communications.

Then, along came the Standard Model to describe all physical particles and phenomena including nuclear.

The Standard Model is pretty complicated, but has been verified by many experiments, most recently, the Higgs Boson.

One problem.

Relativity Theory and Quantum Theory contradict each other in certain situations.

BIG Oops.

This is one of the situations scientists are grappling with today.

In my opinion, Dr. William Tiller has come up with the best "solution".

Tiller believes that The Fundamental Assumption that is the fatal flaw in our current science models is that the only stuff that exists is physical stuff, and must obey Einstein's claim that it cannot travel faster than the speed of light, c.

Quantum Theory has seriously questioned this in many ways, including Bell's Theorem.

What IF there is also some non-physical stuff that does travel faster than the speed of light, c?

Let's call this SupraPhysical Stuff.

Indeed, what if the SupraPhysical Stuff obeys a totally different math model, just as Einstein's model was radically different from Newton's model.

A scientist I call the modern Galileo is named William Tiller.

Tiller has created a new science model which incorporates the Einstein and Quantum models, but goes much further and incorporates the SupraPhysical stuff.

In Tiller's model, both the physical and SupraPhysical Stuff interact with each other via things he calls deltrons.

The SupraPhysical Stuff is where our non-physical bodies reside.

Time does not have meaning in the SupraPhysical part of Tiller's model.

Everything in this non-physical part of our universe is based on frequencies.

Time and frequency are sort of reciprocals of each other.

The Tiller model is quite sophisticated, but is based on well-known math systems.

Tiller was also a highly respected mainstream scientist in the materials field at Stanford University and these models originated there.

But, the best part is that Tiller and his small team have conducted a series of experiments which validate his theories.

You may learn about this at:
https://www.tillerfoundation.org/

# Chapter 8.2:  Math Proves God Exists

**"God" is** a being beyond our understanding that is responsible for life.

A young child knows his mother in many ways, has an intimate relationship with his mother, and the mother gives the child what is needed for the child's well-being.

Sometimes the child likes it, and sometimes not.

Hopefully, as the child grows older the child may understand the mother better and the relationship with mother grows ever stronger.

BUT, will the child ever fully understand the mother?

I doubt it.  I certainly didn't.

I believe this is a good analogy or metaphor for our relationship with GOD.

**"Prove"** means demonstrate the truth of something based on our best evidence, our assumptions, and our interpretations of the evidence.

**"Science"** is our understanding of the world we live in based on evidence we have collected, interpreted, and made assumptions about, Chapter 8.1.

**Fact of Life:  In the 20th Century many scientists came to believe that science proved that there is no such thing as God.**

They believe the physical universe is governed by natural laws that produced what we call life by purely physical processes.

And, they believe that is all there is to it!

Scientists developed a Theory of Evolution which they believe demonstrates the above statement that life is a purely physical process that developed naturally based on the physical processes scientists understand.

Some became what they call "atheists". Ex. Richard Dawkins and evolution.

Their religion is "atheism".

Hubris (excessive pride or self-confidence) creates Ignorance of Truth.

**Many scientists believe that science proves God does not exist.**

**WRONG!**

Here's why.

**There are actually TWO proofs that God exists based on math.**

**First, what is math?** Math is short for mathematics.

Math essentially is a collection of a bunch of axiomatic systems whereby various theorems are proven based on the axioms for each system.

For example, 2 + 3 equals 5 in some axiomatic systems and 0 or 1 in two other axiomatic systems. All three axiomatic systems are equally valid math systems.

The Pythagorean Theorem is true in the axiomatic system called Euclidean Geometry and NOT TRUE in an infinite number of other axiomatic systems called Non-Euclidean Geometries.   Indeed, we live in one of them!

**Math is a universal language which is used to create math models for many things, including science.**

A scientific theory is based on a math model which describes some phenomena.

A scientific theory is considered valid if it explains experiments and observations.

**Science consists of a bunch of scientific theories.**

**Where did science go wrong?**

**Scientist's made an assumption in 1905, that the only stuff that exists is physical stuff that cannot travel faster than the speed of light, c.**

This was the basis of Einstein's Relativity Theories and their math models.

Other scientific models were also developed in the 20th Century called Quantum Theories.  Much modern technology derives from Quantum Theory.

It turned out that in Quantum Theory Models, there was assumed to be stuff that travels faster than the speed of light.   See De Broglie and Bell's Theorem.


These two marvelous math models, or scientific theories, Relativity and Quantum, have been the basis of our modern technologies.

One embarrassing problem.  They contradict each other in critical situations.

**The BAD assumption was Einstein's, that there is no stuff that is non-physical and travels faster than the speed of light!**

The Quantum theorists could not overcome this Einsteinian Limit and had to develop Quantum Theory in a very counter-intuitive way.

So bad it was that the great Quantum physicist, Richard Feynman, said that anyone who thinks s/he understands QED does not understand it.

Feynman was also very skeptical about some of the math models used in QED.

So was the great physicist, Paul Dirac, perhaps the second greatest physicist in the 20th Century after Einstein.

**Fortunately, one very good mainstream scientist in the 20th Century questioned this Einsteinian Limit.**

The brilliant 20th Century and early 21st Century scientist, Dr. William Tiller, has totally debunked this bad assumption.

https://www.tillerfoundation.org/ may be the most important website today.

There you may buy his four books on the subject, which is where I learned Tiller's Theories, and read many White Papers.

**First of all,** Tiller has conducted several experiments that prove there are phenomena unexplainable by conventional science.

**Second,** Tiller has created a math model which incorporates the non-physical stuff as well as the physical stuff.

**Third,** Tiller's scientific model explains many of the so-called paranormal phenomena *sapiens* have observed throughout our history.

**It is in the non-physical part of the universe where what we call God and the afterlife reside.**

**Time has no meaning here.**

**This is where consciousness resides.**

**This is where your soul resides.**

Mainstream scientists deny the existence of this non-physical part of our universe even though Tiller has experiments to prove it.

Tiller's math models are sophisticated, but his experiments are easy to understand.

So, now one can interpret many of the things many of our religions teach us thanks to Tiller's new science.

Of course, one of these things is that something we call God exists, and has a great influence on life.

I doubt we can ever fully understand God any more than a child can understand his mother.

But, we can understand God by his teachings and actions on our life.

I believe science is one of the ways God empowers us to understand life.

**And now, a second math "proof" of God's existence is life itself.**

**This is a Reductio ad Absurdum Proof.**

This means we derive a contradiction to the assumption that life just originated via understood physical processes.

**The simplest life we know of is a cell that can reproduce itself and is controlled by a special code embedded in its DNA.**

A cell is an extremely complex factory that we are just beginning to understand.

We cannot create such a complex factory with our best technologies.

The probability such a complex sophisticated factory just somehow appeared or "evolved" from natural random chemical and physical processes is essentially zero.

Yet, that is the belief of some modern biologists and scientists.

It's certainly what they teach with the Theory of Evolution.

**There is no math model or set of experiments to validate that belief.**

Yes, evolution does exist in a very limited form.

**However, evolution does not explain the creation of life in the beginning.**

And, evolution probably does not explain the creation of different species.

So, where did life come from?

**From something we don't understand very well, and we might call GOD.**

There is one scientist who explains why the Probability of Life just evolving out of natural chemical and physical processes is essentially zero.

James Tour: *The Mystery of the Origin of Life* is a good resource on this you can find on YouTube.

Bottom line for me.

Tour and math convince me there is zero probability life evolved from simple natural processes.

So from where?

Tiller and math convince me it came from some SupraPhysical Source, which is what I call God.

I do not believe I can understand God in any full way, but I can understand God in enough ways to live a "good life".

This is an important application of math for me!

Other important applications are to help you, either directly or indirectly, via someone you love.

See the Special Offers!

# Free Resources

Simply go to [www.CraigHane.com](http://www.CraigHane.com) to get the current free resources available from Dr. Del.

The Video Library Tab will yield many videos Dr. Del has created, and is an ever expanding Library.

These videos are all YouTube videos.

Some are also YouTube videos of others that Dr. Del finds inspirational and informative.

# **Special Offers**

Go to www.TriadMathInc.com/SO for the current Special Offers.

Dr. Del and Triad Math, Inc. like to give students and families actual training so they can evaluate the methods our Programs use to determine if they would then benefit from some of our training products.

Seeing is believing.

Your experience is the only one that counts for you.

So, go take advantage of our current Special Offers.

Dr. Del wants the best for you and your family.

# Dr. Del's Bio

Dr. Del's (aka Craig Hane, Ph.D. in Math,) Story

In 1946, right after the end of WW2, Craig Hane, age 8, attended a three-week summer camp for his Sunday school class with his teacher, Mr. Theron York, with the Nazarene Church in Greencastle, Indiana. Craig still had vivid memories of WW2 and the effects it had on everyone he knew.

Craig lived in the woods along Deer Creek, five miles south of Greencastle in a house with no running water. They cooked on a kerosene stove, had a pot-belly coal stove for heat in the winter, and a two-hole outhouse. There were lots of pleasant times in the woods and creek. Craig considered life idyllic.

The only neighbors were Craig's Uncle Jack and Aunt Inez, sort of second parents since both of Craig's parents worked full time during the War. Craig spent a lot of his time roaming the woods and creek and day dreaming.

He went to school in a four-room schoolhouse with eight grades in Putnamville, Indiana and excelled at arithmetic thanks to his Uncle Jack homeschooling him.

Indeed, he could count to 100 before any of his classmates and his teacher, Miss Lewis, had him help her teach his classmates to count. Remember this was during WW2 when all adults were much occupied with the war effort.

What Craig learned from Mr. York that summer determined the course of the rest of his life.

Obviously, the Golden Rule and Love thy Neighbor and Jesus Loves You and Salvation. However, perhaps the most significant thing was that "what you believe will determine what actually happens to you". Not your desires, but your Beliefs.

Craig also was "saved" by accepting Jesus into his heart at the end of the summer camp after the invitation by Reverend Newby.

In 1950, at age 12, the Hick from the Sticks, Craig and his family moved into the "big city" of Greencastle and Craig went to work at myriad odd jobs saving money for college. Craig made friends with the city kids, but was always the country bumpkin who was good at arithmetic. Not much social life and Craig eagerly anticipated leaving Greencastle and going to college, where life would be much more fun, he thought.

No one in Craig's family had ever gone to college. They were all very hard-working men and women who told Craig college was the path to great success in some profession. Craig believed he would go to college from a very early age.

Craig had always been good at arithmetic and practical geometry thanks to homeschooling by his Uncle Jack, a barber and builder. This is recorded in the Uncle Jack videos Craig shares with parents and is good even today.

Craig had a vision and belief that math was fun and valuable as his Uncle Jack told him and could lead to great success, especially IF Craig would learn more math than his Uncle Jack knew. Through the 8th grade Craig was very good at arithmetic and practical geometry thanks to his Uncle Jack. He usually knew more than his teachers. But, after all, Uncle Jack wasn't a math teacher.

THEN, in the 9th grade Craig struggled with Algebra and did poorly. Craig's counselor, Mr. Skeleton, told Craig that he was not college material and that he should plan to study "shop" and be a working man like his family members.

Oops! What about Craig's belief that math would deliver him to the great successes his family told him about?

Miracle? In the 10th Grade Craig had a wonderful teacher, Miss MaDonna O'Hair for Geometry and he loved it and did very well. This somewhat confirmed his belief in math and his future.

BUT, in the 11th grade, his junior year, he had the same teacher from the 9th grade for Algebra 2. This time, he was much more aggressive and believed in himself. This didn't help too much since the teacher, Mr. Hardman, didn't like Craig, who was now considered a troublemaker by asking too many questions, and Craig received another bad grade.

Craig asked Miss O'Hair for advice. He loved and excelled in Geometry, but did not like Algebra and did poorly in it. She advised him to enroll in College Algebra at DePauw University as a special student. Wow. No one at GHS had ever done that!

The GHS high school principal Mr. McCammon and counselor Mr. Skeleton were against it. Craig was told he would embarrass the high school. Two bad grades in high school Algebra proved he would do even more poorly in college Algebra.

But, Craig's father had a "talk" with Mr. McCammon and Craig was allowed to enroll as a special student for math his senior year at DePauw.

By mistake, Craig was enrolled in a sophomore College Algebra Course instead of the freshman course at DePauw. Dr. Clint Gass was the professor.

Dr. Gass was a great teacher like Miss O'Hair, and "miracle of miracles" Craig earned an A in the College Algebra class. Mr. McCammon and Mr. Skeleton just couldn't understand it. Craig told them Mr. Hardman was not a very good teacher, but they, of course, ignored him. Too bad for other GHS students.

Long story short, even though Craig had mediocre grades in high school he was accepted to the Number One Liberal Arts College in the USA at that time, Oberlin College. Pretty sure Dr. Gass was responsible for that too. He was a wonderful teacher and mentor. Craig kept in touch all through his years at Oberlin when home on vacations.

Craig excelled as a Math Major at Oberlin and tutored his fellow students, and then taught high school math for one year at Western Reserve High School, all four grades. Math also empowered Craig to excel in many other scientific subjects like Physics and Physical Chemistry.

Home for the summer and with no future plans, Dr. Gass suggested Craig enter graduate school at Indiana University, which had never occurred to Craig, and teach at DePauw for a semester while Dr. Gass went on sabbatical leave.

So, Craig did. Graduate school in the early 1960's in math was a lot of fun. You can do math anywhere and need a lot of "unfocused" time. So, motorcycles, parties, rugby, and many other things accompanied math education.

Four years later, Craig received his Ph.D. in Algebraic Number Theory and became Associate Professor of Math at Indiana State University for three years and then at Rose Hulman Institute of Technology for four years.

By now Craig had taught all math courses from 8th grade through first year graduate school several times. It was getting boring. So, Craig decided to apply math to the real world, not just the theoretical world.

Thus, Craig went into many business ventures. Math was always the necessary ingredient in all of these businesses ranging from three auto parts stores, Action Dragway, H & H Racing Gasoline, the Hane Dynabrane and finally an industrial training company, Hane Training, which trained thousands of skilled tradesmen all over North America for over two decades.

Craig's goal ever since 1952, freshman algebra, has been to improve math education in the USA.

This became more urgent with the advent of the scientific calculator while he was teaching at Rose Hulman in 1972, and especially urgent since 2009, with the introduction of a modern Math Tool, Wolfram Alpha, which revolutionizes how math should be learned and practiced in practically all STEM subjects.

"BELIEF is everything!" says Craig.

Most everyone can learn Practical Math today in less than a year thanks to the scientific calculator, and then get involved in a wonderful technical career.

Even science and engineering no longer have a math barrier, thanks to modern technologies like Wolfram Alpha. Calculus and Differential Equations are very easy now. The concepts were always easy, but the obsolete manual tools that are very difficult and were a barrier are obsolete now thanks to Modern 21st Century Tools like Wolfram Alpha.

**Craig believes the future is very bright for humanity thanks to modern technologies which will be able to eliminate material poverty and, thus, war.**

**Most importantly, Craig believes that everyone should "Invest in Yourself", as he did.**

# Appendix – The Six-Tier Syllabus

# Tier 1

## Tier 1 TI-30XA Calculator
TI-30XA Introduction
C1    ON/OFF FIX DEG M1 M2 M3
C2    Real Numbers: Add + Subtract – Equal =
C3    Negative Numbers + ≈ -
C4    Multiply × Divide ÷
C5    Percentage %
C6    Memory  M1, M2, M3 STO  RCL ( )
C7    $X^2$ Square
C8    √X Square Root
C9    1/X Reciprocal "Flip It"
C10   Fractions $A^{B/C}$ + - × ÷
C11   D/C Proper/Improper Fractions
C12   F ↔ D Fraction to Decimal Conversion
C13   DEG RAD GRAD Three Angle Measures
C14   SIN $SIN^{-1}$
C15   COS $COS^{-1}$
C16   TAN $TAN^{-1}$

## Tier 1 Pre-Algebra
Pre-Algebra Introduction
P1    Real Numbers, Integers, and Rationals
P2    The Number Line, Negative Numbers
P3    Rules of Addition + -
P4    Rules of Multiplication × ÷
P5    Distributive Law + and × Combined
P6    Fractions, A/B and C/D, Rules
P7    Squares $X^2$ X Squared
P8    Square Roots √X
P9    Reciprocal 1/X  X ≠ 0
P10   Exponents $Y^X$  Y > 0, X Can Be Any Number

# Tier 2

## Tier 2 Algebra

Introduction to Algebra

A1    Four Ways to Solve an Algebra Equation
A2    The Rule of Algebra
A3    X + A = B This is an Easy Linear Equation
A4    AX = B This is an Easy Linear Equation
A5    AX + B = CX + D This is an Easy Linear Equation
A6    A/X = C/D This is an Easy Linear Equation
A7    AX2 = B This is an Easy Non-Linear Equation
A8    A√X = B This is an Easy Non-Linear Equation
A9    (1) SIN X° = A, -1 ≤ A ≤ 1, or (2) SIN-1X = A°, 0 ≤ A° ≤ 180°
A10    (1) COS X° = A, -1 ≤ A ≤ 1, or (2) COS-1X = A°, 0 ≤ A° ≤ 180°

## Tier 2 Geometry

Introduction to Geometry

G1    What is Geometry?
G2    Straight Lines and Angles
G3    Parallel Lines
G4    Triangles, Definition, Sum of Angles
G5    Pythagorean Theorem
G6    Similar Triangles
G7    Quadrilaterals, Polygons, Perimeters (P)
G8    Area of Triangles and Rectangles
G9    Formulas for Polygons
G10   Circles π Circumference
G11   Circles Area A=πr2
G12   Circles Special Properties

G13  Surface Area Blocks and Cylinders
G14  Surface Area Cones
G15  Volume Blocks and Cylinders
G16  Volume Cones
G17  Surface Area Ball or Sphere
G18  Volume Ball or Sphere, Archimedes
       Tombstone
G19  When Geometry is not Enough for Triangles

## Tier 2 Trigonometry
Introduction to Trigonometry
T1   Trig Functions SIN  COS  TAN
T2   SIN X, Sine of X, X is an Angle (Degrees °)
T3   COS X, Cosine of X, X is an Angle (Degrees
       °)
T4   TAN X, Tangent of X, X is an Angle (Degrees
       °)
T5   Warning about SIN-1
T6   Law of Sines
T7   Law of Cosines – Generalized Pythagorean
       Theorem
T8   Trigonometry Beyond Practical Math
       (Optional)

# Tier 3

## Tier 3 Part 1

T3 Part 1 Introduction

T3 P1 L1 The Real Number System (Simmons pp. 34-36)

T3 P1 L2A Notation and Rules (Simmons pp. 36 - 39)

T3 P1 L2B Notation and Rules (Simmons pp. 36 – 39)

T3 P1 L3 Integral Exponents (Simmons pp. 39 – 40)

T3 P1 L4 Root, Radical, Fractional Exponents (Simmons pp. 40 –43)

T3 P1 L5 Polynomials (Simmons pp. 43-45)

T3 P1 L6 Factoring Polynomials (Simmons pp. 45 – 46)

T3 P1 L7 Linear Equations & Rule of Algebra (Simmons pp. 46 –49)
    Plus: Review of Algebra and Rules from the Tier 2 Practical Math Foundation

T3 P1 L8 Quadratic Equation (Simmons pp. 46 – 49)

T3 P1 L9 Inequalities and Absolute Values (Simmons pp. 49 –50)

T3 P1 L10 Coordinates in a Plane (Simmons pp. 53 –54)

T3 P1 L11 Functions and Graphs (Simmons pp. 51 –53)

T3 P1 L12 Straight Lines & Linear Functions (Simmons pp. 55 –56)

T3 P1 L13 Parallel and Perpendicular Lines (Simmons pp. 55 –56)

T3 P1 L14 Intersecting Straight Lines (Custom Training)

Part 1 of Tier 3 should prepare you for a standard test you will need to pass to graduate from high school.

Part 2 of Tier 3 will teach you additional mathematics you will need to excel on the SAT and ACT and other exams.

## Tier 3 Part 2
T3 P2 L1 Prime Numbers (Custom Notes)
T3 P2 L2 Number Facts and Ideas (Custom Notes)
T3 P2 L3 Percents and Percentage (Custom Notes)
T3 P2 L4 Chain Discounts (Custom Notes)
T3 P2 L5 Markups and Discounts (Custom Notes)
T3 P2 L6 Means, Medians, Averages (Custom Notes)
T3 P2 L7 Ratios and Proportions (Custom Notes)
T3 P2 L8 Logic (Custom Notes)
T3 P2 L9 Arithmetic Progressions (Simmons pp. 77)
T3 P2 L10 Geometric Progressions (Simmons pp. 74 –76)
T3 P2 L11 Geometric Series (Simmons pp. 74 –76)
T3 P2 L12 Permutations and Combinations (Simmons pp. 78 –81)
T3 P2 L13 Combinations (continued) (Simmons pp. 78 –81)
T3 P2 L14 Probability (Custom Notes)

## Tier 3 Part 3: SAT/ACT Preparation
T3 P2 L1 Pep Talk
T3 P2 L2 Test Preparation
T3 P2 L3 Test Techniques
T3 P2 L4 Sample Problems A
T3 P2 L5 Sample Problems B
T3 P2 L6 Sample Problems C
T3 P2 L7 Sample Problems D
T3 P2 L8 More Fun
T3 P2 L9 Fun & Games

# Tier 4

*Precalculus Mathematics in a Nutshell*, and Notes will be used. Geometry, Algebra, Trigonometry, and Complex Numbers, with Wolfram-Alpha will be covered.

T4I Introduction to Tier 4, and Overview

## Tier 4 Geometry
G1 Introduction to Geometry Overview (pp. 2-3)
G2 Triangles: Angles, Parallel Lines, Area (pp. 4-5)
G3 Triangles: Similar Congruent (p. 6)
G4 Pythagorean Theorem (pp. 6-7)
G5 Circles: Pi, Area, Sector (pp. 7-8)
G6 Circles: Inscribed angles (pp. 8-9)
G7 Circles: Tangents & Constructions (Notes)
G8 Angles: Bisect, Trisect, Compass,
    Impossibilities (Notes)
G9 Cylinder: Area, Volume (pp. 9-10)
G10 Cone: Overview (pp. 10-11)
G11 Cone: Problems – Help (pp. 21-22)
G12 Cone: Optional Proof for Math Majors
    (Simmons)
G13 Sphere: Volume and Area, Problems (pp. 22–
    23)
G14 Sphere: Optional Proof with Cavalieri's
    Principle (pp. 13-14)

Interlude #1

## Tier 4 Algebra
A1 Introduction to Algebra, Rules of Algebra Review (p. 33)
A2 Basics: Numbers (pp. 34-35)
A3 Review – Overview Tier 3 (pp. 36-50)
A4 Review – Overview Tier 3 (pp. 51-56)
*A5 Introduction to Wolfram-Alpha (Notes)
A6 Circles (pp. 57-58)
A7 Ellipses (Notes)
A8 Parabolas (pp. 58-60)
A9 Hyperbolas (Notes)
A10 Conic Sections
A11 Functions and Graphs (pp. 60-62)
A12 Polynomial Division (pp. 65-67)
A13 Logarithms Calculator (pp. 63-65)
A14 Logarithms Exponents (Notes)
A15 Examples Log Scale

Interlude #2

## Tier 4 Trigonometry
T1 Introduction to Trigonometry (pp. 92-93)
T2 Review of some Analytical Geometry (pp. 93-96)
T3 Radian Measure (pp. 96-98)
T4 Trig Functions Circle Definition (pp. 98-100)
T5 Trig Identities Intro (pp. 100-101)
T6 Evaluating Trig Functions (pp. 101-103)
T7 Trig functions graphs (pp. 103-105)
T8 Frequency and Phase (Notes)
T9 Identities pp 105-6 sec 4 (pp. 114-5)
T10 Identities and Graphs (Notes)
T11 Proofs of Identities – Appendix B (pp. 111-112)
T12 Inverse Trig Functions (pp. 107-109)
T13 Law of Sines and Cosines (p. 109)

## Tier 4 Complex Numbers

Complex Numbers will be treated with a modern geometric approach. Real Numbers correspond to points on a straight line Complex Numbers correspond to points in the plane. Complex Numbers have many wonderful geometric properties that relate geometry and algebra. Trigonometry is more fully understood when one understands complex numbers. Euler's identity is the key to this. Complex numbers are very powerful and indispensable in modern STEM subjects.

C1 Real Numbers Synopsis
C2 Complex Number Definition
C3 Complex Numbers Geometry
C4 Complex Number Geometry Proof
C5 Interlude for Inspiration y^x
C6 Interlude Preparation
C7 Wonderful Equation
C8 Motivation for Wonderful Equation
C9 Roots of Unity
C10 Clocks and Frequency
C11 Exponents and Logarithms

## Tier 4 Algebra Special Topics
AST1 Mathematical Induction (pp. 83-84)
AST2 Progressions, Permutations, Combinations
    Review Tier3 (pp. 74-80)
AST3 Binomial Theorem (pp. 81-82)
AST4 Linear Equations Determinants (pp. 68-70)
AST5 Linear Equations 3D (pp. 71-73)
AST6 Cone and Sphere, Calculus Preview (84-87)

## Tier 4 Geometry Special Topics for Math Majors/Teachers
GST1 Review of Geometry
GST2 Ceva's Theorem (pp. 27-29)
GST3 Heron's & Brahmagupta's Formulae (p. 18,
    Problem 20, pp. 30-31)
GST4 Geometry and Algebra, Analytical Geometry
GST5 Euclid Geometry vs Non-Euclidean
    Geometries
GST6 Calculus Preview

# Tier 5

## Tier 5 Part 1  Differential Calculus

T5 C1  Introduction to Calculus
       Approach to Learning Calculus
       Calculus Overview
T5 C2 Functions
       Graph Terms for Functions
       Function Graph Terms Sheet for Calculus
       Function Graphs #1 Worksheet
       Examples of Graphs
T5 C2a Functions   -  More Examples
T5 C3 Derivative
       Differential Calculus
       Infinitesimals
       Derivative definitions
       Examples
T5 C4 Derivative Examples
       From definition
       From Wolfram Alpha
T5 C5 Applications to Graphing
       Increasing/Decreasing
       Max/Min
       Points of Inflection
       Concavity
T5 C6 Derivative Rules
       Linear combination Rule
       Leibniz Rule
       Quotient Rule
T5 C7 Chain Rule
       Derivative Examples from Rules
       Wolfram Alpha examples
T5 C8 Implicit Differentiation
T5 C9 Relative Rates of Change
T5 C10a Inverse Functions Basics
T5 C10 Inverse Functions
T5 C11 Series Expansions
T5 C12 Final Thoughts on Derivatives

## Tier 5 Part 2 Integral Calculus
T5 C13 Integral Calculus Overview
T5 C14 Definition of Integral and the FTC
T5 C15 Techniques of Integration Overview
T5 C16 Applications of Integration  Areas
T5 C17 Applications of Integration  Arc Length
T5 C18 Applications of Integration  Volumes Disc
T5 C19 Applications of Integration  Volumes Shell
T5 C20 Applications of Integration  Surface Areas
T5 C21 Parametric Functions  Graphs
T5 C22 Parametric Functions  Arc Length
T5 C23 Parametric Functions  Tangent Line
T5 C24 Parametric Functions  Area
T5 C25 Wolfram Alpha Commands
T5 C26 Improper Integrals   Vertical Asymptotes
T5 C27 Improper Integrals   Horizontal
        Asymptotes
T5 C28 Improper Integrals   H A continued
T5 C29 Surface areas of solids revisited
T5 C30  Wolfram Alpha   Modern STEM Tool

# Tier 6

## Tier 6 Part 1  Differential Equations

T6 DE0  Instructions and Advice

T6 DE1  Introduction to Differential Equations

T6 DE2  First Order Differential Equations

T6 DE3  First Order Linear Differential Equations

T6 DE4  First Order Linear Differential Equations II

T6 DE5  Polynomial Approximations of Functions

T6 DE6  Math Models (MMs) – Chimera or Reality?

T6 DE7  First Order Differential Equations –
          Separation of Variables

T6 DE8  First Order Linear Differential Equations
          Redux

T6 DE9  Second Order Linear Differential
          Equations

T6 DE10  Second Order Linear Differential
            Equations – Constant Coefficients

T6 DE11  First Order Non-Linear ODEs

T6 DE12  Differential Equation Tricks

T6 DE13  Orthogonal Curves

T6 DE14  Polar Coordinates and ODEs