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Calculus Simplified

Miles Mathis
miles@mileswmathis.com

Addendum: Oct. 8, 2006:
It has just come to my attention, some four years after the fact, that I have apparently reinvented a simplified version of the Calculus of Finite Differences. That is to say, my table has been used many times before. I had assumed that such a simple table must not be unknown, I just didn't know where to look. Since I am not a professional mathematician I had never before today heard of finite differences.

From my limited reading on the subject today, it appears that I may nevertheless be interpreting my numbers in novel ways—although this too may fall as I read further. So far I have not found that current or historical treatments of finite differences make the distinction I have been careful to make about the point. I have discovered that the Calculus of Finite Differences has even been used in the past few decades in QED, but it seems that my argument about the point has been undiscovered even there, where it is most needed. As you will see, the Calculus of Finite Differences can be interpreted in any number of ways, and it has historically been interpreted much the same way as the Infinite Calculus has been. That is to say, it has suffered the influence of its much more famous sister. This means that its most useful characteristics have been missed: it has been used for heuristic reasons rather than theoretical reasons. It has not been used in QED to get around the point or to solve the problems of renormalization, it has been only been used to solve certain sorts of equations that seem more amenable to it.

In many of my papers I have made it clear how my interpretation of this Calculus of Finite Differences solves some of the problems of QED and General Relativity. It solves them not only by skirting infinities, but, more importantly, by skirting the point and the point particle. In my interpretation, proved by going all the way back to Euclid (in the long paper), the point has no place in the equations, either as a variable or a function; no place in the tables, no place in the graphs or coordinate systems, and no place on the curve.

I also show that the misapplication of the Infinite Calculus to points has caused a misdefinition of many mathematical spaces, including Hilbert Space.

Currently I am trying to sort through claims that there is a margin of error in the Calculus of Finite Differences, compared to the Infinite Calculus. I do not yet see where such error can occur. At first glance, it appears to me that the Infinite Calculus claims a precision it cannot prove. As I showed in my papers, the Infinite Calculus claims an *infinite* precision, by claiming to be able to find numbers at a point and an instant. If the Calculus of Finite Differences has a margin of error relative to that, then I would say the error actually belongs to the Infinite Calculus. But it may be that in analyzing some functions, the Infinite Calculus is actually to be preferred. I will leave upon that possibility until I know more.

END

Calculus Simplified:

Several years ago I wrote a long paper on the foundation of the calculus. The paper was not really dense or difficult—as these things usually go—since I made a concentrated effort to keep both the language and the math fairly simple. But because I was tackling a large number of problems that had accumulated over hundreds of years, and because calculus is considered a bit scary to start with, the paper was still hard to absorb. I found it necessary to talk a lot about history and theory and to bring up very old and outdated ideas, like those of Archimedes and Euclid. This ended up confusing most of my readers, I think, and very few made it through to the end.

For this reason I have now returned to the subject, hoping to further shorten and simplify my findings. What I plan to do here is try to sell my idea to a hypothetical reader. I will imagine I am talking to a high school student just entering first-semester calculus. I will explain to him or her why my explanation is necessary, why it is better, and why he or she should prefer to take a course based on my explanation rather than a course based on current theory. In doing this, I will show that current notation and the current method of teaching calculus is a gigantic mess. In a hundred years, all educated people will look back and wonder how calculus could exist, and be taught, in such a confusing manner. They will wonder how such basic math, so easily understood, could have remained in a halfway state for so many centuries. The current notation and derivation for the equations of calculus will look to them like the leeches that doctors used to put on patients, as an all-round cure, or like the holes they drilled in the head to cure headache. Many students have felt that learning calculus is like having holes drilled in their heads, and I will show that they were right to feel that way.

What some of you students have no doubt already felt is that the further along in math you get, the more math starts to seem like a trick. When you first start out, math is pretty easy, since it makes sense. You don't just learn an equation. No, you learn an equation *and* you learn why the equation makes sense. You don't just acquire a fact, you acquire understanding. For example, when you learn addition, you don't just learn how to use a plus sign. You also learn why the sign works. You are shown the two apples and the one apple, and then you put them together to get three apples. You see the apples and you go, "Aha, now I see!" Addition makes sense to you. It doesn't just work. You fully understand *why* it works.

Geometry is also understood by most students, since geometry is a physical math. You have pictures you can look at and line segments you can measure and so on, so it never feels like some kind of magic. If your trig teacher was a good teacher, you may have felt this way about trig as well. The sine and cosine stuff seems a bit abstract at first, but sooner or later, by looking at triangles and circles, it may dawn on you that everything makes absolute sense.

Algebra is the next step, and many people get lost there. But if you can get your head around the idea of a variable, you are halfway home. But when we get to calculus, *everyone* gets swamped. Notice that I did not say, "almost everyone." No, I said *everyone*. Even the biggest nerd with the thickest glasses who gets A's on every paper is completely confused. Those who do well in their first calculus courses are the ones that just memorize the equations and don't ask any questions. One reason for this is that with calculus you will be given some new signs, and these signs will not really make sense in the old ways. You will be given an arrow pointing at zero, and this little arrow and zero will be underneath variables or next to big squiggly lines. This arrow and zero are supposed to mean, "let the variable or function approach zero," but your teacher probably won't have time to really make you understand what a function is or why anyone wanted it to approach zero in the first place. Your teacher would answer such a question by saying, "Well, we just let it go toward zero and then see what happens. What happens is that we get a solution. We want a solution, don't we? If going to zero gives us a solution, then we are done. You can't ask questions in math beyond that."

Well, if you teacher says that to you, you can tell your teacher he or she is wrong. Math is not just memorizing equations, it is understanding equations. All math, no matter how difficult, is capable of being understood in the same way that 2+2=4 can be understood; and if your teacher cannot explain it to you, then he or she does not understand it.

What is happening with calculus is that you are taking your first step into a new kind of math and science. It is a kind of faith-based math. Almost everything you will learn from now on is math of this sort. You will not have time to understand it, therefore you must accept it and move on. Unless you plan to become a professor of the history of math, you will not have time to get to the roots of the thing and really make sense of it in your head. What no high school or college student is supposed to know is that even the history-of-math professors don't understand calculus. No one understands or ever understood calculus, not Einstein, not Cauchy, not Cantor, not Russell, not Bohr, not Feynman, no one. Not even Leibniz or Newton understood it. That is a big statement, I know, but I have already proved it and I will prove it again below. The short proof is to point out that if they had really understood it, they would have corrected it like I am about to. If any of these people had understood calculus, they would have reconstructed the whole thing so that you could understand it, too. There is no reason to teach you a math that can't be explained simply. There is no conspiracy. You are taught calculus as a big mystery simply because, until now, it *was* a big mystery.

Now, when I say that math after calculus is faith-based, I am offending a lot of important people. Mathematicians are very proud of their field, as you would expect, and they don't want some cowboy coming in and comparing it to religion. But I am not just saying things to be novel or to get attention. I can give you famous examples of how math has become faith-based. Many of you will have heard of Richard Feynman, and not just because I mentioned him ten sentences ago. He is probably the most famous physicist after Einstein, and he got a lot of attention in the second half of the 20th century—as one of the fathers of QED, among other things. One of his most quoted quotes is, "Shut up and calculate!" Meaning, "Don't ask questions. Don't try to understand it. Accept that the equation works and memorize it. The equation works because it matches experiment. There is no understanding beyond that."

All of quantum dynamics is based on this same idea, which started with Heisenberg and Bohr back in the early 1900's. "The physics and math are not understandable, in the normal way, so don't ask stupid questions like that any more." This last sentence is basically the short form of what is called the Copenhagen Interpretation of quantum dynamics. The Copenhagen Interpretation applies to just about everything now, not just QED. It also applies to Relativity, in which the paradoxes must simply be accepted, whether they make sense or not. And you might say that it also applies to calculus. Historically, your professors have accepted the Copenhagen Interpretation of calculus, and this interpretation states that students' questions cannot be answered. You will be taught to understand calculus like your teacher understands it, and if your teacher is very smart he understands it like Newton understood it. He will have memorized Newton's or Cauchy's derivation and will be able to put it on the blackboard for you. But this derivation will not make sense like 2+2=4 makes sense, and so you will still be confused. If you continue to ask questions, you will be read the Copenhagen Interpretation, or some variation of it. You will be told to shut up and calculate.

The first semester of calculus you will learn differential calculus. The amazing thing is that you will probably make it to the end of the semester without ever being told what a differential is. Most mathematicians learn that differential calculus is about solving certain sorts of problems using a derivative, and later courses called "differential equations" are about solving more difficult problems in the same basic way. But most never think about what a differential is, outside of calculus. I didn't ever think about what a differential was until later, and I am not alone. I know this because when I tell people that my new calculus is based on a constant differential instead of a diminishing differential, they look at me like I just started speaking Japanese with a Dutch accent. For them, a differential is a calculus term, and in calculus the differentials are always getting smaller. So talking about a differential that does not get smaller is like talking about a politician that does not lie. It fails to register.

A differential is one number subtracted from another number: (2-1) is a differential. So is (x-y). A "differential" is just a fancier term for a "difference". A differential is written as two terms and a minus sign, but as a whole, a differential stands for one number. The differential (2-1) is obviously just 1, for example. So you can see that a differential is a useful expansion. It is one number written in a longer form. You can write any number as a differential. The number five can be written as (8-3), or in a multitude of other ways. We may want to write a single number as a differential because it allows us to define that differential as some useful physical parameter. For instance, a differential is most often a length. Say you have a ruler. Go to the 2-inch mark. Now go to the 1-inch mark. What is the difference between the two marks? It is one inch, which is a length. (2-1) may be a length. (x-y) may also be a length. In pure math, we have no lengths, of course, but in math applied to physics, a differential is very often a length.

The problem is that modern mathematicians do not like to teach you math by drawing you pictures. They do not like to help you understand concepts by having you imagine rulers or lengths or other physical things. They want you to get used to the idea of math as completely pure. They tell you that it is for your own good. They make you feel like physical ideas are equivalent to pacifiers: you must grow up and get rid of them. But the real reason is that, starting with calculus, they can no longer draw you meaningful pictures. They are not able to make you understand, so they tell you to shut up and calculate. It is kind of like the wave/particle duality, another famous concept you have probably already heard of. Light is supposed to act like a particle sometimes and like a wave at other times. No one has been able to draw a picture of light that makes sense of this, so we are told that it cannot be done. But in another one of my papers I have drawn a picture of light that makes sense of this, and in this paper I will show you a pretty little graph that makes perfect sense of the calculus. You will be able to look at the graph with your own eyes and you will see where the numbers are coming from, and you will say, "Aha, I understand. That was easy!"

There is basically only one equation that you learn in your first semester of calculus. All the other equations are just variations and expansions of the one equation. This one equation is also the basic equation of what you will learn next semester in integral calculus. All you have to do is turn it upside down, in a way. This equation is

$$\mathbf{y' = nx^{n-1}}$$

This is the magic equation. What you won't be told is that this magic equation was not invented by either Newton or Leibniz. All they did is invent two similar derivations of it. Both of them knew the equation worked, and they wanted to put a foundation under it. They wanted to understand where it came from and why it worked. But they failed and everyone else since has failed. The reason they failed is that the equation was used historically to find tangents to curves, and everyone all the way back to the ancient Greeks had tried to solve this problem by using a magnifying glass. What I mean by that is that for millennia, the accepted way to approach the problem and the math was to try to straighten out the curve at a point. If you could straighten out the curve at that point you would have the tangent at that point. The ancient Greeks had the novel idea of looking at smaller and smaller segments of the curve, closer and closer to the point in question. The smaller the segment, the less it curved. Rather than use a real curve and a real magnifying glass, the Greeks just *imagined* the segment shrinking down. This is where we come to the diminishing differential. Remember that I said the differential was a length. Well, the Greeks assigned that differential to the length of the segment, and then imagined it getting smaller and smaller.

Two thousand years later, nothing had changed. Newton and Leibniz were still thinking the same way. Instead of saying the segment was "getting smaller" they said it was "approaching zero". That is why we now use the little arrow and the zero. Newton even made tables, kind of like I will make below. He made tables of diminishing differentials and was able to pull the magic equation from these tables.

The problem is that he and everyone else has used the wrong tables. You can pull the magic equation from a huge number of possible tables, and in each case the equation will be true and in each case the table will "prove" or support the equation. But in only one table will it be clear *why* the equation is true. Only one table will be simple enough and direct enough to show a 16-year-old where the magic equation comes from. Only one table will cause everyone to gasp and say, "Aha, now I understand." Newton and Leibniz never discovered that table, and no one since has discovered it. All their tables were too complex by far. Their tables required you to make very complex operations on the numbers or variables or functions. In fact, these operations were so complex that even Newton and Leibniz got lost in them. As I will show after I unveil my table, Newton and Leibniz were forced to perform operations on their variables that were actually false. Getting the magic equation from a table of diminishing differentials is so complex and difficult that no one has ever been able to do it without making a hash of it. It can be done, but it isn't worth doing. If you can pull the magic equation from a simple table of integers, why try to pull it from a complex table of functions with strange and confusing scripts? Why teach calculus as a big hazy mystery, invoking infinite series or approaches to 0's or infinitesimals, when you can teach it at a level that is no more complex than 1+1=2?

So here is the lesson. I will teach you differential calculus in one day, in one paper. If you have reached this level of math, the only thing that should look strange to you in the magic equation is the y'. You know what an exponent is, and you should know that you can write an exponent as (n-1) if you want to. That is just an expansion of a single number into a differential, as I taught you above. If n=2, for instance, then the exponent just equals 1, in that case. Beyond that, "n" is just another variable. It could be "z" or "a" or anything else. That variable just generalizes the equation for us, so that it applies to all possible exponents.

All that is just simple algebra. But you don't normally have primed variables in high school algebra. What does the prime signify? That prime is telling you that y is a different sort of variable than x. When you apply this magic equation to physics, x is usually a distance and y is a velocity. A variable could also be an acceleration, or it could be a point, or it could be just about anything. But we need a way to remind ourselves that some variables are one kind of parameter and some variables are another. So we use primes or double primes and so on.

This is important, because it means that mathematically, a velocity is not a distance, and an acceleration is not a velocity. They have to be kept separate. A calculus equation takes you from one sort of variable to another sort. You cannot have a distance on both sides of the magic equation, or a velocity on both sides. If x is a distance, y' cannot be a distance, too.

Some people will try to convince you later that calculus can be completely divorced from physics, or from the real world. They will stress that calculus is pure math, and that you don’t need to think of distances or velocities or physical parameters. But if this were true, we wouldn’t need to keep our variables separate. We wouldn’t need to keep track of primed variables, or later double-primed variables and so on. Variables in calculus don’t just stand for numbers, they stand for *different sorts* of numbers, as you see. In pure math, there are not different sorts of numbers, beyond ordinal and cardinal, or rational and irrational, or things like that. In pure math, a counting integer is a counting integer and that is all there is to it. But in calculus, our variables are counting different things and we have to keep track of this. That is what the primes are for.

What, you may ask, is the difference between a length and a velocity? Well, I think you can probably answer that without the calculus, and probably without much help from me. To measure a length you don’t need a watch. To measure velocity, you do. Velocity has a “t” in the denominator, which makes it a **rate of change**. A rate is just a ratio, and a ratio is just one number over another number, with a slash in between. Basically, you hold one variable steady and see how the other variable changes relative to it. With velocity, you hold time steady (all the ticks are the same length) and see how distance changes during that time. You put the variable you know more about (it is steady) in the denominator and the variable you are seeking information about (you are measuring it) in the numerator. Or, you put the defined variable in the denominator (time is defined as steady) and the undefined variable in the numerator (distance is not known until it is measured).

All this can also be applied to velocity and acceleration. The magic equation can be applied to velocity and acceleration, too. If x is a velocity, then y’ is an acceleration. This is because acceleration is the rate of change of the velocity. Acceleration is v/t. So you can see that y’ is always the rate of change of x. Or, y’ is always x/t. This is another reason that calculus can’t really be divorced completely from physics. Time is a physical thing. A pure mathematician can say, “Well, we can say that y’ is always x/z, where z is not time but just a pure variable.” But in that case, x/z is still a rate of change. You can refuse to call “z” a time variable, but you still have the concept of change. A pure number changing still implies time passing, since nothing can change without time passing. Mathematicians want “change” without “time”, but change *is* time. If a mathematician can imagine or propose change without time, then he is cleverer than the gods by half, since he has just separated a word from its definition.

At any rate, I think you are already in a better position to understand the calculus than any math student in history. Whether you like that little diversion into time and change is really beside the point, since even if you believe in pure math it doesn’t effect my argument.

All the famous mathematicians in history have studied the curve in order to study rate of change. To develop the calculus, they have taken some length of some curve and then let that length diminish. They have studied the diminishing differential, the differential approaching zero. This approach to zero gives them an infinite series of differentials, and they apply a method to the series in order to understand its regression. But it is much more useful to notice that curves always concern exponents. Curves are all about exponents, and so is the calculus. So what I did is study integers and exponents, in the simplest situations. I started by letting z equal some point. If I let a variable stand for a point, then I have to have a different sort of variable stand for a length, so that I don't confuse a point and a length. The normal way to do this is to let a length be Δz (read "change in z"). I want lengths instead of points, since points cannot be differentials. Lengths can. You cannot think of a point as (x-y). But if x and y are both points, then (x-y) will be a length, you see.

In the first line of my table, I list the possible integer values of Δz. You can see that this is just a list of the integers, of course. Next I list some integer values for other exponents of Δz. This is also straightforward. At line 7, I begin to look at the differentials of the previous six lines. In line 7, I am studying line 1, and I am just subtracting each number from the next. Another way of saying it is that I am looking at the rate of change along line 1. Line 9 lists the differentials of line 3. Line 14 lists the differentials of line 9. I think you can follow my logic on this, so meet me down below.

1	Δz	1, 2, 3, 4, 5, 6, 7, 8, 9….
2	$\Delta 2z$	2, 4, 6, 8, 10, 12, 14, 16, 18….
3	Δz^2	1, 4, 9, 16, 25, 36, 49 64, 81
4	Δz^3	1, 8, 27, 64, 125, 216, 343
5	Δz^4	1, 16, 81, 256, 625, 1296
6	Δz^5	1, 32, 243, 1024, 3125, 7776, 16807
7	$\Delta\Delta z$	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1
8	$\Delta\Delta 2z$	2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2
9	$\Delta\Delta z^2$	1, 3, 5, 7, 9, 11, 13, 15, 17, 19
10	$\Delta\Delta z^3$	1, 7, 19, 37, 61, 91, 127
11	$\Delta\Delta z^4$	1, 15, 65, 175, 369, 671
12	$\Delta\Delta z^5$	1, 31, 211, 781, 2101, 4651, 9031
13	$\Delta\Delta\Delta z$	0, 0, 0, 0, 0, 0, 0
14	$\Delta\Delta\Delta z^2$	2, 2, 2, 2, 2, 2, 2, 2, 2, 2
15	$\Delta\Delta\Delta z^3$	6, 12, 18, 24, 30, 36, 42
16	$\Delta\Delta\Delta z^4$	14, 50, 110, 194, 302
17	$\Delta\Delta\Delta z^5$	30, 180, 570, 1320, 2550, 4380
18	$\Delta\Delta\Delta\Delta z^3$	6, 6, 6, 6, 6, 6, 6, 6
19	$\Delta\Delta\Delta\Delta z^4$	36, 60, 84, 108
20	$\Delta\Delta\Delta\Delta z^5$	150, 390, 750, 1230, 1830
21	$\Delta\Delta\Delta\Delta\Delta z^4$	24, 24, 24, 24
22	$\Delta\Delta\Delta\Delta\Delta z^5$	240, 360, 480, 600
23	$\Delta\Delta\Delta\Delta\Delta\Delta z^5$	120, 120, 120

from this, one can predict that

24	$\Delta\Delta\Delta\Delta\Delta\Delta\Delta z^6$	720, 720, 720

And so on

Again, this is what you call simple number analysis. It is a table of differentials. The first line is a list of the potential integer lengths of an object, and a length is a differential. It is also a list of the integers, as I said. After that it is easy to follow my method. It is easy until you get to line 24, where I say, “One can predict that. . . .” Do you see how I came to that conclusion? I did it by pulling out the lines where the differential became constant.

7	$\Delta\Delta z$	1, 1, 1, 1, 1, 1, 1
14	$\Delta\Delta\Delta z^2$	2, 2, 2, 2, 2, 2, 2
18	$\Delta\Delta\Delta\Delta z^3$	6, 6, 6, 6, 6, 6, 6
21	$\Delta\Delta\Delta\Delta\Delta z^4$	24, 24, 24, 24
23	$\Delta\Delta\Delta\Delta\Delta\Delta z^5$	120, 120, 120
24	$\Delta\Delta\Delta\Delta\Delta\Delta\Delta z^6$	720, 720, 720

Do you see it now?

$2\Delta\Delta z = \Delta\Delta\Delta z^2$

$3\Delta\Delta\Delta z^2 = \Delta\Delta\Delta\Delta z^3$

$4\Delta\Delta\Delta\Delta z^3 = \Delta\Delta\Delta\Delta\Delta z^4$

$5\Delta\Delta\Delta\Delta\Delta z^4 = \Delta\Delta\Delta\Delta\Delta\Delta z^5$

$6\Delta\Delta\Delta\Delta\Delta\Delta z^5 = \Delta\Delta\Delta\Delta\Delta\Delta\Delta z^6$

All these equations are equivalent to the magic equation, $y' = nx^{n-1}$

In any of those equations, all we have to do is let x equal the right side and y’ equal the left side. No matter what exponents we use, the equation will always resolve into our magic equation.

If I know anything about teenagers, I will expect this reaction: “Well, sir, that may be a great simplification of Newton, for all we know, but it is not exactly 1+1=2.” Fair enough. It may take a bit of sorting through. But I assure you that compared to the derivation you will learn in school, my table is a miracle of simplicity and transparence. Not only that, but I will continue to simplify and explain. Since in those last equations we have z on both sides, we can cancel a lot of those deltas and get down to this:

$2z = \Delta z^2$

$3z^2 = \Delta z^3$

$4z^3 = \Delta z^4$

$5z^4 = \Delta z^5$

$6z^5 = \Delta z^6$

Now, if we reverse it, we can read that first equation as, “the rate of change of z squared is two times z.” That is information that we just got from a table, and that table just listed numbers. Simple differentials. One number subtracted from the next.

This is useful to us because it is precisely what we were looking for when we wanted to learn calculus. We use the calculus to tell us what the rate of change is for any given variable and exponent. Given an x, we seek a y’, where y’ is the rate of change of x. And that is what we just found. Currently, calculus calls y’ the derivative, but that is just fancy terminology that does not really mean anything. It just confuses people for no reason. The fact is, y' is a rate of change, and it is better to remember that at all times.

You may still have one very important question. You will say, "I see where the numbers are coming from, but what does it *mean*? Why are we selecting the lines where the numbers are constant?" We are going to those lines, because in those lines we have flattened out the curve. If the numbers are all the same, then we are dealing with a straight line. A constant differential describes a straight line instead of a curve. We have dug down to that level of change that is constant, beneath all our other changes. As you can see, in the equations with a lot of deltas, we have a change of a change of a change…. We just keep going down to sub-changes until we find one that is constant. That one will be the tangent to the curve. If we want to find the rate of change of the exponent 6, for instance, we only have to dig down 7 sub-changes. We don't have to approach zero at all.

In a way we have done the same thing that the Greeks were doing and that Newton was doing. We have flattened out the curve. But we did not use a magnifying glass to do it. We did not go to a point, or get smaller and smaller. We went to sub-changes, which are a bit smaller, but they aren't anywhere near zero. In fact, to get to zero, you would have to have an infinite number of deltas, or sub-changes. And this means that your exponent would have to be infinity itself. Calculus never deals with infinite exponents, so there is never any conceivable reason to go to zero. We don't need to concern ourselves with points at all.

I hope you can see that the magic equation is just a generalization of all the constant differential equations we pulled from the table. To "invent" the calculus, we don't have to derive the magic equation at all. All we have to do is generalize a bunch of specific equations that are given us by the table. By that I mean that the magic equation is just an equation that applies to all similar situations, whereas the specific equations only apply to specific situations (as when the exponent is 2 or 3, for example). By using the further variable "n", we are able to apply the equation to all exponents. Like this:

$$\mathbf{nz^{n-1} = \Delta z^n}$$

And we don't have to prove or derive the table either. The table is true by definition. Given the definition of integer and exponent, the table follows. The table is axiomatic number analysis of the simplest kind. In this way I have shown that the basic equation of differential calculus falls out of simple number relationships like an apple falls from a tree.

Even pure mathematicians can have nothing to say against my table, since it has no necessary physical content. I call my initial differentials lengths, but that is to suit myself. You can subtract all the physical content out of my table and it is still the same table and still completely valid.

We don't need to consider any infinite series, we don't need to analyze differentials approaching zero in any strange way, we don't need to think about infinitesimals, we don't need to concern ourselves with functions, we don't need to learn weird notations with arrows pointing to zeros underneath functions, and we don't need to notate functions with parentheses and little "f's", as in f(x). But the most important thing we can ditch is the current derivation of the magic equation, since we have no need of it. I will show you that this is important, because the current derivation is gobblydegook.

I am once again making a very big claim, but once again I can prove it, in very simple language. Let's look at the current derivation of the magic equation. This derivation is a simplified form of Newton's derivation, but conceptually it is exactly the same. Nothing important has changed in 350 years. This is the derivation you will be taught this semester. The figure δ stands for "a very small change". It is the small-case Greek "d", which is called *delta*. The large-case is Δ, remember, which is a capital *delta*. Sometimes the two are used interchangeably, and you may see the derivation below with Δ instead of δ. You may even see it with the letter "d". I will not get into which is better and why, since in my opinion the question is moot. After today we can ditch all three.

Anyway, we start by taking any functional equation. "Functional" just means that y depends upon x in some way. Think of how a velocity depends on a distance. To measure a velocity you need to know a distance, so that velocity is a *function* of distance. But distance is not a function of velocity, since you can measure a distance without being concerned at all about velocity. So, we take any functional equation, say

$y = x^2$
Increase it by δy and δx to obtain
$y + \delta y = (x + \delta x)^2$
subtract the first equation from the second:
$\delta y = (x + \delta x)^2 - x^2$
$= 2x\delta x + \delta x^2$
divide by δx
$\delta y / \delta x = 2x + \delta x$
Let δx go to zero (only on the right side, of course)
$\delta y / \delta x = 2x$
$y' = 2x$

That is how they currently derive the magic equation. Any teenager, or any honest person, will look at that series of operations and go, "What the. . . ?" How can we justify all those seemingly arbitrary operations? The answer is, we can't. As it turns out, precisely none of them are legal. But Newton used them, he was a very smart guy, and we get the equation we want at the end. So we still teach that derivation. We haven't discovered anything better, so we just keep teaching that.

Let me run through the operations quickly, to show you what is going on. We only have four operations, so it isn't that difficult, really. Historically, only the last operation has caused people to have major headaches. Newton was called on the carpet for it soon after he published it, by a clever bishop named Berkeley. Berkeley didn't like the fact that δx went to zero only on the right side. But no one could sort through it one way or the other and in a few decades everyone just decided to move on. They accepted the final equation because it worked and swept the rest under the rug.

But what I will show you is that the derivation is lost long before the last operation. That last operation is indeed a big cheat, but mathematicians have put so many coats of pretty paint on it that it is impossible to make them look at it clearly anymore. They answer that δx is part of a ratio on the left side, and because of that it is sort of glued to the δy above it. They say that $\delta y/\delta x$ must be considered one entity, and they say that this means it is somehow unaffected by taking δx to zero on the right side. That is math by wishful thinking, but what are you going to do?

To get them to stand up and take notice, I have been forced to show them the even bigger cheats in the previous steps. Amazingly, no one in all of history has noticed these bigger cheats, not even that clever bishop. So let us go through all the steps.

In the first equation, the variables stand for either "all possible points on the curve" or "any possible point on the curve." The equation is true for all points and any point. Let us take the latter definition, since the former doesn't allow us any room to play. So, in the first equation, we are at "any point on the curve". In the second equation, are we still at any point on the same curve? Some will think that $(y + \delta y)$ and $(x + \delta x)$ are the co-ordinates of another any-point on the curve—this any-point being some distance further along the curve than the first any-point. But a closer examination will show that the second curve equation is not the same as the first. The any-point expressed by the second equation is not on the curve $y = x^2$. In fact, it must be exactly δy *off* that first curve. Since this is true, we must ask why we would want to subtract the first equation from the second equation. Why do we want to subtract an any-point on a curve from an any-point off that curve?

Furthermore, in going from equation 1 to equation 2, we have added different amounts to each side. This is not normally allowed. Notice that we have added δy to the left side and $2x\delta x + \delta x^2$ to the right side. This might have been justified by some argument if it gave us two any-points on the same curve, but it doesn't. We have completed an illegal operation for no apparent reason.

Now we subtract the first any-point from the second any-point. What do we get? Well, we should get a third any-point. What is the co-ordinate of this third any-point? It is impossible to say, since we got rid of the variable y. A co-ordinate is in the form (x,y) but we just subtracted away y. You must see that δy is not the same as y, so who knows if we are off the curve or on it. Since we subtracted a point on the first curve from a point off that curve, we would be very lucky to have landed back on the first curve, I think. But it doesn't matter, since we are subtracting points from points. Subtracting points from points is illegal anyway. If you want to get a length or a differential you must subtract a length from a length or a differential from a differential. Subtracting a point from a point will only give you some sort of zero—another point. But we want δy to stand for a length or differential in the third equation, so that we can divide it by δx. As the derivation now stands, δy must be a point in the third equation.

Yes, <u>δy is now a point</u>. It is not a change-in-y in the sense that the calculus wants it to be. It is no longer the difference in two points on the curve. It is not a differential! Nor is it an increment or interval of any kind. It is not a length, it is a point. What can it possibly mean for an any-point to approach zero? The truth is it doesn't mean anything. A point can't approach a zero length since a point is *already* a zero length.

Look at the second equation again. The variable y stands for a point, but the variable δy stands for a length or an interval. But if y is a point in the second equation, then δy must be a point in the third equation. This makes dividing by δx in the next step a logical and mathematical impossibility. You cannot divide a point by any quantity whatsoever, since a point is indivisible by definition. The final step—letting δx go to zero—cannot be defended whether you are taking only taking the denominator on the left side to zero or whether you are taking the whole fraction toward zero (which has been the claim of most). The ratio $\delta y/\delta x$ was already compromised in the previous step. The problem is not that the denominator is zero; the problem is that the numerator is a point. <u>The numerator is zero</u>.

My new method drives right around this mess by dispensing with points altogether. You can see that the big problem in the current derivation is in trying to subtract one point from another. But you cannot subtract one point from another, since each point acts like a zero. Every point has zero extension in every direction. If you subtract zero from zero you can only get zero.

You will say that I subtracted one point from another above (x-y) and got a length, but that is only because I treated each variable as a length to start with. Each "point" on a ruler or curve is actually a length from zero, or from the end of the ruler. Go to the "point" 5 on the ruler. Is that number 5 really a point? No, it is a length. The number 5 is telling you that you are five inches from the end of the ruler. The number 5 belongs to the length, not the point. Which means that the variable x, that may stand for 5 or any other number on the ruler, actually stands for a length, not a point. This is true for curves as well as straight lines or rulers. Every curve is like a curved ruler, so that all the numbers at "points" on the curve are actually lengths.

You may say, "Well, don't current mathematicians know that? Doesn't the calculus take that into account? Can't you just go back into the derivation above and say that y is a length from zero instead of a point, which means that in the third equation δy is a length, which means that the derivation is saved?" Unfortunately, no. You can't say any of those things, since none of them are true. The calculus currently believes that y' is an instantaneous velocity, which is a velocity at a point and at an instant. You will be taught that the point y is really a point in space, with no time extension or length. Mathematicians believe that the calculus curve is made up of spatial points, and physicists of all kinds believe it, too. That is why my criticism is so important, and why it cannot be squirmed out of. The variable y is not a length in the first equation of the derivation, and this forces δy to be a point in the third equation.

A differential stands for a length only if the two terms in the differential are already lengths. They must both have extension. Five inches minus four inches is one inch. Everything in that sentence is a length. But the fifth-inch mark minus the fourth-inch mark is not the one inch-mark, nor is it the length one inch. A point minus a point is a meaningless operation. It is like 0 – 0.

This is the reason I was careful to build my table only with lengths. I don't use points. This is because I discovered that you can't assign numbers to points. If you can't assign numbers to points, then you can't assign variables or functions to points. When I was building my table above, I kind of blew past this fact, since I didn't want to confuse you with too much theory. My table is all lengths, but I didn't really tell you why it had to be like that. Now, however, I think you are ready to notice that points can't really enter equations or tables at all. Only ordinal numbers can be applied to points. These are ordinal numbers: 1st, 2nd, 3rd. The fifth point, the eighth point, and so on. But math equations apply to cardinal or counting numbers, 1, 2, 3. You can't apply a counting number to a point. As I showed with the ruler, any time you apply a counting number to a "point" on the ruler, that number attaches to the length, not the point. The number 5 means five inches, and that is a length from zero or from the end of the ruler. It is the same with all lines and curves. And this applies to pure math as well as to applied math. Even if your lines and curves are abstract, everything I say here still applies in full force. The only difference is that you no longer call differentials lengths; you call them intervals or differentials or something.

The students will now say, "Can't you go back yourself and redefine all the points as lengths, in the existing derivation? Can't you fix it somehow?" The answer is no. I can't. I have showed you that Newton cheated on all four steps, not just the last one. You can't "derive" his last equation from his first by applying a series of mathematical operations to them like this, and what is more you don't need to. I have showed with my table that you don't need to derive the magic equation since it just drops out of the definition of exponent fully formed. The equation is axiomatic. What I mean by that is that it really is precisely like the equation 1+1=2. You don't need to derive the equation 1+1=2, or prove it. You can just pull it from a table of apples or oranges and generalize it. It is definitional. It is part of the definition of number and equality. In the same way, the magic equation is a direct definitional outcome of number, equality, and exponent. Build a simple table and the equation drops out of it without any work at all.

If you *must* have a derivation, the simplest possible one is this one:

We are given a functional equation of the general sort

$y = x^n$

and we seek y', where, by definition

$y' = \Delta x^n$

Then we go to our generalized equation from the table, which is

$nx^{n-1} = \Delta x^n$

By substitution, we get

$y' = nx^{n-1}$

That’s all we need. But I *will* give you one other piece of information that will come in handy later. Remember how we cancelled all those deltas, to simplify the first equations coming out of the table? Well, we did that just to make things look tidier, and to make the equations look like the current calculus equations. But those deltas are really always there. You can cancel them if you want to clean up your math, but when you want to know what is going on physically, you have to put them back in. What they tell you is that when you are dealing with big exponents, you are dealing with very complex accelerations. Once you get past the exponent two, you aren’t dealing with lengths or velocities anymore. The variable x to the exponent 6 will have 7 deltas in front of it, as you can see by going back to the table. That is a very high degree of acceleration. Three deltas is a velocity. Four is an acceleration. Five is a variable acceleration. Six is a change of a variable acceleration. And so on. Most people can’t really visualize anything beyond a variable acceleration, but high exponent variables do exist in nature, which means that you can go on changing changes for quite a while. If you go into physics or engineering, this knowledge may be useful to you. A lot of physicists appear to have forgotten that accelerations are often variable to high degrees. They assume that every acceleration in nature is a simple acceleration.

In my long paper I covered a lot of other interesting topics, but I will only mention one more of them here. I have told you a bit about quantum mechanics above, so I will give you a clue about the end of that story, too. QED hit a wall about 20 years ago, and that is why all the big names are now working on string theory. String theory is a horrible mess, one that makes the mess of calculus look like spilled milk. But one of the main reasons it was invented was to save QED from the point. This problem I have solved for you about the point is exactly the same one that cold-cocked QED. All of physics is dependent on calculus and its offshoots, and using calculus with points in the equations has ended up driving everyone a little mad. The only way that physicists could make the equations of QED keep working is by performing silly operations on them, like the ones that Newton performed in his derivation. These operations in QED are called “renormalization”. That is a big word for fudging. The inventor of renormalization was the same Richard Feynman who I told you about above. His students are still finding new ways to renormalize equations that won’t work in normal ways. Mr. Feynman was a big mess maker, but he did have the honesty to at least admit it, regarding renormalization. He himself called it “hocus pocus” and a “dippy process” that was “not mathematically legitimate.” It would have been nice if Newton or Leibniz or Cauchy had had the intellectual honesty to say the same about the calculus derivation.

The reason this should be interesting to you is that my correction to the calculus solves all the problems of QED at one blow, although they haven’t figured that out yet. Just by reading this paper you are now smarter than all the “geniuses” fudging giant equations. With your new knowledge, you can go to college, wade briskly through all the muck, and start putting the house in order. Your understanding of calculus and the point will allow you to climb ladders that no one even knew existed. So please remember me when you get to the top. And don't dump any more garbage that might land on my head.

Trig Derivatives Found Without the Old Calculus:

Since I first published my paper on the calculus several years ago, I have gotten many angry emails like this one:

You are wrong! Mathematics is a science about numbers. Graphs, plots are for illustration—you can prove nothing from them.
$y = \sin x$
$y' = \cos x$
How do you prove that by your method?
Yuri

Even my mother, who is a professional mathematician, has failed to see how I can incorporate my table into an analysis of all functions. She never got angry, but she has used my silence as proof that my method has limited use.

Now, I said in a footnote to that paper that my method applied to all of calculus and all functions, not just differentials or polynomials. It applies to trig functions, logarithms, integrals, and so on. I assumed that anyone who understood my argument would see that immediately. I didn't even bother to write a follow-up paper on integration, it seemed so clear to me that anyone could just read up the tables instead of down. I was busy with other important problems and decided to let that paper hang, along with any paper that specifically addressed trig functions. Frankly I had hoped that someone might come along and see my point, and that they would do the dirty work of advancing my theory into these other alleys. Once I have solved a problem, I tend to get bored, and stating the obvious does not really inspire me to write.

However, I now see, years later, that I was mistaken in assuming that my initial paper would penetrate into the mathematical community. It has been turned down for publication in all the top forums, for what I think are political reasons. So I have recently gone back and simplified my argument, self-publishing a shorter and simpler paper, argued in what I consider to be an extremely transparent manner and language. I hope that this paper may eventually make some headway in the mainstream, even if I continue to be blocked by the higher-ups.

Beyond that, I have decided to publicly solve Yuri's trig problem for him, knowing full well that it won't be the further miracle anyone needs. No matter what I do or how I do it, I now expect most of the status quo to find a way to dismiss it out of hand. They weren't bothered by the fact that the current equation has been hanging from skyhooks for 350 years, and so they won't be impressed to see the equation finally grounded. Anyone who studies my table and doesn't undergo an epiphany is someone who is pretty much unreachable, and solving this trig problem with the table won't reach them either. But here goes.

So, Yuri, watch closely, my friend. I will do it so quickly and so easily, you will no doubt think it is nothing. I will show you how to do it without limits, without going to zero, without infinite series, and without the current derivation of the calculus. I will do it using only my table of exponents and the <u>constant</u> differential.

$y = \sin x = \pm\surd(1 - \cos^2 x)$

Notice that we are still dealing here with exponents. The cosine is squared and that is the important fact here, not the fact that we are dealing with trig functions. From a rate of change perspective, the trig function is meaningless. A sine or cosine is just a number, like any other. It is written as function of an angle, but that does not affect the rate-of-change math at all. The cosine of x is a single variable, and we could rewrite it as b if we wanted to, to simplify the variable for the rate of change math. Likewise, we could rewrite $\sin x$ as a, if we desire. All we have to do is make sure we don't confuse sine and cosine, since they vary in different ways, but we can mark them anyway we want.

Let $a = \sin x$
$b = \cos x$
Therefore, we could rewrite the equation as
$y = a = \pm\surd(1 - b^2)$
Square both sides
$y^2 = 1 - b^2$
Since sine and cosine are co-dependent, we can differentiate either side, or both sides, starting with either side we like.
Let $z = 1 - b^2$
$z = y^2$
$\Delta z = z' = 2y$ (from my table of integer exponents)
$\Delta(1 - b^2) = 2y$
Now switch sides and differentiate again
$2y = \Delta(1 - b^2)$
The rate of change of 1 is zero, and we know that rate of change cannot be negative by definition.
$2\Delta y = 2y' = 2b$ (once again, straight from the table of exponents)
$y' = b = \cos x$

You will say that I just followed normal procedure, but I didn't, since whenever I use the equation $\mathbf{nz^{n-1} = \Delta z^n}$ I pull it from my table of exponents and constant differentials, not from current sources, which I have shown are all faulty. I prove this equation using a constant differential, not a diminishing differential or a method using limits. My table shows that with the exponent 2, you only have to go to a third sub-change in the rate of change chart in order to find a straight line, or a constant rate of change. This means that you aren't anywhere near zero, and aren't anywhere near an infinite series of any kind. You are two steps below the given rate of change for this problem (which is an acceleration or its pure math equivalent) and two steps is two steps, not an infinite number of steps. In any rate of change problem, we simply aren't dealing with infinite series, points, or limits. We are dealing with subchanges, and we are seeking a line of **constant differentials**. Not a point, *a line*. This is why my method is so important.

It does not matter in this problem that the curve was created by sine or cosine. The way the curve was created does not concern us in calculus. All we need is at least one dependence. If we have that dependence then we can use the definition of exponent and integer to create the table, and that table will straighten our curve out in a definite and finite number of steps—the number of steps being absolutely determined by the exponent itself.

An infinite series is only created by an infinite exponent. But an exponent signifies a change, and a change requires time, so that an infinite exponent would imply infinite time. We do not need to solve equations concerning infinite time, not in physics and not in mathematics. Therefore we have no need of infinite series in rate of change problems.

My analysis of the Cartesian graph was necessary to discover the problem with calculus, and therefore this analysis certainly transcends "illustration", especially since that word has been thrown at me in a pejorative sense. I never claimed that calculus was all about graphs, or implied that the graph was the central feature of either calculus or of my argument. But I would never have discovered what I did without an in-depth analysis of the graph and the way the curve is created there, and I could never fully explain my method without using the graph to make it clear.