Math and Me
Ellis Boal
5-16-16

The 50th reunion of my 1966 Bowdoin College class is in a couple of weeks. I was a math major there. It was a rarefied world, so I decided to set down some reflections.

I had a privileged upbringing in a Chicago suburb, though I wasn't always conscious of it. I graduated from a private high school in 1962.

I was bad in college application interviews. In preparation Mom drove me around to different schools in the east, lecturing me in the car about my "thirst for knowledge."

I knew I had no thirst. I just thought 12th grade comes after 11th grade, and college comes after 12th grade. So when interviewers asked why I wanted to go to their school, I would just say, "I don't know; I heard it was a good place."

Bowdoin was the only one that accepted me. I arrived in Brunswick and matriculated with no idea what might be my major.

The summer before, I floated down the Mississippi River on a raft with high school friends.

Bowdoin

In those years at Bowdoin almost everyone was in a fraternity. Rushing was completed the 3-day weekend before classes started. I attended rush parties at several houses. Ninety-five percent or better of the incoming class pledged then, some on the first night.

When asked what I wanted to do with my life my answer was to be an astronaut, even knowing I couldn't because I wore glasses. I had always been intrigued with outer space. But this was thought to be beyond weird. After initial welcomes at the parties, I found myself ostracized at house after house.

Back at the dorm Saturday night I wept. But the next day I was offered spots at KS and TDX, and dropped at the latter.

Even months later I was taunted by some about the astronaut thing.

Because of my last name, as a joke classmates addressed me as "Toilet." (I had grown up with the nickname "Ted.") At first I disliked it, a lot. But friends came to use it

nonchalantly. Soon I grew to like it, even revel in it, taking it as a token of affection.

Having had calculus in 12th grade, I started a course in linear algebra with Dan Christie, the math department head. After several frustrating weeks I wasn't getting it. One night I asked Ted Strauss, a sophomore in my house also in the class, if I could come over and try to go through the homework together. He said come at 10:00 pm so I did.

In the middle of one of the problems a light bulb came on. It was the beginning of my enlightenment. I ended up acing the course, and all subsequent math courses at the college.

I liked math because unlike the other subjects it didn't demand much. As long as you paid attention you didn't have to think or feel. You create your own worlds and then work the puzzles. At least that's what I thought. When asked how it could be used or what good it was in the real world, I answered I didn't know and the question didn't interest me.

The same can be said of art. And for what it is worth, I have heard it said that on every campus the math department is the most left-wing.

The problem with physics, which I also considered as a major, is messy reality always gets in the way. Nothing ever comes out neatly. In the labs I did things wrong and ending up the last one to leave every week. Physicists sometimes say math is the queen of the sciences. What they really think is it is the whore of the sciences.

Morehouse

Meanwhile I started developing social consciousness, inspired in part by sister Nina back home. Still in high school, she stood her ground to the point of arrest several times in civil rights actions in Chicago. She missed my graduation in 1966, rightly, due to joining the James Meredith march to Jackson Mississippi. Meredith had started alone and was shot on the second day despite police presence. Thousands from around the country came to him, which Meredith eventually rejoined and completed.

I vowed that one day I would follow in her footsteps. The beginning of that had been my sojourn at Morehouse College in Atlanta the second semester of my sophomore year.

The best and most important part of my experience at Bowdoin was this chance. Six of us went. In exchange, five Morehouse students came to Bowdoin.

There, I had an intriguing class in number theory at Atlanta University. I was introduced to Dedekind cuts and construction of the real number system. But I didn't spend much time with it, or with any of the other courses. I was too busy drinking in the culture, acting in a couple of plays and trying (unsuccessfully) to compete in track. Single-handedly, I integrated and toured with the glee club.

No one at Morehouse addressed me as "Toilet."

That summer, anonymously I emptied my bank account. I had accumulated it methodically since elementary school. I gave it to the Mississippi Freedom Democratic Party and rejected a receipt. It went for a bus to get MFDP supporters to the Democratic Convention in Atlantic City that year, to challenge the regular Mississippi delegates' place in representing the state.

Algebra, Geometry

In those years all the Bowdoin teachers were men. I liked it that they were always "Mr." -- never "Professor" or "Dr."

One of my teachers, Dan Sterling, cautioned me against activism as we were walking one day, arguing I would lose out on prestigious career paths. The word was his. I wasn't used to thinking in terms of prestige. The time I spent studying was average compared to others at the college. I wasn't obsessed or even committed to math, and anyway I didn't see how the two could conflict.

Sterling did steer me to an interest in projective geometry -- where you grapple with the concept of parallel lines meeting at a point in infinity -- about which one night I lectured the department to acclaim.

In the spring of my junior year I took an advanced algebra class from Albert Gilman. Gilman was a right-winger who had advocated Goldwater's side in a faculty debate with a Johnson supporter during the 1964 presidential campaign.

I don't remember that we ever specifically talked politics, but at least he would have known I had been at Morehouse and had the number course. Even so in the classes I had him for, he treated me ok. I had no pause later in asking him for graduate school recommendations.

One day in the spring he scheduled an exam. It was the last of the semester. For some reason I was confused as to what day it would be. By dumb luck, a classmate reminded

me of it 30 minutes before it was to start at 9:00 am.

I had done all the assignments and the exam was to be open-book. You could bring books and your class notes. There had been no need to study much for it. The chance notice that morning didn't bother me. It was a beautiful day. I gathered my notes and materials and walked over to decrepit Seth Adams Hall where math classes were.

There were 4-5 other students in the class. Gilman handed out the exam and blue books. It was scheduled for an hour but he said we could actually take as long as we wanted. He sat down at the front and we went to work.

I don't remember the specific questions, or even the specific subject-matter of the course. But I will never forget what followed.

Students didn't have computers or calculators then. Slide rules were for physics not math. Your only tool was a pencil and yourself.

There were three problems. I worked through the first one. It was basic and easy. It took maybe 15 minutes.

I started the second one. It took longer than expected. By the time I finished the hour was up. Meanwhile a couple of the others finished the exam, and left.

I kept working. One by one the others all left. Gilman left too at some point, saying just to leave the blue book under the door of his office when done.

Starting on the third problem I hit a roadblock. Resorting to my class and homework notes I tried to understand it, as the clock ticked away. Comforted by the unlimited time allowed, nevertheless tension built as I persisted, turning over one rock, then another, and then another, trying to find clues to the puzzle.

Occasionally in past courses I had found an error in an exam or even in the textbook. In one exam, the instructor had asked us to evaluate an algebraic expression and then draw a three-dimensional graph of it. In making up the question the instructor hadn't realized the drawing would stretch to infinity. It was an impossible task. I sketched it to infinity anyway, using shading and arrows to show perspective and distance, even as the instructor discovered the mistake and announced to skip the drawing. Smugly I walked out, only to learn later I had made a careless mistake in a different, easy part of the test, resulting in a devastating less-than-perfect score.

I wondered if Gilman too had given us a mistake. But regressing to class notes of earlier and earlier lectures, my mind started to grasp an important concept that -- without realizing it -- I had consistently misconstrued throughout the whole course.

Alone in the exam room with enormous concentration, I ended up teaching myself an entire section of the syllabus.

I completed the third problem and finally relaxed. By then it was noon or later.

As a safeguard, I decided to re-check my work on the first two questions. I was shocked to see an error in the first one, the easy one. I fixed it.

Disconcertingly, the second one also had an error. It wasn't a huge conceptual error, but it did take time to get straight.

I looked over and cleared everything a final time. Finally I closed the book, and put it under Gilman's door. It was 3:15 pm. I went to the Union and treated myself to a hamburger.

Gilman gave me 100. I don't know if he ever knew the effort I had to put into it. I left Bowdoin believing -- and I still believe today -- that all exams in all courses should be open-book.

In another course, in advanced calculus I believe, instructor Chuck Grobe carefully walked through the proof of a theorem on the board. Grobe had been one of the people to compliment my geometry lecture. At the end he put down the chalk. One of the other students raised his hand and said he didn't understand. I didn't understand either. So Grobe walked through it again. We all expressed puzzlement. He couldn't see why, saying "it's beautifully clear." I didn't know who to fault for this, him or me. I didn't follow up with him. I just felt bad about the failure to communicate.

Unique factorization

Wells Johnson was my honors adviser. He was a nice guy, and good at explaining things. One day he asked if I would like to meet him for a game of squash or maybe it was handball, in the college's new courts. There he thrashed me.

Under his tutelage I wrote my honors paper "Unique Factorization of Ideals in Finite Algebraic Number Fields."

(I considered as a sub-title, "The Stranger From Dry Creek Gulch.")

Here is the gist: Everyone knows that an integer other than 0 or 1 can be factored uniquely to prime numbers. Thus for instance 12 = 2 x 2 x 3 and 91 = 7 x 13.

But not everyone knows this (skip these paragraphs if you want): An "ideal" is a generalization of the set, typically, of multiples of an integer; such as the set of all multiples of 3 or of negative 5. As with integers, ideals can be multiplied. Like integers, an ideal can be prime or not.

Integers themselves can be generalized to something called "algebraic integers."

The paper elaborated the notion, due to the German Richard Dedekind in around 1900, that every ideal in the ring of algebraic integers in a finite field extension of the rational numbers can be factored uniquely into prime ideals, even though factorization of the integers themselves is not unique.

Interesting. Download the paper here: *http://ellisboal.org/pages/math.shtml* .

It was pretty good except for a couple of things. First, it was not original; it simply replicated Dedekind's nearly century-old proof.

Similarly in an earlier class I had reconstructed the proof of the impossibility of trisecting an angle with just a compass and straightedge. But that was the stage of math I was at, not creative and just absorbing the work of others who walked before me. Évariste Galois developed the theoretical underpinnings of the trisection proof before falling in a dual at 21.

(Actually, we were taught nothing -- and didn't care that we were taught nothing -- about the lives of those who walked before. Galois was a French revolutionary republican, an associate of the writer Alexandre Dumas. Before the dual he stayed up all night writing letters and what would become his mathematical testament. Five years later in 1837 final details of the trisection proof were worked out by opium user Pierre Wantzel at age 23. Another saint was Emmy Noether, the eponym for Noetherian rings, a central point of discussion in my factorization paper. World-renowned, Noether left Germany in 1933 when the Nazi government dismissed Jews from university positions. She settled at Bryn Mawr College in the US and died two years later after surgery at age 53. Another was Kurt Gödel. I attended a lecture once about his astounding incompleteness theorem but couldn't wrap my head around it. It holds that no consistent set of axioms can prove all truths about the relations of arithmetic; there will always be statements that are true

but unprovable. Gödel died at 65 pounds by starving himself to death, believing that food was poison.)

(Because of Noether I sometimes say I specialized in women's mathematics.)

Second, Dedekind's was just an existence theorem. Existence theorems are important theoretically but they don't actually get you anywhere. They tell you there is an answer, but they don't tell you what the answer is. When I presented the paper to the faculty, I showed no facility with what should have been the fun part, specific operations and answers with uniquely factored ideals. The talk was a flop. Rightly, Johnson gave me an A not A+.

One time he came over to the Senior Center for dinner. We ate together. Another teacher sat with us. He asked Johnson, "Do you ever learn anything from your students? Do they ever teach you something?"

Gently he looked at me. I was his star. Then he returned to his questioner.

He said "No."

Commencement

At the end of senior year, course work and exams were finished and commencement was at hand. We all had a few days with nothing to do. On one of them classmate Sandy Schmidt and I paddled a canoe from Bailey Island near Brunswick to the Halfway Rock light in Casco Bay, a round trip of 8-10 miles through open ocean waters and soft swells. I am pretty sure we didn't have life jackets.

The next day at the senior center, my roommate Jon Fine said Nate Dane, a teacher, was trying to reach me and I should call him.

I didn't get it. I had finished a 5th year Latin class with Nate the spring of my freshman year. That was three years earlier. Other than an occasional hello, there had been no contact since.

The course had ended unhappily.

Why? Nate was one of the very few teachers at Bowdoin who preferred the use of first names. I liked that. And as a teacher he was ok. In the course I felt I was doing well enough. I felt comfortable as I took the final exam.

But a couple of weeks later when I got home to Illinois and received grades in the mail, he gave me a B-.

The first semester, taking from Paul Ryan, I had got a B+. I didn't think my performance had deteriorated so drastically from then, or even at all. I felt insulted, ripped off. I considered writing a letter of protest. But Nate hadn't returned the graded exam, so I had no evidence. And by then he might have left town for the summer.

I seethed, but let the matter drop. I said nothing about it when I returned in the fall.

So why would he want to talk to me, now three years later? I called him.

He said he was nominating me for Phi Beta Kappa. I was astonished. My grades had been good, but not that good. I can still hear my answer: "You are scraping the bottom of the barrel."

"This is my decision," he said, adding that it had been approved by others in authority. The committee had disregarded the grades at Morehouse, which were lower.

Then he said this: "Why didn't you come to see me?"

Again I was astonished. This time I knew exactly what he meant. I said "I didn't know I could."

Later Jon explained the facts of life about Nate. He liked students, particularly athletes, and wanted them to like him. Jon was in the KS house, known for its athletes. Jon told me it was Nate's practice to let students know their grades before the final day that he was to turn them in. The notice was by a posting I think Jon said, maybe a coded posting, on his office door.

Jon added Nate's further practice was to invite/expect students to come see him to ask for a better grade, the traditional result of which would be an uptick.

I knew nothing of this, until Nate asked me why I hadn't come and then Jon sat down with me.

Had I known of the practice, I might not have complied. It didn't seem right.

Even so, I have Nate -- or maybe his memory and guilt -- to thank for my election to an

elite society.

The aftermath

In the spring I had applied for PhD programs at various graduate schools. I also applied for a Rhodes scholarship. Gilman's was among the recommendations I used.

But again, I was poor at interviews. For a Wilson fellowship I was asked what a "ring" was. It was a softball question. Noetherian rings were a major part of my honors paper. But I gave a wrong answer. One of the interviewers corrected me. I was mortified.

I did make it to the final for the Rhodes. That was easy, given that in the first round they had to choose two from only three applicants from Maine. But in the finals I was so out-classed. The credential of one of the winners was he had choreographed a ballet. I was dazzled.

I did manage to get a four-year NSF fellowship. NSF decided just on your recommendations and grades. There was no interview. It was tenable at any university in the free world. It covered tuition, books, room and board, and a few hundred dollars extra. I could have taken it at Oxford, where the Rhodes would have taken me, had I applied there.

At 22, I cut myself from my family financially. Because of the NSF extra dollars, I feel justified in telling people that in a former life I was a professional mathematician.

I got into Berkeley and Chicago. I chose Chicago because I heard it was better in algebra. The drawback was it was near my home, which meant there would be less travel, less adventure.

That summer I hitchhiked around Europe alone, staying in hostels or sleeping out. Doing it that way is best. It's lonely but it forces you to try different languages and immerse yourself in local culture.

At Chicago, I was housed randomly with two graduate business students from Hawaii. They were nice guys, but we were not on the same page. After a semester I moved into International House, which maintained a 50% ratio of foreign and US students.

At the math orientation meeting, everyone else was also on a fellowship. Irving Kaplansky, the department head, told us Chicago was one of the "big four" in algebra, the others being Harvard, Princeton, and Moscow.

One of the teachers, Israel Herstein, had written the book "Topics in Algebra" used in one of my classes at Bowdoin. It was a great book, opting always for the elegant solution. But in person he was inscrutable.

The problem with Chicago was that, unlike me, everyone else there actually was obsessed. Instructor Abraham Albert said at the beginning of one class there would be no textbook, just our own notes of his lectures. He said he would expect everyone by the end to be able to write down the whole course, proving every theorem.

He added something that stayed with me for life: You can have good ideas and bad ideas. Even so, "nine times out of ten the good idea is wrong."

The department did have a life. One time there was a party and someone wrote up a skit. I was cast as the "red grad," a reference to Mel Rothenberg, the department's topologist, that I ran into again in later years at left conferences. Kaplansky played keyboards, spectacularly.

There was a downside. I don't remember Ahmed Chalabi, an Iraqi, but he got his PhD there working under George Glauberman who was my adviser. We may have met. Later he headed an expatriate group which fabricated the evidence of weapons of mass destruction which brought the US to invade Iraq in 2003. Investing prowess amassed him a fortune of $100 million.

Slipping

Slowly I began to fade. I realized I was flunking out. Glauberman was sympathetic but couldn't help. For spring break I hitchhiked to St. Louis, slept nights in the back seat of an abandoned bus, and tried to spend the days at a university library reviewing my class notes.

After a couple of afternoons I gave up. I explored the city and the deserted underground of the Arch, which was in the final stages of construction. Walking in the railyards, workers told me how I could catch a ride in a local boxcar over the river, where I could get another train back to Chicago.

It worked. The next day on the second try, the local train made it over the bridge. I found the Chicago train and a flatcar carrying a piggy-backed trailer. The car allowed a view of the passing countryside and protection from potential inclement weather. The ride was 20 hours. Sleep was difficult. During the night I woke and found the train was

in a city yard somewhere. I got off and had breakfast at an all-night diner. Back on the train, at the frequent stops I walked with the crew. Rolling to a stop in Chicago a cop spotted me. I showed him my student card and he let me go.

In the math department, sitting in the library one day I pulled out my unique factorization paper from Bowdoin. I realized I couldn't follow it any more.

I went to see Kaplansky. He said this: "If you don't know absolutely that you want to be here, you shouldn't be here."

Right away that settled it. I took incompletes, and quit all courses. A great humiliating loss. Jealously I watched others of my incoming class walking the campus, already with master's degrees. I could have been among them. Most acutely I felt for my instructors back at Bowdoin who had gone to bat for me.

I'm not entirely sure the end was due to intimidation. I have always thought -- or hoped -- that with good mentoring I could have survived and become a journeyman at the trade, teaching at a minor college somewhere and coming up with an occasional new proof.

Treading water

That summer I went into Peace Corps training in Colorado to go to Afghanistan. I was pretty good at Pashto the language and the staff thought I would have a good bazaar-level manner with people. But they deselected me saying I was "immature" and they were afraid I would put a picket line around the king's palace. Another stunning defeat.

I went into teaching high school math in Chicago. I saw and escaped the start of the city-wide riot there the morning after Martin Luther King was killed. I was a poor teacher and the school didn't re-hire me at the end of the year. Another defeat.

I drove a CTA transit bus for the summer, joined a wildcat strike of black drivers at the end, and was busted for protesting at the 1968 Democratic National Convention. Later I drove taxi.

Thirteen of us went to trial in the protest case. Guilty, it went to the Illinois supreme court where we lost. The US supreme court denied review; one dissenting justice would have taken the case and acquitted us. Quitting teaching, I expected to have to go to prison or Canada to stay out of the draft. But I took a draft counseling class and uncovered an obscure classification (I-S(C)) which saved me.

11

But economically the NSF, teaching, and driving had been great. Teaching paid $30 a day. In those days it was a huge sum, I considered, more than you can make by stealing. Most of it went in the bank. I got a fixed-term higher-interest note of some kind, and it ended up paying for law school.

The summer of 1969 I spent in California, ingesting cannabis and hallucinogens and panhandling. I started Michigan law school. On consecutive days, the school had rejected me, changed and put me on a waiting list, and then accepted me. In the spring I was in the BAM strike for affirmative action, and led the action to shut down my torts class. I helped co-found Ann Arbor GLF. I left Michigan after a year to join SDS in Detroit, and then was purged from that.

Today

Arrested four times the first year in Detroit and by then firmly in and of the left, I found my heart. I lived in a commune, read Marx, and finished law school. Unlike at Bowdoin I never looked at my grades. For 25 years I practiced labor law from the labor side. Once I worked 60 hours in a row to get a brief filed on time in the court of appeals for a fired UAW steward. He had led a week-long wildcat strike of 6000 at Chrysler.

At the millennium I moved to Charlevoix in northern Michigan. I have run for Congress several times with the Green Party. Part-time I do mainly frack law now, stopping a well here or a pipeline there.

In labor, I'm defending the UAW student-worker local at the University of California. It voted in 2014 to endorse BDS policies against Israel's treatment of Palestinians. Six high-priced lawyers are on the other side.

Last winter I was third in the state in my age group in xc skiing, including two 50k's. I just found a poster from 30 years ago when my band was the warm-up act for a talk by Bernie Sanders. Occasionally I still play at open mikes.

Socially retarded when I left Bowdoin, I was thrilled to marry LuAnne Kozma in 2012. She leads the Michigan frack work politically.

Today my relation to math is what it always was, puzzles. A few years ago I read and replicated the general solution for a spherical triangle given any three of the six parts. Later I wrote a c++ program for arithmetic operations on numbers up to +/- 100 billion trillion quadrillion, showing proofs of the answers. See the above link.

I solve the daily KenKen puzzles in the New York Times. In five minutes using just a pencil I can convince anyone -- even the most innumerate -- that the square root of 2 is not a fraction of whole numbers. In the same way but in more than five minutes, I can prove and demonstrate the algorithm for extracting the square root of any number, again with just a pencil.

Some day I want to find an instructor somewhere, take an algebra class, and re-teach myself Dedekind's proof, and Galois's too.

But this time will be different. I will be right there with lovely examples of uniquely factored ideals, and unrestrained calls for intensive research.

Then I will begin astronaut training.

Subject: Re: 1966 Reunion
From: Edward Schmidt <edwardc_schmidt@comcast.net>
Date: 6/6/2016 5:45 PM
To: ellisboal@voyager.net

Ted, As far as I am concerned I'd leave the essay as is.

Thanks you for the invitation as well as memories of Linear Algebra that convinced me NOT to consider a career in mathematics. I still dabble in recreational math such as listing the largest mass living uniform DNA organisms. Yes Aspen tree, giant Sequoia "Sherman", and "honey" fungus are the top 3.

Hope you do enjoy Chebeague. I think you did also wear life jacket at least after we got tossed around somewhat

Memories are fickle sometimes; perhaps nearly always.

Sandy.

> On Jun 6, 2016, at 3:02 PM, Ellis Boal <ellisboal@voyager.net> wrote:
>
> Thank you Sandy,
>
> Attached is the story posted about a month ago on our class page at the college's site, in which my own memory of our adventure is related. I trust your memory of everything better than mine, but you don't say whether I too wore a life jacket. Probably I would have followed your recommendation.
>
> Perhaps based on what you say I should revise the piece.
>
> At dinner on Saturday I sat with my old algebra teacher Wells Johnson. Most of the piece is about math, so I sent it to him with the same invitation to correct any mistakes.
>
> Right now LuAnne and I am on Chebeague Island at a family compound. Not sure how many more days we will rest here, but if you happen to sail or paddle by the hook at the southeast end you are welcome to anchor or tie up at the slip and walk up to the main house (straight up from where you land) where we are, for a drink or a meal.
>
> LuAnne's phone if you call first: 231-547-2828
>
> Ted
>
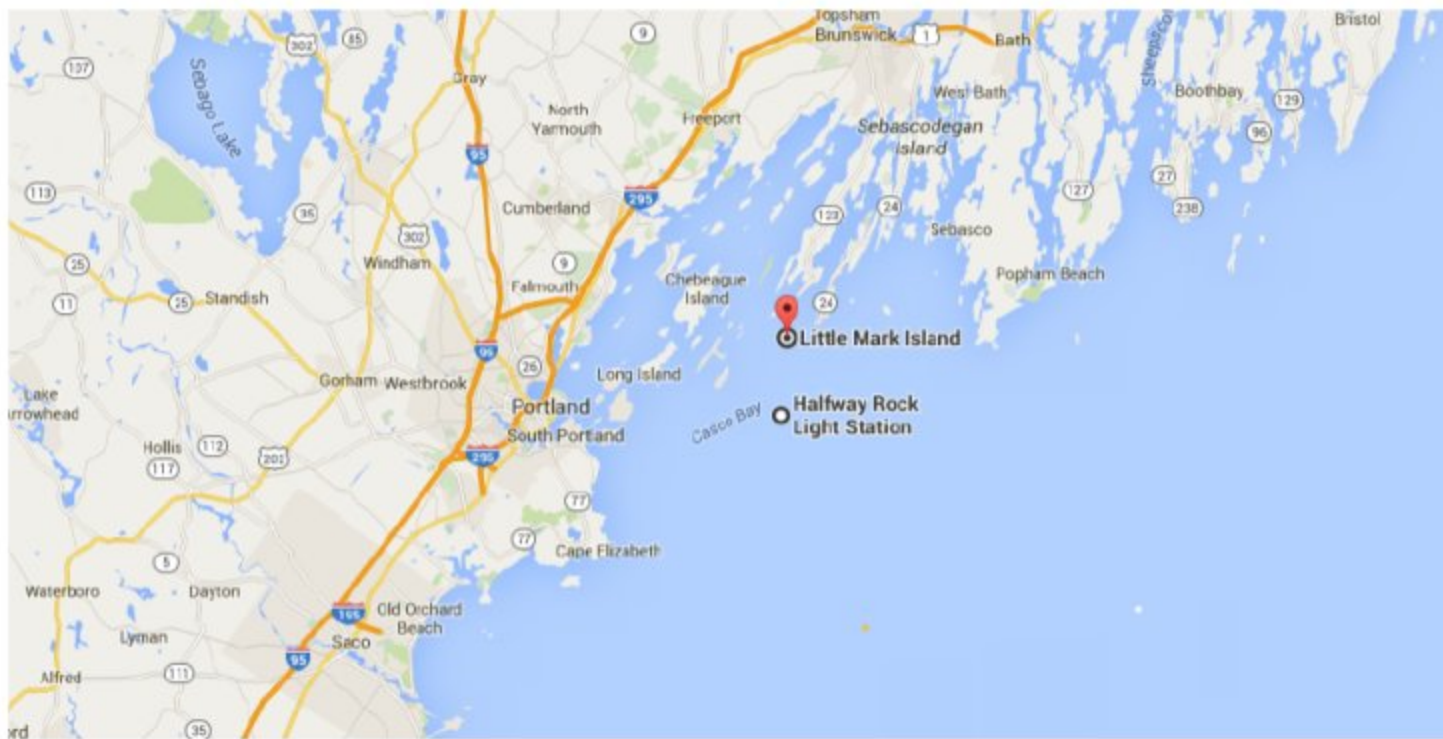> On Mon, June 6, 2016 6:09 am, Edward Schmidt wrote:
>> Ted, upon further reflection, perhaps SLOW recall, just prior to Commencement we borrowed the canoe from the Bowdoin Sailing Club located at that time on the Androscoggin. I am certain we embarked from the little beach at Landâs End Bailey Island with intent of paddling to Halfway Rock. AS the afternoon sea breeze built so did the waves and our stamina faded. After reversing course, our first landfall was Little Mark Island with its 30 foot unlighted day mark. We explored the guano guarded structure trying to ignore the smell and simultaneously recover enough strength to return journey. I do believe I wore a lifejacket for remember large bruise on my right arm from chafed paddling. Foolhardy at best, pretty stupid but guided by divine good fortune.
>>
>> Thanks for the memories.

Sandy

`<mathAndMe2.pdf>`

Halfway Rock Light Station, Bailey Island, ME 04003 to Little Mark Island, Harpswell, ME 04066