

SABBATICAL LEAVE REPORT

1976-1977

STUDY AND EUROPEAN TRAVEL

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Sabbatical Leave Part I
Study at Cal Poly University

During the period from September 1976 to December 1976, my sabbatical leave activity consisted of study at California State Polytechnic University, Pomona. I was enrolled in 12 units of study, including the courses Linear Algebra, Mathematical Statistics, Metric Mathematics, and Handball. The latter course served two purposes. It rounded out my total number of units from 11 to 12 and gave me an opportunity to keep physically fit as well as mentally fit. The courses of study required a great deal of mental concentration and the handball was a welcome relief.

The course which will probably be of most benefit to me as a teacher at Mt. San Antonio College was Mathematical Statistics. We studied from a book by Robert V. Hogg and Allen T. Craig called "Introduction to Mathematical Statistics," (3rd Edition). This text is an excellent, error free work on Statistics and the problems for solution were very challenging. During the first quarter of work, just the first three chapters were studied and I worked out almost all the problems, not just those assigned by our professor, Cameron Bogue. This course has given me a much better and deeper insight into Probability and Statistics and will be of great help to me in teaching Math 13 (Elementary Probability and Statistics). The major difference between the courses is that Calculus is used extensively and some infinite series, whereas the course at Mt. Sac only used Intermediate Algebra. Our professor proved many of the properties of probability distributions, which would be accepted without proof in an elementary course.

The course called "Numerical Methods In Linear Algebra" is related to a course that we offer at Mt. Sac called Finite Mathematics, but on a much higher

level. I feel that the course was of value to me as a teacher at Mt. Sac because it enlarged my mathematical perspective. We used an informal computer language that is related to Fortran IV, a course which I have taught here. The course at Cal Poly reviewed Linear Algebra and used it as a tool for manipulating matrices. The conclusion of the course was a study of Eigen Values and Eigen Vectors.

The course in Metric Mathematics consisted of a study of the Metric System, the process of changing over to the system, and how to teach this system in our schools. The latter part of the course was concerned with developing techniques for teaching Arithmetic, and I picked up ideas that are relevant to our Math 55 course.

In the process of going to school at Cal Poly I met many former students of mine from Mt. Sac and it was helpful to me, as a teacher, to get their reactions to both institutions. One student who had done an excellent job in my Math 33C and Math 13 classes here happened to sit next to me in the Mathematical Statistics class at Cal Poly. He was one of the better students in that class, and I am sure he earned an A or B grade.

It was a valuable experience to see the professors in action at Cal Poly, and I'm sure that I have picked up techniques that will make me a better teacher at Mt. San Antonio College.

In Appendix A there is a transcript of my grades for the courses taken at Cal Poly.

Sabbatical Leave Part II
Developing Audio Visual Tapes

For the month of January I spent my time in the Mathematics Department at Mt. San Antonio College developing audio visual tapes to be used as an aid to learning for our courses called Elementary Statistics, Elementary Algebra, Intermediate Algebra, and Fundamental Mathematics. I recorded tapes on Signed Numbers, Σ notation, and The Binomial Expansion. These tapes are now on reference in the Mathematics Conservatoire for use by our students. It helps to be able to refer students to audio visual aids in the Mathematics Conservatoire, particularly if they missed a classroom presentation or if they are having difficulty in grasping the ideas related to certain topics. The audio visual tapes go into greater depth than one has time for in the classroom. Ideas are explained in such detail that students can participate in a rich learning experience, especially since they have audio and visual learning coupled with guided drill problems which are solved by the students and then checked by viewing the tape.

My experience recording these tapes was very helpful to me as I now understand the mechanics of operations in our Mathematics Conservatoire recording studio and will be able to produce other tapes for my classes.

Sabbatical Leave Part III

Travel in Europe

This part of my sabbatical leave posed new and unusual types of problems as this would be my first trip to Europe, where I would experience so many differing cultures. Just coping with the changing languages and monetary systems seemed to be problem enough. My previous sabbatical was a tour of Australia and New Zealand where we had no language problem, but Europe was certainly to be another matter.

Almost as soon as I became acquainted with a few phrases in the language and the monetary system of one country, it was necessary to "erase" my memories and start with a new system. My wife was on leave from the Charter Oak School District and together we teamed up to solve these problems.

Driving was quite a problem too, especially in the big cities. The best solution was to find a campground in the outskirts of a city and use bus transportation. However, In Rome we had reserved a room at Foyer Unitas, where sisters led in-depth guided tours. We entered the city limits of Rome at 4:30 p.m., armed with an excellent map, and by the time our camper was safely garaged and we were settled in our room it was 9:30 p.m. Those five hours were packed with some of the most hectic experiences of my life. I had suffered through a maze of one-way streets, and cars were double-parked or triple-parked in very inopportune places. Students had been rioting and burning cars, and it was unsafe for parked cars as they could be looted at any time. This was an incongruity of the "Holy" City that was hard to accept.

Our trip commenced in England where we purchased a Ford Transit Wayfarer Van-type camper. We had a comfortable bed, eating quarters, stove, sink,

refrigerator, closet, and storage drawers. We lived comfortably in these quarters for six months, February through July.

The engine of our camper was a 2 Liter V-4 which, coupled with an automatic transmission, gave us practically zero acceleration after each stop. There was a granny gear which enabled us to negotiate some 20% grades, but at a speed of 5 mph or less. We did get 18-19 mpg which helped our "slender" budget withstand the high price of gasoline.

While in Epping, near London, I found time to visit a local high school while the camper was being checked over. The students seemed to be very businesslike. I noted that the school was sponsoring a career day for parents and students to help relate their education to a professional pursuit.

Our stay in England lasted approximately ten days and was highlighted by a tour of Windsor Castle and Hampton Court. Our tour leader packed more information into that tour than we could absorb in such a short time, but most of the facts were very interesting.

We admired the great architectural structures to be found everywhere in London and revelled in their beauty. I spent a great deal of time in the Science Museum.

Another highlight of our visit in London was a concert at the Royal Albert Hall, where we heard a 150-voice choir and the London Royal Symphony Orchestra perform.

On our way to Dover to take the ferry to France, we stopped at Canterbury and were favorably impressed with this historic community. We saw numerous buildings and towers constructed of stone and particularly admired Canterbury Cathedral, where Christian services have been going on for over 1,350 years.

We had mostly cold, rainy weather in England and this continued as we traveled down the coast of France, but we did see many cathedrals and some

beautiful chateaux in the Loire Valley. The Loire River was in flood and we were forced into several detours. There were many signs that said "Camping", and if one followed the arrow, a matter of inundation by floodwaters would have been the result.

I will not forget the imposing sight of LeMont St. Michel as we first saw it, towering above the sea with a stormy and forbidding sky above. This sight is remarkable because the stony structure towers above an already tall, craggy island.

I visited the University of Angers, a Catholic university, and found some very old buildings and others that were quite new. No classes were in session, but I found the mathematics classrooms in a new building and visited with students who were calculating binomial probabilities using an old Olivetti calculator. Many bulletins were posted in the classrooms, serving the purpose of relating studies at the university to various occupations.

As the weather had been rather bad, we were pleased to see a definite improvement as we visited a warm and sunny city of Bayonne. There are many Basque people in this part of France so we visited a Basque museum that showed the history of these proud people, their tools, literature, art, dress, artifacts, and accomplishments. I was very surprised to see a map of the many Basque explorations by sea. Many of these appeared to be of a comparable caliber to the voyages of Christopher Columbus.

A picture of Basque Jai Alai players as they were exhibited in costume, at the museum, appears in Appendix B.

Now we entered Spain and made our first stop in Pamplona, a city famous for the running of bulls. We were not there at the correct time to see this activity. I did visit La Escuela Universitaria de Estudios Empresariales, which we would call a business college. Here I met a young lady, Zuri Urmenenta.

She was an English teacher, so we were able to communicate. I was glad to find out that a lady of Basque descent had made good as a teacher. She showed me a language laboratory but there was no mathematics laboratory. Their mathematics program included Calculus and Statistics.

I was impressed with their faculty room. It looked very much as though it had been taken right out of a castle and then deposited in this school. The furnishings were of the same quality.

We soon learned that life in Europe is structured around an afternoon break of several hours. I fail to see how schools and businesses can be operated efficiently under such a system.

North of Guadalajara we blundered through a fierce snowstorm with biting cold winds, and in my preoccupation with keeping our camper on the road we almost ran out of gasoline. I think only fumes were left in the tank when we found a gasoline station.

The principal attraction which we found in Madrid was the Prado Museum, where we spent many hours studying the great art work for which this museum has gained world-wide fame.

The Moors certainly left an impressive structure in Granada, called the Alhambra. The lacy filigree that protrudes from ceilings and arches gives each room a romantic atmosphere, especially when combined with beautiful patios and gardens. The Moors must have had a wonderful way of life and certainly a most remarkable taste in architecture.

The drive from Granada to Almeria by way of Guadix was most notable as we saw the majestic snow covered Sierra Nevadas with Mulhacén as the highest peak. We also saw the picturesque cave homes of Guadix. These cave dwellings were similar to those we saw in the Loire Valley of France, but in Guadix

the white-washed doors and window frames made an impressive sight. A photograph of this area is shown in Appendix B.

As we came near to the coast and Almeria, the welcome sight of acres and acres of orange groves appeared in the valley. Later we enjoyed their very fine produce.

We spent about five days in a campground situated on the beach near Almeria. This was a much needed rest and rehabilitation period after a hectic month of travel. The days by the Mediterranean were hot and sunny. The one hot shower in the campground used solar heat to warm the water and it operated very efficiently.

Near Valencia, Spain, we had a bad experience. There is an extensive system of irrigation ditches in this area and we had the misfortune of tipping over into one that was about three feet wide and four feet deep. A picture of our camper tilted at an odd angle is shown in Appendix B. The lesson to be learned by this experience is to not give way to approaching trucks to the extent that a right wheel is slightly off the macadam. There are many roads in Spain where no warning post or rails shelter a driver from roadside ditches and precipices.

A visit to the University in Barcelona was very disillusioning. I found the area for mathematics and entered a classroom where the walls were marble--but burned or painted on the marble were "communistic" slogans. The floor was littered with cigarette butts and other trash, and the seating and lighting were very inadequate. However, the notes from a lecture on Vector Calculus remained on the blackboard and appeared to be at a very good level of instruction. In talking with laymen about education in Spain, one gains the impression that tradition has anchored their curriculum for too long a period.

Students were rioting in an effort to force a change. Also, the fact that education often does not lead to a good-paying position in Spanish society created many problems. A photograph of the classroom is in Appendix B.

It had been recommended to me by Dr. Tom O'Connor that I should read Michenor's "Iberia" as we traveled through Spain. This was particularly helpful in Barcelona as many of our experiences were more meaningful as a result of this reading.

The county building contained murals of Christopher Columbus before Queen Isabella, and the rooms contained carved furniture, stained glass windows, tapestries, and beautiful chandeliers.

A very unusual sight is the church called Familia Sagrada by Guadi. There are many tall towers and the objects shown on these towers include almost anything one could imagine.

Froy Tiscareño, who was also on sabbatical leave from the Mt. San Antonio College mathematics department, and his wife Elsie, met us at Cannes where we were able to exchange many helpful ideas for the rest of our trip in Europe. Together we toured Cannes, Nice, and Monaco, and spent a great deal of time visiting the aquarium at Monaco. An indoor shot of a whale's skeleton came out pretty well and is included in the photos in Appendix B.

This area of Southern France is breathtakingly beautiful. We drove along the Mayenne Corniche route and the sights were of deep blue water backed by luxurious cliffside homes, and in the background were the snow-covered lines of Alps.

We left Spain and started traveling on the marvelous autostradas of Italy. They were much like the autopistas of Spain except that there were many hundreds of tunnels, bridges, and viaducts. The Italians have accomplished a masterpiece of engineering to have their country covered with such fine highways.

We admired the many works of art, sculpture, and architecture of Florence, Pisa, Rome, Venice, and Milan as well as the ruins of Pompeii and the beautiful blue grotto of Capri.

My major thrill in Italy was to visit the Museum of The History of Science in Florence. The museum abounded in mathematical and scientific instruments designed and constructed by such famous scientists as Galileo Galilei, Tyco Brahe, Michael Faraday, Charles Boyle, Ignatio Dante, and Christopher Schissler to mention only a few. This museum instilled in me the feeling that I was viewing a collection of objects closely related to people and events that could be called the Cradle of Science. There were calculating machines of ingeneous design for the purpose of shortening arithmetic operations, but the various astrolobes were the most spectacular in appearance.

A middle finger of Galileo's hand was on display in a jar with a pedestal. His body had been moved for re-burial and in the process portions were moved to four different locations for exhibit!

I was able to purchase slides and a book showing the more important ideas and objects from this museum. With these materials I should be able to share a worthwhile experience with my students and fellow teachers.

Another worthwhile experience was a visit to the University of Padua. I had made a contact in Sienna to see Dr. Silvio Della Pria but he was out the day of my visit. However, I did meet with five professors who were conducting their own seminar on singularities involved in intersecting curves. The lecture was in Italian and much of the material was "wordy" so I was only able to grasp a few ideas, but the most helpful idea was that mathematics teachers should work cooperatively together to upgrade their knowledge of mathematics.

These same five professors all taught Analytic Geometry with approximately

200 as a class size. They found little time for research as they had to develop most of their teaching materials rather than to use a text.

After my visit to the University of Padua, my wife met me with a very long face - she had lost our only set of keys to the camper. We were locked out and it was growing dark. This was one time when we were thankful for a clever "lock picker". He had us into the camper in no time with a hot wire job. We went to Mestre where tumblers and keys were obtained at a cost of \$71. Later the original keys were found caught inside the torn lining of my wife's purse.

We garaged our camper in Rome and enjoyed a five-day stay at Foyer Unitas, a small hotel run by Dutch ladies of a religious persuasion. Their purpose is to bring travelers together into a united group and offer lectures and guided tours in great depth.

One of our tours was to be part of an audience of over 5,000 people with the Pope. The whole procedure was explained in great detail by our guide. She even had enough influence to have the organist reduce the volume so she could speak to us.

Two other tours involved churches with Byzantine mosaics; Santa Maria Maggiore and Prudenzia. At the former it is claimed Christ's manger resides. Whether it does not, symbols such as this are much venerated by the people.

We were fortunate to have a young man named Bob Hesterman residing at Foyer Unitas. He had been in charge of the restoration of Rembrandt's famous painting "Night Watch". The painting had been slashed by a man who was found to be insane. Herr Hesterman gave a lecture one evening to a large group at Foyer Unitas. He explained each step in the restoration of Night Watch and

used slides to make the lecture very interesting. Later, in Amsterdam, we had the pleasure of viewing this great painting, and no evidence of the slashing could be seen.

We entered Yugoslavia near Trieste and traveled the beautiful coastline through Rijeka, Split, and Dubrovnik. The coastline is very rocky with a sparse bit of green dotting the steep, craggy shoreline. There must be many clever stonemasons in this country as almost every home and church is built of stone. From all appearances, this building activity didn't diminish the almost unlimited supply of stones on the rocky coastline.

One other item of note is the very large number of very tall Yugoslavians. They have enough to stock many Olympic basketball teams, at least so far as height is concerned.

To avoid some very bad driving around Albania, we took a ferry from Dubrovnik to Corfu and Igoumenitsa, Greece. The drive to Athens was through very pastoral scenery, but there were parts of Athens that reminded me of Tijuana, at least so far as the beaten-up buses are concerned. The prices for most items were very low, particularly in contract to prices in Austria and Switzerland.

We enjoyed the Acropolis and visited three museums before leaving on April 22 on a seven-day cruise in the Aegean Sea. Our plans to land and have guided tours at Santorini and Heraklion were prevented by a very strong wind. There were many disgruntled passengers aboard the Aquarius. We did cruise close by Santorini to see the remains from a volcanic eruption which was four times as strong as the eruption that almost destroyed Krakatao in 1883, in which 36,000 people were killed. The eruption at Santorini also caused destruction as far away as the island of Crete where life was in evidence as early as the 6th millennium B.C., the oldest civilization in the Aegean area.

Various civilizations which existed on Crete ended with catastrophes such as earthquake or tidal wave. Two interesting phenomena occurred on Crete; there was an extensive middle class; and women achieved a high place in Cretan society.

The Aquarius docked in the harbor of the City of Rhodes and our tour took us across the island to another Acropolis, less imposing to that at Athens. In 305 B.C., Demetrius laid siege to the fortifications on Lindos, and after being unsuccessful gave his war equipment to the defenders out of admiration. They sold it and had an enormous bronze statue 105 feet high erected near the main gate of the city. We didn't see the statue as it had fallen during an earthquake and was taken away by invaders at a later date.

On our tour we passed the Voice of America broadcasting station. There are fifteen American families living on the island of Rhodes that are involved in running this station.

Rhodes has compulsory education for ages 6-12 and then three years of high school, the latter being at the City of Rhodes and at Archangelos. If a student wishes to attend a university it is necessary to leave the island and go to Athens, Thessalonica, or Petras. There was, in ancient times, a famous university under Demosthenes and Esconis while Rhodes was under Roman Rule.

On the morning of the 4th day of our cruise we docked at Kusadasi, Turkey, and took a tour bus to the site of the ancient city of Ephesus. At one time 300,000 people lived in this city. We walked for over a mile to see the extensive ruins, which represented about 20 percent of the original city. We saw the remains of the Maecinian, Minoan, Dorian, Ionian, and Hellenistic periods. See photo in Appendix B.

Ephesus was a gateway between the East and the West and became a financial and intellectual center. We saw avenues paved with marble, showing chariot tracks. The city had piped water and the convenience of a rather "modern" style community toilet room.

The apostle, Paul, had lived and preached at Ephesus for three years, and it was at the Grand Theater (an open air affair) where people shouted and yelled "Diana" at Paul's fellow disciples because they had proclaimed that statues made by human hands could not be Gods.

Pythagoras was born in nearby Samos, and Thales, who measured the pyramids and predicted a sun eclipse, also came from this Ionian intellectual center. We saw the remains of a school or gymnasium that dated back to the 2nd century A.D.

Our ship sailed through the Dardanelles, the Magara Sea, the Bosphorus, into the Black Sea and then returned to Istanbul. Istanbul was more closely packed with humanity than Athens, if such a thing could be possible.

The tour leader pointed out to us that Turkey is the most Westernized of the Eastern countries and gave us a great deal of information on the history of Turkey as we visited first a palace where many precious jewels were on display, and then Santa Sophia, and the Blue Mosque. The latter had four marble columns, each 16 feet in diameter. The idea of the flying buttress originated in this area of Istanbul. The Blue Mosque is the third largest church in the world. The architect for Santa Sophia was Isadores of Milates, and Antheneias of Thalec was the mathematician. Another great Turkish mathematician was Mehmet II.

Our last tour was on the island of Patmos where we visited a monastery erected in 1088 by Chrystabolis after the island was donated by Alexis for this purpose.

St. John was imprisoned on this island for many years and we saw the grotto where he wrote the material for Revelations, which is also called the Apocalypse.

There was a famous school on Patmos, founded in the 17th Century, where all fields of knowledge were taught, but today the school mainly emphasizes theology.

Friday, April 29, we disembarked from the Aquarius and took a bus back to our campground at Dafne. It was like being liberated to be back in our camper and to be able to go places where and when we pleased.

We drove North to Thessalonica and stayed at one of our nicest campgrounds on the shore of the Aegean Sea and with Mt. Olympus in the background. We saw fishermen pulling in their net and witnessed the result of using fine mesh nets. The largest fish was only eight inches long and many were three inches long or less. We were told that this type of fishing has been depleting the Aegean's storehouse of fish.

Two students from the University of Thessalonica were camped nearby so we had them over to a dinner of small fish. Their English was rather halting but we had a good talk about Greek life and their educational system.

Our trip through the middle of Yugoslavia was by way of Skopje, Nis, Beograd, and Ljubljana. We had been warned of the bad road and bad drivers and this was true of the Nis to Zagreb section. This road is in very primitive condition and carries a heavy volume of traffic.

In the southern part of Yugoslavia we saw many farmers, both male and female, toiling in the fields. Homes were simple and life in this area is very agrarian in nature. As we moved north into Slovenia, conditions improved and we could see many beautiful homes and very rich-looking farm land

with heavily timbered hills behind lush green meadows. The area around Ljubljana was very much similar to what we saw in Austria.

I had hoped to visit some schools in Ljubljana but my contact was not at home and then my calculator was stolen by some boys who were playing around our campground in a "friendly" sort of way, so we were glad to drive on to Vienna, Austria.

It is quite a contrast to visit countries like Spain, Italy, and Yugoslavia and then come to Austria where we found the country to be very beautiful and the people to be very polite and gracious, especially in Vienna. Our only regret was that it cost so much to be in such nice surroundings. For example, a cup of coffee served at a refreshment stand in the beautiful park near Hofburg Palace cost \$1.20.

We had two excellent guided tours in Vienna, one to places of interest in the city and the other to the Vienna Woods. The city population is 1.6 million and decreasing. Half the city's area is in parks and they were beautiful, with many flowers and blooming trees.

Our afternoon tour took us to Hinterbrule where we went down into a gypsum mine that had been used by the Germans as an underground airplane factory. A lower level was flooded, but the Germans had pumped it dry while it was being used as a factory.

Our route to a Cistercian Monastery at Holy Cross took us by an inn built over an old mill where Franz Shubert often composed music, including the Pastorale, 6th Symphony. In the early days these monks formed the nucleus of the educational system as most of the common people could not read or write. Many of the monks at Holy Cross died before the age of 25 because of the cold, damp condition of their living quarters. The courtyard had graves where the bodies were literally stacked.

I spent many hours in the Technical Museum. In front of the museum is mounted a propeller from a turbine invented by Kaplan, and his statue is located in the lobby of the museum. Some of the items of special interest were motors developed by Benz and Daimler, one being a V-motor. There were early iron-working tools, coin making exhibits, early locks and keys (some wooden), the laboratory of Von Welsbach, a windmill model from the 1830-1927 period, also a watermill and an old Roman hand driven mill, a Lilianthal glider of 1894, and a model of U.S.A.'s Mercury Capsule, to mention some of the more interesting exhibits. A photo of Kaplan's propeller and the museum are in Appendix B.

I made a visit to the University of Vienna's central campus. The buildings were imposing, with marble used extensively in the construction. The classrooms surround a central courtyard where busts of the more famous professors lined the perimeter. I noticed, particularly, Ludwig Boltzman 1844-1906, Professor of Mathematics 1873-1876, Professor of Theoretical Physics 1894-1900, 1902-1906. Another bust was of the well known scientist, Christian Doppler, Professor 1850-1853. See Appendix B for a photo of Ludwig Boltzman.

By May 12th we had traveled to Cologne where we spent the day touring the Cathedral, the Roman-German Museum, the Wallraf-Richartz Museum, and the University. I was very impressed with the Roman-German Museum because it exhibited so many objects discovered in archeological excavations. I had just read Irving Stone's The Greek Treasure, and it was easy to imagine the objects in this museum to be very much like the finds at Hissarlik and Mycenae by Dr. Schlieman and his wife, Sophia.

I found very modern and efficient facilities at the University of Cologne. There were many classrooms for instruction in English, there was a huge library with escalators, and the buildings were of modern design using reinforced concrete.

There was a separate Mathematics building and I was able to attend a lecture on the solution of differential equations. The lecture room was on the top floor of a three-story building. It was light and open because of large windows along each side. In front there were three banks with three boards in each bank which operated up and down on a sliding mechanism. Square pieces of chalk were used which had a paper cover like our crayons. The professor used a wet sponge to erase the board, and then when he wrote, the letters were almost illegible on the damp surface. The professor was young and informally dressed and seemed to know a great deal about mathematics, but his manner of lecturing was not very forceful. There were only about ten students in a room that would hold more than 70. A picture of the classroom is in Appendix B.

On May 14 we drove to Lisse near Amsterdam and visited the Keukenhof Gardens. I think that about every possible shape and color of tulip was displayed in the most beautiful of settings along with hyacinths, azaleas, orchids, and many other flowers. This was the most beautiful display of flowers that I have ever seen.

Our return trip took us through Bennebroek where we saw beautiful homes surrounded with flowers set in magnificent landscapes. A photo is included in Appendix B. This was a display of home gardening superior to what we had seen in Christchurch, New Zealand, on a previous sabbatical leave ten years ago.

The Rijk Museum in Amsterdam is one of the greatest in the world and we spent many hours there. It was a rich experience to see Rembrandt's Night Watch which I have written of previously. The painting is behind glass so that the varnish used in its repair will dry slowly. This museum had an ex-

cellent section on archeological finds and another section on scientific instruments and models.

Another excellent museum in Amsterdam is the one exhibiting paintings of Van Gogh. As I had read his biography, it was interesting to see such a large collection of his work and again note that a man's fame often materializes after his death. This was evident in the large number of visitors to this gallery.

The cities of Ghent and Brugges in Belgium offered sights of many medieval structures. In Brugges there is a College of Europe where an attempt is being made to solve the economic and social problems involved in the unification of Europe.

An important seaport near Brugges is Zeebrugges. The principal activity is fishing. The catch is brought to a huge warehouse where an auction is held. Students occasionally visit this area on field trips to see the auction.

On our way to Paris we broke a fan belt and generator pulley, which caused a great deal of inconvenience and delay as the Ford garages would only sell the generator and pulley as a unit for 600 francs or about \$125. A mechanic at Fresnes adapted a pulley from a generator of a wrecked car for 92 francs. This was our first breakdown in 8,400 miles of touring.

We enjoyed the famous sights of Paris and spent a complete day at the Louvre and were most impressed with the oriental section where we viewed a Babylonian calendar from 340 B.C., signature seals from 3,000 B.C. (showing the earliest forms of writing), and the Code deLois Hammurabi, Roi De Babylone, 1792-1795. This latter exhibit was a large conical shaped stone about four feet high and about one foot in diameter at the base, was covered with ancient writing, and there was a scene at the top depicting Hammurabi receiving this

code from God. A scholar who happened to be present at the museum explained to us that this code predated the Bible, but that many of the ideas show up in parallel form in the Bible. The translation of the ancient writing was accomplished by using the Rossetta Stone writings in three languages (for the same subject). We saw this Rossetta Stone is the British Museum in July.

At the grand palace in Paris is a museum of science called Descouverte. It is a part of the University of Paris, and I found it to be full of fruitful ideas on how to interest a student in science. Nowhere in my previous experience have I seen such a wonderful display of exhibits coupled with actual live laboratory lectures which made use of excellent equipment.

One room was devoted completely to the history of numbers and the development of methods of calculation with numbers. Another circular room had a band of random numbers, about head high, surrounding the observer and then various mathematical exhibits from the field of Statistics. An excellent exhibit showed a surface whose cross sections illustrated correlations, and another exhibit showed regression lines for two sets of data, one being a father's height and the other the son's height. The model illustrated the results of 1,000 sets of data points.

Many exhibits showed how mathematical curves and surfaces occur in nature, for example, a peacock's tail was spread out showing double faces of Spirals of Archimedes.

In another place a model of Newton's book Principia was shown along with an explanation of $F = \frac{kmm'}{r^2}$.

A young girl was giving a lecture on the heart. She was dissecting a heart using an overhead projector. All the different functions of tissues, muscles, and tubes were explained in interesting detail.

The program of events and lectures at Descouverte showed a lecture by T. Gehrels of the University of Arizona on a photographic explanation of Jupiter. It was good to see a mention of the U.S.A. after being away for four months.

To quote the Michelin Guide, "The Palais de la Decouverte is a center of advanced scientific study, and is also the most important museum for the layman: it shows by exhibitions, experiments, demonstrations, and documentary films, the great stages and latest progress of science in all its fields."

Our route took us through Luxembourg into Germany at Trier and then on to Koblenz where we took a boat trip on the Rhine to Rudesheim and return. A commentary on the various castles along the steep river bank, along with gay folk music, made the trip very interesting and enjoyable. There were many barges and some from as far away as Amsterdam. We had seen the heavy barge traffic on the Danube, Mosel, and Neckar Rivers, the latter employing a system of locks which we witnessed in operation near Heidleberg. Without its river transportation system, Germany would be badly crippled economically since as many as 300 barges might pass a given point on a river per day.

One of the benefits of travel is the association with people from other ways of life. We were invited in for short visits at various points of our travels, but at a service station at Mossbach, Germany, we met a young couple with an invitation to stay at their weekend farm house at Guttenbach, where we stayed for two days and not only learned about their way of life but also the villagers' way of life as this was a very small farming community beside the Neckar River.

The students from many little villages in this area are transported to Mossbach where a large high school is located. The students from Guttenbach cross the Neckar on a ferry before being picked up by a school bus. We

crossed this same river on a three-car ferry that was 80 years old and is reported to break down periodically, but luckily not with us on it.

After traveling the Romantic Road and seeing the interesting walled city of Rothenberg and Dinklesbuhl and Nordlingen, we came to the large city of Ulm. Here we visited a cathedral which has the tallest spire of any cathedral, 528 feet. This cathedral contained many carved figures of wood representing some very famous people, Pythagoras and Cicero among others. It seemed rather strange to me that Pythagoras was carved to be playing a lute, but Mathematics and Music can be shown to harmonize even though they are such widely differing disciplines.

At Donaueschingen we had another visit with Froy and Elsie Tiscareño at the home of Elsie's aunts. We saw the Donauquelle, "source of the Danube", and toured a four-story home and office building that was being built of reinforced concrete. The engineering was so excellent that the structure was able to support a swimming pool on the third floor.

We had a good insight into the German way of life as we ate and talked with Elsie's relatives. We were shown "home" movies with sound that showed various hikes, local festivals, and folk music.

Switzerland is noted for its beautiful mountains, homes, and landscapes, and we felt this country lived up to its reputation. We enjoyed trips to the Eiger and Jungfrau and admired the clean beautiful towns nestled in the nearby foothills.

We had a book called, "The Castles of Ludwig II of Bavaria" by Heinrich Kreisel. What we read in this book made our visits to Neuschwanstein, Linderhof, and Herrenchiemsee more meaningful. I was impressed with some of the conveniences that were installed in these structures, which were built over 100 years ago. There was central heating, hot and cold water plumbed

into the kitchen, a rotisserie that ran from a motor energized by the flow of hot air in the flu of a stove, and a disappearing table which worked much like a dumb waiter. There was also an underground grotto lighted by energy from dynamos which had just been invented simultaneously with the construction of the grotto.

The beautiful art and craftsmanship that went into the decoration of Ludwig's castles was breathtaking and seemed to us to be superior to what we had seen in other parts of Europe.

In Salzburg we visited a natural history museum that seemed to have every type of animal, bird, and insect on display. One very interesting exhibit was of a mummified Rhinoceros from the Ice-Age, which had been discovered in 1929. There were some large fish on display whose fins were definitely undergoing a change to legs.

As we left Austria and traveled northwesterly toward Munich, we admired the beautiful homes and farms with green fields and craggy snow-covered Alps in the background. The main difference between the mountains of Southern Germany and Switzerland, and Austria, in contrast to our Sierras, would be the wide expanse of green fields and slopes that reach high up into the mountains.

The Deuches Museum in Munich had a wealth of scientific displays, and I spent many hours studying them. My benefits would have been increased had I been able to read German with more proficiency.

There were both ancient and modern surveying instruments on display, including a meter stick (1801) with pictures of its use over rough terrain. Many pendulums were displayed in the form of experiments and mathematical applications. There were also experiments on the center of gravity, one being a model of the Tower of Pisa. A pendulum suspended from a very tall

tower was swinging in a vertical plane and as the earth revolved, tabs on the circumference of a circle were being knocked down.

A very interesting part of the museum consisted of models of automobiles, old and new, some by Daimler and some by Benz. "Der Benz-Motorwagen von 1886, number 1," was on exhibit in a well-preserved state. There was a 1906 Mercedes, a horse drawn carriage, and a Prunkwagen of Ludwig II from 1818, the carriage of which was just as ornate as Ludwig's castles.

We drove quite some distance from our route to see the Benz-automuseum and manufacturing plant only to find that the museum was "geschlossen" for construction and repairs and the only tour was at Sindelfingen rather than Stuttgart. This tour started with a one-half hour film showing the overall process of producing the auto and then we were taken by a guide for a one-hour tour of the assembly plant. The output of this facility is 1,600 cars per day, of which about 60 are sports cars. About 90% of the latter are exported to the United States.

The workers number 34,000 and many are from Greece, Italy, Spain, and other Southern European countries. There is a training facility where some 800 workers go through a three-year apprentice program. There are over 4,000 women among the employees and the average wage is \$8 per hour.

The most remarkable phase of the assembly is the coordination of parts from the warehouse to delivery on the assembly line for the 600 possible options on the cars. A card on the basic chassis unit is read by a camera and the information for all the various components for that unit is relayed to a computer which in turn insures that all the parts will be supplied to this unit at precisely the right time as it moves along the assembly line. Our guide said that engine installation required only 20 seconds. This compares very favorably to the 1/2 to 1 hour of time that I have spent in installing an engine in a chassis at home.

Later, at Wolfsburg, we had a two-hour tour of a Volkswagen factory. This tour showed us, in more detail, the various processes in building the models called Passat and Golf, known as Dasher and Rabbit in the U.S.A.

Our guide was very helpful in explaining all the various processes and gave us several bulletins on their operations. Wolfsburg is a very modern city, built specifically in conjunction with the factory. Many of the homes are heated with heat produced at the factory, and all the electrical power for this town is produced at the factory. This city was constructed in 1938 as part of Hitler's movement to provide jobs for the people and to start producing war equipment. About two-thirds of the facility was destroyed in World War II but has since been rebuilt and added to until at the present time 50,000 workers are employed.

Today in Germany 180,000 workers are producing 10,000 cars per day. Cars are exported to 150 countries. The Golf and Passat models are very popular in Germany and especially in Wolfsburg where the workers are able to purchase a car at a 16% reduction in price. A photograph of Wolfsburg is in the appendix.

At Kassel I visited the Hesse Museum which contained many ancient scientific instruments. This museum was similar to the fine museum in Florence but on a smaller scale. One interesting item was a hollowed out stone with markings which enabled one to tell time by the drop in the water level as the water ran out of a small hole in the bottom. This Egyptian clock dated back to 1,400 B.C. if I read my German correctly!

In Copenhagen we took a tour with a very fine guide, knowledgeable in the fields of Education and Social Science. We visited a kindergarten, a day nursery, a home for the elderly, and a school. We were given a great deal of information about these institutions and could only draw the conclu-

sion that despite all the careful planning, things were not running smoothly, particularly since 1960. There have been many financial cutbacks in their services.

Since many mothers work, it is a common occurrence for a mother to have a 14-week maternity leave after which she goes back to work and the child is placed in a day nursery. This may be having some influence on the breakdown of discipline in the schools as the home is no longer the strong unifying influence that it had been.

After leaving Copenhagen we traveled northward through Göteborg, Sweden, and had some very interesting experiences in Oslo, Norway, seeing the Outdoor Folklore Museum, the Viking Ships, the polar exploration vessel, Fram, and the Kon Tiki. We also saw Vigeland Park and Museum and the Munch Museum. The art in the Munch Museum seemed rather weird to one unschooled in art appreciation.

From Oslo we took the main road to Bergen but turned off at Hol and took a road that soon turned into a narrow, bumpy, winding road that passed through an area where a great deal of the construction is aimed at power development. Our route passed through numerous tunnels, some as long as three kilometers. The tunnels were unlighted, with turns and steep grades. This was a type of driving I had never done in my life. Between tunnels we passed through beautiful mountains with snow fields and lakes. We eventually came to Flam and took the very scenic rail trip to Myrdal which featured many beautiful waterfalls. Then we took a ferry ride from Aurland to Gudvangen on the beautiful Songenfjord.

After leaving Gudvangen we came to a portion of narrow road that switch-backed for 2.3 kilometers at a grade of 20%. This bit of driving was a very harrowing experience because our V-4 Ford with automatic transmission could

only crawl up this grade at a walk and there was no room for another car to pass. This was not the end of our excitement as we soon came to a 12% to 18% grade of descent to Dole through more winding tunnels and switchbacks! Despite the bad driving conditions, the scenery was most beautiful and we were impressed by the homes on ridges and slopes in very mountainous areas.

At Bergen we visited the University but most of the professors were gone to those homes in the mountains. I was impressed by the many volumes by famous mathematicians in the University Library.

From Bergen we took a ferry to Newcastle on Tyne, then drove through the Scotch Highlands, and then south to Shakespeare country and then on to Stonehenge where I shot a roll of film, much of which will probably be used by the MSAC Astronomy Department.

We then returned to London where we spent more time in the British National Museum before selling our camper and returning home after a week in Zurich.

Our trip of six month's duration was of quick passage through widely varying types of environments. I think that another visit to Europe would be planned with less variety and more in-depth study of longer duration at just a few areas.

SUMMARY

The benefits of this sabbatical have been varied and numerous. Earlier in the report I have already written of the way my study at Cal Poly University and my work in the Mathematics Conservatoire will help to improve my performance as a teacher at Mt. San Antonio College.

My experiences in Europe should also be very helpful. I think that one of the greatest benefits is the wealth of illustrative examples that I will be able to insert into my lectures in the mathematics classes here.

There is also the benefit of being able to understand the problems of the various countries of Europe and to be able to interpret international news with a better perspective.

The sabbatical year has been a change of pace which has left me in a refreshed state, ready to tackle the problems of the classroom.

I found little evidence of any Mathematics Laboratories or tutorial systems to rival that of Mt. San Antonio College.

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DATE OF BIRTH

89114
PERMANENT NO.

CALIFORNIA STATE POLYTECHNIC UNIVERSITY
POMONA

MARKING SYSTEM GRADE POINTS

1606 ALDERSGATE DR
ADDRESS AT DATE OF ADMISSION

LA VERNE
CITY

CA
STATE

A - EXCELLENT	W - WITHDREW	A - 4	F - 0	SP - 0
B - GOOD	NO PENALTY			
C - AVERAGE	AU - AUDIT	B - 3	I - 0	RD - 0 1
D - PASSING	RD - REPORT DELAYED	C - 2	W - 0	
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GRADUATE MAJOR OPTION

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EDUCATION

GRADUATE STUDENT

DEPARTMENT AND COURSE NUMBER	COURSE TITLE	GRADE	UNITS	GRADE POINTS
89114 K FALL 76	HANDBALL	A	10	40
PE 118	LINEAR ALGEBRA	A	40	160
MAT 403	MATH STATISTICS	A	40	160
MAT 440	METRIC MATH	A	30	120
MAT 501			120	480

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WITHDRAW

This information is confidential as defined in public law 92-180
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consent of the student(s) concerned.

MEMORANDA

SUMMARY OF TRANSFER UNITS APPLIED
YEAR ATTENDED COLLEGE UNITS ATTENDED UNITS COMPLETED GRADE POINTS

Robert L. Lowman

This is a true statement of the official record. Honorable Dismissal granted unless otherwise noted.

JAN 6 1977