LIBERAL ARTS MATH FOR SURVIVAL: INTERNET AND CLASSROOM FORMATS

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Introduction

Welcome to "Liberal Arts Math for Survival" via the Classroom and Online College. Moraine Valley Community College uses this website for their Liberal Arts Math Course. The textbook, "Quantitative Methods in Mathematics" used for this course is also used by seniors at Saint Laurence High School, who have the option of dual-enrolling in Math 4 (StL) and Math 120 (MVCC). This presentation tours the website and textbook.

The Tour

Students complete exams, assignments and reading per scheduled deadlines listed in the syllabus. Projects are dropped off at my mailbox or faxed to my office. Exams are taken in the Moraine Valley testing center, where the exams are proctored. The student has to show a student photo ID in order to take an exam. A window of one week is given for the exams. In some cases exams are faxed to testing centers outside our campus. Exams have been faxed to testing centers at the marine base in Quantico Virginia, Springfield, Illinois and Macomb, Illinois.

Starting with the home page, the picture of "David and Goliath" is very appropriate for this course. Many liberal arts students experience Math Anxiety. Mathematics is their Goliath. In this course we try to make them feel like David, by covering topics they may encounter in the real world. Every example in the textbook and on the website follow George Polya's four steps to problem-solving.

1. Understand and Picture the Problem
2. Devise a Plan
3. Execute the Plan
4. Check your Work

The seven topics covered in Math 120 include

1. Interest (Savings accounts, simple and compound)
2. Cars (car purchases: monthly payments and remaining balance)
3. Homes (Closing costs, escrow accounts for property taxes and homeowner's insurance)

4. Annuities (Annuities that grow: Future value and Sinking Fund, Annuities that decay: Present value and Amortization)
5. Geometry (Perimeter, Area, Volume, Home Renovation)
6. Statistics (Descriptive Statistics: bar graphs, pie charts, histograms, polygons, IQR boxplots, mean, median and standard deviation)
7. Probability (Probability, odds, probability distributions, expected value and decision trees)

Each topic has a project that requires the student to use concepts from several sections in the chapter.
Project 1 requires the student to simulate a car purchase. They have to calculate the monthly payment for several deals based on different interest rates and years, and calculate the remaining balance on the loan. They use the site http://autos.yahoo.com/advanced/autos.html to select their car.
Project 2 requires the student to simulate a home purchase. They have to calculate the monthly payment (P&I and escrow), determine the closing costs, refinance the mortgage and calculate the money saved by refinancing. They use the site http://www.realtor.com to select their house.
Project 3 uses the annuity formulas to compare 40 years of saving with 20 years of saving for retirement. Both plans have the same payout to make the comparison easier.
Project 4 requires the student to calculate the cost of various home renovation projects. A floor plan provides the basis for the renovations being done to different rooms.
Project 5 has the student correct a pie chart error distributed by the United Way in a national subscriber campaign, their expenditures summed to 112.8%!
Project 6 has the student use the populations from the 50 states to find mean, median, and standard deviation, followed by the construction of a histogram, polygon, and IQR boxplot.
Project 7 has the student analyze a raffle for a house. Probabilities and odds are calculated for the different prizes. The expected value for the raffle is also calculated.
Project 8 has the student use the expected value in a decision tree to select the best course of action for a business.

Within the lessons online are links to sites. For example in Lesson 3 the amortization formula is presented

AMORTIZATION OF A LOAN

$$P = \frac{\left(\frac{AR}{n}\right)\left(1+\frac{R}{n}\right)^{nT}}{\left(1+\frac{R}{n}\right)^{nT}-1}$$

Students can use the link http://www.interest.com/hugh/calc/simple.cgi to check their calculations.

While the amortization formula is initially daunting, it is broken up into three factors, AR/n, $(1 + R/n)^{(nT)}$ and $(1 + R/n)^{(nT)} - 1$. The students perform these three calculations and store them in memory. The partitioning of the formula is less intimidating for the student. The students are encouraged to review and validate their own car contract or their parent's. In the real world students can calculate the monthly payment on their calculator while the salesperson is using the computer. It does change the complexion of their negotiations.

In Lesson 4, the remaining balance of a loan is calculated. This section is based on our personal experience of paying off a car loan. We called the bank holding the title to our car. They differed from our calculated balance by $300. We faxed them a breakdown of all 48 payments, P&I and remaining balance and they could not find any errors. When they reviewed the loan they found their error. The loan rate was for 8.9%, but someone entered 9.8% into the computer. This transposition was their error. Two methods of calculating remaining balance are covered: the interest on remaining balance and the rule of 78. The importance of the **"No Prepayment Penalty"** clause is stressed. If the loan contract does not have it, then all of the remaining payments must be made to pay off the loan.

The next topic is purchasing a home. (Lesson 5) Once again the Amortization formula plays a key role. But in addition to the loan, the homeowner must pay property taxes and insurance. These bills are paid by money deposited monthly into an escrow account. The importance of paying property taxes is shown in the newspaper article: **Eviction notice 'has taken my life away'.** The article relates the story of a 75 year old homeowner who lost their home due to unpaid property taxes.

Another article **HOMEOWNERS JOINING RUSH TO REFINANCE** is presented. The link http://www.bankrate.com/brm/calc_vml/refi/refi.asp demonstrates the amount of money saved by refinancing.

Feedback from students is positive. Several adult students have refinanced their mortgages. Several younger students have shown this lesson to their parents and they have also refinanced. In addition to the down payment, the purchase of a home has additional expenses, closing costs. These expenses are explained in Lesson 6.

Annuities that grow, multiple deposits over a period of time and annuities that decay, multiple withdrawals over a period of time are developed next. Lesson 7, discusses sinking funds and future value of the annuity. Lesson 8, details present value of an annuity and amortization. These concepts are tied together in Lesson 9, where Social Security and saving for retirement is discussed. The project for this section compares starting a retirement fund early, saving for 40 years, to a retirement plan compared to

savings for 20 years. Both plans have the same payout over 25 years ($2,400 a month for 25 years). The 40 year plan returns 8.8 times the original amount of money invested. (Total investment of $81,888 returns $720,000). The 20 year plan returns 3.9 times the original amount of money invested. (Total investment of $181,977.60 returns $720,000).

Saving for retirement may not be on students minds, but filing federal income taxes shows immediate returns. By opening an Individual Retirement Account (IRA) the student can get a larger tax refund. Tax returns "without an IRA" and "with an IRA" are compared. The "No IRA" tax return has an income tax of $611 and a refund of $13. The "with an IRA" tax return has an income tax of $408 and refund of $216. The same information is used in figuring both returns. The only difference is a $2,000 contribution to an IRA in the "with an IRA" return. This tax data comes from my son's tax return when he was a full time college student and working part time.

Lessons 10 through 13 cover Perimeter, Area, and Volume. The basic shapes of rectangles, triangles and circles are covered. These concepts are tied together in Lesson 14, where the concepts are used to renovate a home. Another personal experience is portrayed. We had a brick patio installed. I used orange spray paint to outline the area on the lawn. I estimated the area to be about 575 square feet. We had three bids. The costs differed by 10 cents per square foot. However, bids were 550 square feet, 700 square feet and 1,000 square feet. These area differences caused great concern and these concepts are used in the project for this section.

Lessons 15 through 18 cover Descriptive Statistics: how to organize data into a table, find suspicious data (outliers) and make graphs and calculate statistics for a sample. The statistics of mean, median and standard deviation is presented. In Lesson 18, the importance of outliers and blood profiling are discussed. Following is an excerpt from an article about the ozone layer states

The Nimbus 7 satellite had in fact been gathering evidence of low ozone levels since 1976. The damage to our atmosphere caused by chlorofluorocarbons went undetected and untreated for up to nine years because outliers were discarded without being examined. ***Moral: Don't just toss out outliers, as they may be the most valuable members of a dataset!***

Lessons 19 through 22 cover probability, odds, probability distribution table, expected value, and decision trees. In Lesson 19 probability is defined as a fraction between zero (never) and 1(always). Lesson 20 uses the Kentucky Derby to present odds. Lesson 21 summarizes a situation (experiment) with a probability distribution table (random variable and their corresponding probabilities). Lesson 22 uses expected value in the decision tree structure to make decisions, maximizing profits and minimizing costs.

At the end of the course, many students have commented that they will keep the textbook and bookmark the Math 120 website for future reference. These student responses are my measure that the course will help them with their financial survival in the real world.