Topics for Mathematical Literacy

OVERVIEW: "Topics for Mathematical Literacy" is a college-level mathematics course, designed for college students who do not expect to need college algebra, a statistics course, or a higher-level mathematics course. The goal of the course is to focus on subjects that could be of value to students, and help to make them mathematically literate. "Topics for Mathematical Literacy" includes five major components: exponential and logarithmic functions, personal finance (including interest rates and annuities), basic logical thinking, basic principles of probability, and statistical reasoning. These topics need to be covered, but not necessarily in this order or in this fashion. Institutions are welcome to include optional topics within one of the given topics or outside the given topics, as time permits.

OUTCOMES RELATIVE TO THE BASIC COMPONENTS:

I. Exponential and Logarithmic Functions[1] (2+ weeks)

a. Identify the basic properties of exponential functions (including a^x) and the natural and common logarithms.
b. Graph exponential and logarithmic functions, including those that have undergone basic shifts and transformations.
c. Solve equations involving exponential functions and logarithmic functions.
d. Recognize exponential functions from tables, graphs, or equations.
e. Be able to convert between exponential and logarithmic expressions.
f. Model and solve applied problems involving exponential functions and the logistic function, including models of exponential growth and exponential decay that appear in finance and biology problems.

II. Personal Finance (3+ weeks)

a. Use appropriate formulas, algorithms, and technology to solve problems involving taxes, savings, loans, investments, and credit cards.
b. Use compound and continuous interest formulas to solve problems involving loans and investments, such as total interest paid, present value, future value, growth rate or time period, and the annual percentage yield.
c. Prepare and interpret an amortization (table) schedule, and use it to compute the monthly payments and interest costs for loans, i.e. for cars or homes.
d. Analyze loans to calculate payment, total interest paid, present value, and future value. Determine the balance and amount of interest at any time during the amortization.
e. Analyze increasing and decreasing annuities to calculate rent, total interest, present value, and future value.

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[1] The Exponential and Logarithmic Functions component can be connected with the Personal Finance component, that is, study general "growth," and then topics in finance relate to particular aspects of growth.

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f. Solve problems involving what one can afford in order to achieve a financial goal, i.e., annuity payment, mortgage payment.
g. Optional: Analyze and compare different real-world loan situations, for example: traditional vs. Roth IRAs, add-on loans, and mortgage points.
h. Optional: Use difference equations to model a variety of real-world situations, including finance problems (particularly appropriate for solving annuity problems in which the money never runs out) and analyze difference equation graphs.

III. Logical Thinking (2+ weeks**)**

a. Express logical statements symbolically and translate symbolic statements into English statements.
b. Assess the validity of logical expressions.
c. Explore common logical fallacies.
d. Use Venn Diagrams to solve logic problems.
e. Distinguish between a deductive argument and inductive argument (or reasoning).

IV. Probability (3+ weeks)

a. Calculate the number of possible events, using counting rules, combinations and permutations.
b. Calculate basic and conditional probabilities used in decision-making processes.
c. Use data from two-way tables, tree diagrams, Venn Diagrams, and area models in order to determine probabilities and make informed decisions.
d. Calculate odds, and explain the relationship between odds and probabilities.
e. Analyze outcomes, draw conclusions or make decisions related to risk, pay-off, expected value and false negatives/positives in various probability contexts.

V. Statistical Reasoning (2+ Weeks)

a. Identify limitations, strengths or lack of information in studies including data collection methods and possible sources of bias.
b. Compare the results of polls using margin of error, and identify errors or misuses of statistics to justify particular conclusions.
c. Solve problems requiring interpretation and comparison of complex numeric summaries, including weighted averages, indices, coding and ranking
d. Make decisions based on data from two-way tables, tree diagrams, Venn diagrams, and area models.