

MTH 150 SURVEY OF MATHEMATICS – Course Objectives

Throughout the course the student should be able to:

- show a clear and logical method for solving applied problems;
- write answers to applied problems in complete sentences and interpret the results.

Required Topics: Estimation, Algebra, Geometry, Consumer Mathematics, Probability, Statistics

Optional Topics: The instructor may choose additional topics such as: Topology, History of Mathematics, Computer Applications, Numeration Systems, The Real Number System, Game Theory or Logic. Typically, an additional topic would be made possible by “infusing” algebra throughout the topics rather than studying algebra as a separate topic.

1. Estimation

- 1.1 Use estimation to approximate an answer to an applied problem.
- 1.2 Use estimation to determine whether a given answer to an applied problem is reasonable.

2. Algebra

- 2.1 Review adding, subtracting, multiplying and dividing fractions.
- 2.2 Use the correct order of operations to evaluate a numerical expression.
- 2.3 Evaluate formulas for specified values of the variables.
- 2.4 Solve first degree linear equations containing one variable.
- 2.5 Translate verbal expressions into algebraic expressions.
- 2.6 Translate word problems into one-variable equations and solve.

3. Geometry

- 3.1 Use the formula for the area of rectangles, squares, parallelograms, triangles and circles to solve applied problems.
- 3.2 Determine the perimeter of any given polygon and the circumference of any given circle, to solve applied problems.
- 3.3 Use the formula for the volume of rectangular solids, cylinders, cones and spheres to solve applied problems.
- 3.4 Determine the surface area of rectangular solids and cylinders.
- 3.5 Use the Pythagorean Theorem to solve applied problems.
- 3.6 Use unit conversions to solve applied problems.

4. Consumer Mathematics

- 4.1 Change a fraction to a percent, a decimal to a percent and a percent to a decimal.
- 4.2 Solve applied problems by finding any of the variables in the following: n percent of $a = b$
- 4.3 In simple interest problems, solve for any variable in $I = prt$.
- 4.4 Solve applied problems by computing compound interest.
- 4.5 Compute effective annual yield [or effective annual interest rate], also known as annual percentage yield (APY).
- 4.6 Solve applied problems by computing present value.
- 4.7 Compute the monthly payment for a fixed installment loan.
- 4.8 Compute the annual percentage rate (APR) [or true annual interest rate] of a fixed installment loan.
- 4.9 Compute the minimum payment due on a credit card and the balance due the following month.
- 4.10 Compute finance charges using the average daily balance method or the unpaid balance method.

4.11 For a conventional mortgage loan, compute the:

- monthly mortgage payment;
- the total amount of interest over the life of the mortgage.

5. Probability

5.1 Compute the empirical probability that event E will occur by means of the formula $P(E) = \frac{\text{the number of times event } E \text{ has occurred}}{\text{the total number of times the experiment has been performed}}$.

5.2 Use the law of large numbers to explain the meaning of a probability. (e.g., A probability of $1/6$ means that over the long run, on average, the event will occur one out of every 6 times.)

5.3 Compute the theoretical probability that event E will occur by means of the formula $P(E) = \frac{\text{the number of favorable outcomes}}{\text{the total number of possible outcomes}}$.

5.4 Write an explanation that probability must be a number between 0 and 1, inclusive.

5.5 In the context of a problem, explain that:

- an empirical probability of 0 means that the event never occurred, but could occur in the future;
- an empirical probability of 1 means that the event always occurred, but may not occur in the future;
- a theoretical probability of 0 means that the event will never happen;
- a theoretical probability of 1 means that the event is certain to happen.

5.6 Demonstrate an understanding that outcomes must be equally likely in order to calculate the probability of an event E using the formula $P(E) = \frac{\text{the number of favorable outcomes}}{\text{the total number of possible outcomes}}$. Students should be able to:

- articulate this assumption in an instance in which it is not stated (e.g., In order to calculate the probability of drawing a red ball from an urn containing 10 red and 5 green balls, you must assume that each ball is equally likely to be chosen.);
- write an explanation that there is insufficient information to calculate a probability in an instance in which it cannot be determined whether the outcomes are equally likely (e.g., In order to calculate the probability of drawing a red ball from an urn containing only red balls and purple balls, you must know how many there are of each color.);
- calculate probabilities of events for which some manipulation is required in order to obtain equally likely outcomes. (e.g., In order to calculate the probability that a spinner lands on a specific color given a spinner for which the colored areas are unequal in size, you must subdivide the areas).

5.7 Determine the odds in favor of or against event E occurring and determine the probability of an event given the odds.

5.8 Compute the expected value of an event E . Explain in the context of a problem that this is an average over the long run and cannot be used to predict the outcome the next time the event occurs.

5.9 Determine the fair price to play a "game".

5.10 Determine whether a "game" is fair or not.

5.11 Use sample spaces to show possible outcomes and calculate probabilities.

5.12 Determine whether two events, A and B , are mutually exclusive.

5.13 Determine whether two events, A and B , are dependent or independent.

5.14 Compute compound probabilities, that is $P(A \text{ and } B)$ and $P(A \text{ or } B)$.

6. Statistics

- 6.1 Define and recognize biased samples and random samples.
- 6.2 Explain how a graph or statement is a misinterpretation of statistics or is misleading.
- 6.3 Construct and interpret a frequency distribution table and a histogram from a given set of data.
- 6.4 Interpret a frequency polygon and a circle graph.
- 6.5 Distinguish among and compute the mean, median, mode and midrange for a given set of data.
- 6.6 Distinguish between and compute the range and standard deviation for a given set of data.
- 6.7 Identify rectangular distributions, J-shaped distributions, bi-modal distributions, skewed distributions and normal distributions from graphs.
- 6.8 Sketch and label a normal curve given the mean and standard deviation.
- 6.9 Determine what percentage of normally distributed data is within a given number of standard deviations from the mean, and explain your answer.
- 6.10 Write an explanation that a distribution must be normal in order to apply the empirical rule or use the z-score table to determine the percentage of data within a given number of standard deviations of the mean.

7. Metric System

- 7.1 Convert from one metric unit to another metric unit using liter, gram, and meter as basic units. The following prefixes should be emphasized: kilo, hecto, deka, deci, centi, and milli.
- 7.2 Use dimensional analysis (proportions) to convert units of measurements in the metric system to equivalent units in the U.S. Customary system and vice versa. (For example, convert liters to cups.)