MTH 121B: Concepts and Applications with Algebra Review (CT)

Course catalog description
A quantitative reasoning skills course for non-science majors. Topics include logical thinking, problem solving strategies, beginning statistics and probability, exponential and logarithms modeling, formula use, with basic algebra review.

Credit hours
4 hours

Prerequisites
ACT Math 17 or 18, or equivalent

Critical thinking (CT) designator
This course carries a CT designator, and students who complete the course receive 3 hours of CT credit towards their general education requirements.

List of topics
- Introduction to quantitative literacy
- Logical thinking
- Fallacies of relevance
- Fallacies of numbers and statistics
- Problem solving through unit analysis
- Problem solving strategies
- Systems of standardized units; rounding numbers
- Scientific notation, order of magnitude
- Scaling factors
Learner outcomes

**Introduction** - Students will be able to:

- define quantitative literacy;
- recognize the importance of quantitative literacy in their lives;
- discuss several misconceptions about mathematics.

**Logical Thinking** - Students will be able to:

- know the difference between a deductive and inductive argument;
- be able to test if a deductive argument is valid or invalid;
- determine if a valid argument is sound or unsound;
- determine if an inductive argument is weak or strong;
- use truth tables to determine the truth value of a compound proposition;
- use Venn diagrams to determine the validity of a deductive argument.

**Fallacies of Relevance** - Students should be able to:
• define “fallacy” and recognize many different common fallacies.

**Fallacies of Number and Statistics** - Students should be able to:

• distinguish between necessary and sufficient cause;
• define and use the concepts of absolute and relative change.

**Problem Solving through Unit Analysis** - Students should be able to:

• use appropriate units to assist them in problem solving;
• apply Polya’s four-step procedure for solving problems.

**Problem Solving Strategies** - Students should be able to:

• Students should recognize that not every problem can be solved using the four-step procedure;
• Students should be able to solve certain problems that they haven’t seen before by carefully thinking them through.

**Systems of Standardized Units; Rounding Numbers** - Students should be able to:

• convert commonly used units from the US Customary System to the Metric System and vice versa;
• round numbers.

**Scientific Notation; Order of Magnitude** - Students should be able to:

• change large or small numbers to scientific notation;
• make simple estimates using the four-step procedure for problem solving;
• determine order of magnitude estimates.

**Scaling Factors** - Students should be able to:

• measure a distance on a map or model and determine the actual distance or size using the given scale;
• put large numbers in perspective using different techniques.
**Uncertainty**- Students should be able to:

- determine uncertainty ranges that derive from measurements and be able to state a level of confidence in the measurement;
- determine the number of significant digits for measurements and exact numbers;
- combine approximate numbers;
- interpret the graphs that are commonly found in weekly news magazines.

**Applications in Large Numbers and Unit Analysis**- Students should be able to:

- to use the quantitative skills developed earlier to solve problems.

**Relations; Rates of Change**- Students should be able to:

- identify the independent and dependent variables in a relation;
- draw the graphs of relations and use relations as models of real world problems;
- determine the slope of a linear relation and be able to graph a linear relation.

**Linear Equations; Creating Linear Models**- Students should be able to:

- solve linear equations with numbers;
- solve literal linear equations;
- make a linear model from two or more data points.

**Counting Techniques**- Students should be able to:

- use the Multiplication Principle;
- compute the number of arrangements possible allowing repetition;
- compute simple permutations;
- compute simple combinations;
- know when to apply each idea.

**Probability Theory**- Students should be able to:
• compute probabilities for independent events, dependent events, mutually exclusive events, non-mutually exclusive events using a priori techniques.

**Expected Values and Binomial Probability Formula**- Students should be able to:

• compute the expected value;
• compute the probability of success in an experiment.

**Statistics; Graphing Statistical Data**- Students should be able to:

• explain the difference between inferential and descriptive statistics;
• interpret data from different types of graphs.

**Measure of Central Tendency; Normal Distribution**- Students should be able to:

• use the properties of the normal distribution and be able to decide if it is an appropriate model of given data;
• explain how standard deviation and margin of error relate to statistical surveys.

**Sample Issues in Statistical Research**- Students should be able to:

• recognize abuses of statistics after studying many examples.

**Exponential Growth**- Students should be able to:

• explain the difference between exponential growth and linear growth;
• explain why exponential growth cannot continue indefinitely in real world situations;
• solve and interpret doubling time and half-life problems.

**Applications of Exponential Models**- Students should be able to:

• use exponential growth and decay models to predict a quantity after any time;
• use exponential growth and decay models to find the time \( t \) given the other variables;
• create models of exponential growth or decay from given data points.

**Using Formulas** - Students should be able to:

• use given formulas;
• tell if a formula makes sense when described in words or pictures;
• determine the correct units when manipulating a formula.

**Logarithmic Scales** - Students should be able to:

• give two examples of natural phenomena whose models are logarithmic;
• solve simple logarithmic equations;
• manipulate common logarithms.

**Financial Formulas** - Students should be able to:

• make a personal budget;
• compute compound interest for the discrete and continuous cases;
• compute the amount in a retirement account;
• compute the monthly car or house payments and understand how accelerating a loan will save on interest.

**Technology**
Students must have a calculator that can perform exponentiation (e.g. \( x^y \)).

**Suggested textbooks**


**Last updated**
December 2016