Developmental Math Course: "Mathematical Foundations"

Description and Outcomes

Description

The Mathematical Foundations Course focuses on algebraic and numerical skills in a context of applications and problem solving to prepare students for Statistics or Contemporary Mathematics. Topics will include quantitative relationships, patterning and algebraic reasoning, functional reasoning, probabilistic and statistical reasoning, incorporating quantitative communication skills (see outcome #2) and technology.

This document is a framework for the Mathematical Foundations Course. There are other developmental courses leading to STEM pathways. Institutions can customize the description and outcomes listed above. However, it is crucial that institutions cover all the outcomes listed below so that students can succeed in the appropriate college-level courses at any institution in the state. Institutions may add to these outcomes when designing their own course(s).

Outcomes

Upon course completion, the students will be able to:

1. Use number concepts to describe quantitative relationships in a variety of contexts.
2. Communicate, interpret and explain mathematical concepts using appropriate symbolic notation and vocabulary.
3. Manipulate and solve equations, using appropriate mathematical techniques and technology.
4. Solve word problems in various contexts and interpret results by using mathematical concepts with appropriate terms and units.
5. Solve systems of two equations graphically and algebraically, and interpret the results in an appropriate manner.
6. Recognize whether a linear or non-linear mathematical model is appropriate, and use the appropriate model to represent the relationships between variables.
7. Summarize and interpret data using graphs, tables, technology, and statistics (including measures of central tendencies and dispersion).
8. Collect data and use information from the data to make reasonable conclusions by employing appropriate numerical and algebraic concepts such as fractions, ratios, decimals and percents.

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Outcomes with clarifying statements and examples

Upon course completion, the students will be able to:

1. Use number concepts to describe quantitative relationships in a variety of contexts.

   - Analyze, represent and solve real-world problems involving proportional relationships, with attention to appropriate use of units.
   - Use and simplify exponents and radicals to express quantities.
   - Summarize, represent, and interpret given data using numbers in different forms (fractions, decimals, percentages, and scientific notation).
   - Summarize categorical data for two or more categories in two-way frequency tables, interpreting relative frequencies in the context of the data.

2. Communicate, interpret and explain the mathematical concepts using appropriate symbolic notation and vocabulary.

   - Examples are: (1) reading a word problem and creating a mathematical model from the problem; (2) reading a mathematical expression and interpreting it within a specific context.

3. Manipulate and solve equations, using appropriate mathematical techniques and technology.

   - For example: (1) demonstrate understanding of interest formulas and how they relate to saving money, (2) change a recipe or building instructions to fit some new parameters (e.g. different number of diners, different costs of materials or size of building project).

4. Solve word problems in various contexts and interpret results by using mathematical concepts with appropriate terms and units.

   - Analyze real-world problem situations, and use variables to construct and solve equations or inequalities involving one or more unknowns or variable quantities. For example: (1) revenue = price x # of items sold, (2) find the breakeven point for a particular profit function.

5. Solve systems of two equations graphically and algebraically, and interpret the results in an appropriate manner.

   - Be able to use knowledge of graphs of linear equations to solve a system of two equations, e.g. find the break-even point for a profit function or find an equilibrium point for a set of supply and demand functions.

6. Recognize whether a linear or non-linear mathematical model is appropriate, and use the appropriate model to represent the relationships between variables.

- Describe the behavior of linear and exponential functions using words, algebraic symbols, graphs, and tables, identifying the important characteristics.
- Identify the reasonableness of a linear or exponential model for given data. From a table of approximately linear data, explore different linear equations that result from using two different data points. Use appropriate terms and units to describe rate of change and intercepts.

7. Summarize and interpret data using graphs, tables, technology and statistics (including measures of central tendencies and dispersion).

- Represent and interpret data using graphs (bar graphs, dot plots, histograms and boxplots) and use statistics to compare shape, center (median, mean) and spread (range, interquartile range) of two or more different data sets in the context of the data sets. Also, read someone else's data analysis and interpret the associated graphs and statistics provided.

8. Collect data and use information from the data to make reasonable conclusions by employing appropriate numerical and algebraic concepts such as fractions, ratios, decimals and percents.

- Interpret statements about chance, risk and probability that appear in everyday media, understanding that the likelihood of a chance event is a number between 0 and 1 (or between 0% and 100%) that expresses the likelihood of the event occurring with larger numbers indicating greater likelihood. Evaluate the reliability of such statements (e.g. was it really a one-in-a-million chance?)
- Approximate the likelihood of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For example, when rolling a single die 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.
- Find probabilities of simple events using organized lists, tables, tree diagrams, and simulation, understanding that the probability of an event is the fraction of equally likely outcomes in the sample space for which the event occurs.