MTH 156 Course objectives (revised 10/05)

Use problem-solving approaches to demonstrate strategies to investigate similarities among problems throughout the course. The spirit of approach is to develop more than one way to explain processes of problem solving. *Mathematical understanding is achieved through experiment, discovery, conjecture, invention and reasoning. This is not a teaching methods course.*

1. Mathematical Reasoning

1.1 Build new mathematical knowledge through problem solving.
1.2 Recognize and use connections among mathematical ideas.
1.3 Analyze and evaluate the mathematical thinking and strategies of others.
1.4 Recognize and apply mathematics in contexts outside of mathematics.

2. Functions

2.1 Model problem situations using representations such as graphs, tables and equations to draw conclusions.
2.2 Investigate how a change in one variable relates to a change in a second variable.
2.3 Represent and analyze patterns and functions using words, tables and graphs.
2.4 Express mathematical relationships using a variety of function models.
2.5 Identify and describe situations with constant or varying rates of change and compare them.
2.6 Use functions to represent, understand and predict quantitative relationships.
2.7 Relate and compare different forms of representation for a relationship.
2.8 Construct graphs to communicate mathematical ideas.

3. Statistics

3.1 Apply statistical thinking in contexts outside of mathematics.
3.2 Systematically collect, organize and interpret data.
3.3 Construct and interpret visual representations of data including dot plots, bar graphs, line graphs, histograms, box plots and stem-and-leaf plots.
3.4 Compute and interpret measures of central tendency (mean, mode, median).
3.5 Compute and interpret measures of spread (range, interquartile range ,standard deviation).
3.6 Compute and interpret measures of position (percentiles, 5-number summary).
3.7 Identify the characteristics of samples and populations and describe the role of randomization in the sampling process.
3.8 Examine visual graphs and descriptive statistics to determine the validity of stated conclusions for a set of data.
3.9 Make inferences and convincing arguments based on an analysis of the data.
3.10 Apply concepts of statistics as strategies in problem solving.

4. Probability

4.1 Determine experimental probability by conducting experiments, simulations or surveys and recording observations.
4.2 Determine theoretical probability by determining the number of successful outcomes out of the number of possible outcomes.
4.3 Compare and contrast theoretical probability of event with experimental probability.

4.4 Predict the probability of outcomes of simple and two-stage experiments or events.
4.5 Draw a model of the sample space for an event(s) using a tree diagram.
4.6 Calculate the probabilities for complementary, independent and mutually exclusive events.
4.7 Apply various counting techniques (permutations, fundamental counting principle) to determine number of ways an event(s) can occur.
4.8 Draw an area model (spinner) to determine the geometric representation of a sample space.
4.9 Calculate the odds in favor and odds against an event occurring.
4.10 Compute the expected value of an event or "game" and determine if a game is "fair" or not.
4.11 Apply concepts of probability as strategies in problem solving.
4.12 Utilize probability rules to determine conditional probability.

5. Geometry

5.1 Compare and analyze attributes of 2- and 3-dimensional geometric figures in order to classify these figures according to their respective properties.
5.2 Use geometric relationships and properties in problem solving.
5.3 Identify characteristics for basic geometric terms (point, line, plane, space).
5.4 Identify characteristics and correct symbolic notation for subsets of a line and for perpendicular and parallel lines.
5.5 Apply the Jordan Curve Theorem and Map Coloring Problem to problem solving in topology.
5.6 Use visual tools such as networks and Euler's rules of traversability to problem solve.
5.7 Identify angle relationships (complementary, supplementary, corresponding, vertical, alternate interior, alternate exterior).
5.8 Compute the sum of interior and exterior angles of a convex polygon.
5.9 Determine whether a polygon is convex or non-convex.
5.10 Use a protractor and ruler to draw geometric shapes with specified properties such as side lengths or angle measures.
5.11 Recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science and everyday life.

6. Measurement

6.1 Use dimension (unit) analysis as a problem solving strategy.
6.2 Convert within metric and English systems, and between English and metric systems of measure.
6.3 Develop strategies for estimating as part of the measurement process.
6.4 Measure various attributes of shapes using standard and non-standard units of measure.
6.5 Calculate areas and perimeters of simple and irregular shapes.
6.6 Calculate volume and surface areas of simple and irregular solids.
6.7 Determine angle measures for problems involving parallel lines, triangles, and regular polygons.
6.8 Use visualizations and spatial reasoning to solve problems.
6.9 Use the Pythagorean Theorem as a strategy in problem solving.
6.10 Identify measurable attributes of objects and select appropriate units and tools for the attribute being measured.
6.11 Recognize attributes of length, area, volume, weight, time, and temperature, and size of angles.
6.12 Use measurement to analyze characteristics and properties of 2 and 3-dimensional geometric shapes.
6.13 Use the similarity principle to discuss changes to perimeter, area and volume of figures affected by a scale factor, k.
6.14 Use measurement process to solve quantitative reasoning word problems.

7. Transformations, Symmetries and Tilings of Plane Figures

7.1 Recognize and apply slides, flips and turns with 2-dimensional figures.
7.2 Describe a motion or series of motions that will show two shapes congruent or similar.
7.3 Identify line and rotational symmetry in 2-dimensional figures.
7.4 Describe size, orientation and position of shapes under transformations such as flips, turns, slides and scaling.
7.5 Identify and create shapes that have line and/or rotational symmetry.
7.6 Predict and describe the results of translation, rotation, reflection and dilation using 2-dimensional shapes.
7.7 Use manipulatives and/or software to explore the rigid motions and dilations.
7.8 Use manipulatives and/or software to create symmetric patterns and tilings.
7.9 Identify, compare and contrast regular versus semi-regular tilings.

8. Similarity, Congruence, Constructions

8.1 Replicate Euclid's constructions involving copying, bisecting, and creating perpendicular and parallel lines.
8.2 Use constructions as a strategy in problem solving.
8.3 Use constructions as proof for congruent (SSS, SAS, ASA, AAS) or similar triangles (AAA).
8.4 Construct representations of geometric figures using a compass and straightedge.
8.5 Define basic properties of congruent and similar polygons.
8.6 Use principles of congruence, similarity and proportional reasoning to model and interpret physical and mathematical situations in application problems.
8.7 Relate congruence and similarity to transformational geometry concepts of rigid motion and dilation.
8.8 Recognize reasoning and proof as fundamental aspects of mathematics.
8.9 Select and use various types of reasoning and methods of proof.
8.10 Develop and evaluate mathematical arguments and proofs.