MTH 104 Intermediate Algebra with MTH 099 A Review of Elementary Algebra

A comprehensive departmental final exam testing the degree of mastery of the following course objectives is required. MTH 099 objectives are denoted by [099].

1. Sets of Numbers

1.1 Classify a given real number as being a counting or natural number, whole number, integer, rational or irrational number. [099]
1.2 Introduce the concept of imaginary and complex numbers.
1.3 Write complex numbers in $a + bi$ form; add, subtract, multiply, and divide complex numbers in $a + bi$ form.

2. Properties of Real Numbers [099]

2.1 Be able to use the Commutative, Associative, Distributive, Identity, and Inverse Properties.

3. Operations on Real Numbers [099]

3.1 Review arithmetic operations on rational numbers.
3.2 Use the concept of absolute value as distance from zero on the real number line to determine the absolute value of real numbers.
3.3 Evaluate a given expression by applying the correct priority of operations.

4. Equation Solving Techniques

4.1 Solve first degree equations in one variable. [099]
4.2 Solve literal equations and formulas for a single variable. [099]
4.3 Solve quadratic equations in one variable.
   a. Solve by factoring [099]
   b. Solve by using the square root method.
   c. Solve by completing the square where $a = 1$.
   d. Solve by the quadratic formula.
4.4 Use the discriminant to classify the roots.
4.5 Solve rational equations.
4.6 Solve radical equations involving one radical term.

5. Polynomials, Exponents and Radicals

5.1 Simplify exponential expressions with integer exponents. [099]
5.2 Define and identify polynomials and their degree. [099]
5.3 Add and subtract polynomials. [099]
5.4 Multiply polynomials up to and including a trinomial by a trinomial. [099]
5.5 Divide a polynomial by a monomial. [099]
5.6 Simplify exponential expressions with rational exponents.
5.7 Simplify square root and cube root radical expressions.
5.8 Perform arithmetic operations on square root and cube root radical expressions.

6. Factoring

6.1 Factor a monomial GCF from a polynomial. [099]
6.2 Factor a polynomial containing four terms by grouping. [099]
6.3 Factor the difference of two squares. [099]
6.4 Factor trinomials of the form $x^2 + bx + c$ [099]
6.5 Factor trinomials of the form $ax^2 + bx + c$, where a is a nonzero integer using either, the "ac factoring by grouping method" or the "trial and error method". [099]
6.6 Factor perfect square trinomials. [099]
6.7 Factor the sum and difference of two cubes.

7. Rational Expressions

7.1 Simplify rational expressions.
7.2 Multiply and divide rational expressions.
7.3 Add and subtract rational expressions.
7.4 Simplify complex fractions.

8. Inequalities in One and Two Variables [099]

8.1 Solve a linear inequality in one variable, graph the solution on the real number line and express the solution using set notation and interval notation.
8.2 Solve compound linear inequalities, graph the solution on the real number line, and express the solution using set notation and interval notation.
8.3 Graph a linear inequality in two variables on the Cartesian coordinate system.

9. The Cartesian Coordinate System

9.1 Use the Cartesian coordinate system to describe the x– and y–axes, the origin and quadrants, and determine the positions of ordered pairs. [099]
9.2 Graph linear equations in two variables by plotting points. [099]
9.3 Determine the x- and y-intercepts and use them to graph a linear equation. [099]
9.4 Understand the concept of the slope of a line and use the slope formula to determine the slope of the line through two given points. [099]
9.5 Determine the slopes of horizontal, vertical, parallel and perpendicular lines. [099]
9.6 Graph linear equations in two variables by the slope-intercept method. [099]
9.7 Write the equation of a line in slope-intercept form and in point-slope form: [099]
   a. Given the slope and the y-intercept
   b. Given a graph with integer x- and y-intercepts
   c. Given the slope and a point on the line
   d. Given two points on the line.
9.8. Use the vertex, axis of symmetry, and intercepts to graph a quadratic equation of the form $y = ax^2 + bx + c$

10. Systems of Equations

10.1 Solve a system of linear equations in two variables graphically. [099]
10.2 Solve a system of linear equations in two variables algebraically using substitution and addition/elimination methods. [099]
10.3 Solve a system of three linear equations in three variables algebraically.
10.4 Solve linear-quadratic systems in two variables of the form $y = ax^2 + bx + c$ algebraically and verify the solution graphically.
10.5 Solve systems of two quadratic equations in two variables of the form $y = ax^2 + bx + c$ algebraically and verify the solution graphically.

11. Functions

11.1 Determine if relations written as a correspondence between sets and as a set of ordered pairs are functions.
11.2 Determine the domain and range of a set of ordered pairs.
11.3 Determine the domain and range of a graph, expressing the results in interval notation.
11.4 Use the vertical line test to determine if a graph represents a function.
11.5 Introduce function notation and evaluate functions at specific values of the independent variable.

12. Trigonometry

12.1 Review the use of the Pythagorean Theorem.
12.2 State the sine, cosine, and tangent ratios in terms of opposite side, adjacent side and hypotenuse of a right triangle.
12.3 Find any angle or side of a right triangle given one acute angle and one side, or two sides.

13. Applications

Creating open expressions and using those expressions to write equations involving one or two variables to solve applications will be integrated throughout this course. Examples from other disciplines will be incorporated whenever possible. The following types of applications are required.

13.1 Geometric formulas including perimeter of rectangles, squares, and triangles, and circumference of circles [099]
13.2 Simple interest involving one rate and two rates [099]
13.3 Motion problems solved with a linear equation involving one rate and two rates [099]
13.4 Ratios [099]
13.5 Proportions solved by cross-multiplication, including unit conversion [099]
13.6 Linear inequalities [099]
13.7 Number problems solved with a linear equation [099]
13.8 Problems involving money [099]
13.9 Percent problems including tax and commission [099]
13.10 Mixture problems involving money and percent [099]
13.11 Linear graphs including determining the equation of a line, using the graph for estimation at a given value, and using the equation to calculate a specific value [099]
13.12 Systems of two linear equations solved algebraically [099]
13.13 Systems of three linear equations solved algebraically
13.14 Geometric formulas including area of rectangles, squares, triangles, and circles
13.15 Number problems solved with a rational equation and a quadratic equation
13.16 Work problems
13.17 Motion problems solved with a rational equation involving two rates
13.18 Radical equations involving one radical term
13.19 Evaluating functions including determining the maximum and minimum of quadratic functions
13.20 Solve right triangle