Learning Outcomes - UNR Math 126

Summary of Math 126 Learning Outcomes

1. **Fundamental concepts in Algebra**
   Students are able to recognize real numbers and use their properties. They perform operations on algebraic expressions and simplify algebraic expressions involving exponents and radicals.

2. **Equations and Inequalities**
   Students solve linear, quadratic and other types of equations. They also solve linear, quadratic, polynomial, rational and absolute value inequalities.

3. **Functions and Graphs**
   Students understand the concepts and are able to identify the domain, the range, intercept, zero and asymptote. They are able to perform basic operations on functions: addition, subtraction, multiplication, division and composition. They define and determine the inverse of a function. Students recognize and graph linear, quadratic and absolute value functions. They describe symmetries of graphs.

4. **Polynomial functions**
   Students know and are able to use the Division algorithm for polynomials, the Remainder Theorem and factor Theorem. They use long division and synthetic division to find a quotient and remainder and the zeroes of a polynomial. They sketch the graph of polynomial function of degree greater than two and of rational functions.

5. **Exponential and Logarithmic functions**
   Students recognize and define exponential and logarithmic functions. They sketch and analyze graphs of exponential and logarithmic functions. They solve word problems involving exponential and logarithmic functions, including problems about compounding interest, exponential growth and decay.

6. **Systems of equations**
   Students solve systems of two and three variables by substitutions and Gaussian elimination. They are able to use systems to solve word problems. They perform basic operations like addition, subtraction and multiplication on matrices, and are able to determine the inverse of a square matrix.
Upon successful completion of Math 126, a student should be able to:

1. Fundamental concepts in Algebra
   (a) Understand the relationships of different number systems.
   (b) Recognize and use properties of real numbers.
   (c) Use the definition of absolute value.
   (d) Simplify algebraic, exponential and radical expressions.
   (e) Understand and use the terminology associated with the rectangular coordinate system.
   (f) Use the distance and the midpoint formulas.
   (g) Define and find the symmetries on a graph.
   (h) Identify and use the equations of lines.
   (i) Identify and use the slope of a line.
   (j) Identify the center and radius, and sketch the graph of a circle given by an equation in standard or general form.

2. Equations and Inequalities
   (a) Solve linear equations.
   (b) Understand and use interval notation to express solutions of inequalities.
   (c) Solve linear inequalities.
   (d) Graph linear equations.
   (e) Recognize and solve quadratic equations using the quadratic formula.
   (f) Understand and use the Zero Factor Theorem.
   (g) Solve absolute value and rational equations.
   (h) Solve absolute value and rational inequalities.

3. Functions and Graphs
   (a) Evaluate expressions using function notation.
   (b) Represent functions using formulas, tables and graphs.
   (c) Identify functions from algebraic, graphical, tabular and verbal representations.
   (d) Use function notation when evaluating functions and sketching graphs of functions.
   (e) Identify the domain and range of functions.
   (f) Graph a piece-wise defined function.
   (g) Identify properties of graphs such as relative and global extrema, symmetry, increasing, decreasing, even, and odd.
   (h) Translate between the graph and the equation of a function.
   (i) Perform operations on functions, including composition of functions.
   (j) Identify one-to-one functions.
   (k) Identify and graph the inverse of a function. Find the inverse of a given function.
4. **Polynomial functions**

   (a) Analyze and graph quadratic functions. Determine their vertex and intercepts.
   (b) Find the equations of quadratic functions from given data.
   (c) Set up and solve quadratic applications, including maximum/minimum problems.
   (d) Analyze and graph polynomial functions of degree greater than 2.
   (e) Perform basic operations on polynomials.
   (f) Use the division algorithm for two polynomials.
   (g) Apply the Remainder Theorem and Factor Theorem for polynomials.
   (h) Find real zeros of polynomials.
   (i) Graph rational functions.

5. **Exponential and Logarithmic functions**

   (a) Analyze and graph exponential and logarithmic functions.
   (b) Convert from logarithmic form to exponential form; and from exponential form to logarithmic form.
   (c) Solve exponential and logarithmic equations.
   (d) Set up and solve problems involving exponential growth and decay.
   (e) Understand and use the compound interest formula.

6. **Systems of equations**

   (a) Solve non-linear systems of equations using the substitution.
   (b) Solve systems of linear equations
   (c) Set up and solve application problems using a system of equations.
   (d) Perform basic operations on matrices
   (e) Identify the inverse of a 2x2 or 3x3 matrix
   (f) Evaluate 2x2 and 3x3 determinants
   (g) Use Cramer’s rule to solve a system of linear equations

7. Solve application problems and interpret, and draw inferences from, the results.
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Upon successful completion of Math 127, a student should be able to:

1. Trigonometric functions
   
   (a) Angles
   
   i. Measure angles in degrees and radians and convert from one system to the other.
   ii. Tell the exact radian and degree measures of the special angles.
   iii. Use the formulas for the length of a circular arc and the area of a circular sector.
   iv. Find the angular and linear speed.
   v. Solve applied problems involving angles, arc length, area of sector, angular and linear speeds.

   (b) Right triangles
   
   i. Identify and name the sides of a right triangle
   ii. Use the definitions of the six trigonometric functions of an acute angle of a right triangle.
   iii. Use the Pythagorean Theorem.
   iv. Use the reciprocal identities, the tangent and cotangent identities and the Pythagorean identities.
   v. Find trigonometric functions using definitions and identities.
   vi. Give the special values of trigonometric functions.
   vii. Solve right triangle application problems.

   (c) Trigonometric circle
   
   i. State the definitions of sine and cosine of any angle on the unit circle.
   ii. Give the values of sine and cosine at the special angles on the unit circle.
   iii. Define tangent, cotangent, secant, and cosecant in terms of sine and cosine.
   iv. State the domains of the trigonometric functions.
   v. Determine which quadrants have positive and negative trigonometric values.
   vi. Estimate the values of trigonometric functions of any angles using the trigonometric circle and the reference angles.
   vii. State and use the fundamental identities relating the trigonometric functions.
   viii. Verify that an equation is an identity by transforming one side into the other one.
   ix. State and use the definition of periodic functions.
   x. Graph sine and cosine functions using amplitude, period, and phase shifts.
   xi. Graph tangent, cotangent, secant, and cosecant functions.
   xii. State for the trigonometric functions their domain, range, period, symmetries, (vertical) asymptotes, x-intercepts, y-intercept, and whether the function is even or odd.

2. Analytical trigonometry
   
   (a) State and use various trigonometric identities: addition, difference, double angle, half angle, product-to-sum, sum-to-product, etc.
   (b) Verify trigonometric identities and find counter examples to false identities.
   (c) Define and graph inverse trigonometric functions.
   (d) Solve trigonometric equations.
3. Applications of trigonometry
   (a) Geometry
      i. Use the laws of sines and cosines to solve non-right triangles.
      ii. State and use the formula of the area of a triangle given two sides and the angle between them.
      iii. Use the law of sines, law of cosines and the area formula to solve applied problems.
   (b) Complex numbers
      i. Use the definitions of the absolute value and of the conjugate of a complex number.
      ii. Perform basic arithmetic operations on complex numbers.
      iii. Determine the trigonometric form of a complex number.
      iv. Multiply and divide two complex numbers in trigonometric form.
      v. State and use De Moivre’s formula.

4. Additional topics in trigonometry

5. Vectors
   (a) Define and graph vectors in 2-D.
   (b) Identify the horizontal and vertical components of a vector.
   (c) Perform operations with vectors: addition, subtraction, scalar multiplication.
   (d) Calculate the dot product of two vectors and use it to find the length of vectors, and the angle between them.

6. Parametric equations. Polar coordinates
   (a) Plot points and graph curves given by parametric equations.
   (b) Plot points and graph curves in polar coordinates.

7. Topics in Analytical Geometry
   (a) Parabolas
      i. State and use the definition of a parabola
      ii. Know and use the standard form of the equation of a parabola for vertical and horizontal orientation
      iii. Use the method of completing the square to find the vertex, focus and directrix from a general form of an equation of a parabola.
      iv. Sketch the graph of a parabola.
      v. Solve word problems resulting in equations of parabolas.
   (b) Ellipses
      i. State and use the definition of an ellipse.
      ii. Know and use the standard form of the equation of an ellipse.
      iii. Use the method of completing the square to find the center, vertices, foci, major axis and minor axis from a general form of an equation of an ellipse.
      iv. Sketch the graph of an ellipse.
v. Solve word problems resulting in equations of ellipses.

(c) Hyperbolas

i. State and use the definition of a hyperbola.

ii. Know and use the standard form of the equation of a hyperbola.

iii. Use the method of completing the square to find the center, vertices, foci, transverse axis and conjugate axis, and asymptotes from a general form of an equation of a hyperbola.

iv. Sketch the graph of a hyperbola.

v. Solve word problems resulting in equations of hyperbolas.