Learning Outcomes - UNR Math 127

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, arclength, 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 counterexamples 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.