

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.