

## MTH 175 PreCalculus (effective Spring 2019)

Students will be expected to demonstrate an understanding of precalculus beyond the manipulation of symbols, and to apply precalculus to practical problems throughout the course.

### 1. Exponential and Logarithmic Functions

- 1.1 Use the properties of logarithms to rewrite expressions involving logarithms. [Review]
- 1.2 Simplify and/or evaluate logarithmic expressions. [Review]
- 1.3 Solve exponential and logarithmic equations in one variable, including quadratic in form. [Review]
- 1.4 Solve related application problems.

### 2. Functions and Advanced Graphing Techniques

The concepts learned in the following objectives should be able to be applied to at least the following function types (unless indicated otherwise): absolute value, power, piecewise, radical, rational, exponential, logarithmic, trigonometric, inverse trigonometric, and combinations of basic functions.

- 2.1 Obtain and simplify (when appropriate) the difference quotient,  $\frac{f(x+h)-f(x)}{h}$ , for a given polynomial, rational, or radical function. Interpret the difference quotient as the average rate of change of the function and as the slope of a secant line in the graph of the function.
- 2.2 Determine the composition of two or more functions.
- 2.3 Given a composite function,  $f(g(x))$ , identify the argument (inside) function,  $g(x)$ , and the outside function,  $f(x)$ .
- 2.4 Given a function, determine important features such as domain, range, inverse (over an appropriate domain), intercepts, asymptotes (vertical, horizontal, and oblique), end behavior, and any removable discontinuities.
- 2.5 Given the graph of a function, determine all important features.
- 2.6 Sketch the graph of a given function by finding and clearly showing important features.
- 2.7 Graph functions using rigid and non-rigid transformations.

### 3. Trigonometric Functions

- 3.1 Define radian units of measure, and place angles measured in radians in standard position.
- 3.2 Convert between radians and degrees.
- 3.3 State the six trigonometric ratios (in terms of  $x$ ,  $y$ , and  $r$ ) for an angle in standard position with terminal side passing through a point  $(x,y)$ .
- 3.4 Find the exact values of the six trigonometric ratios of quadrantal angles  $(0, \pi/2, \pi, 3\pi/2)$ , special angles  $(\pi/6, \pi/4, \pi/3)$ , and integer multiples of those angles.
- 3.5 For any angle  $\theta$  in standard position with terminal side passing through a point  $(x, y)$ , determine the exact values of trigonometric functions for other angles with the same reference angle.
- 3.6 Given one trigonometric ratio of an angle  $\theta$  in standard position and a constraint, determine the remaining five trigonometric ratios of that angle.
- 3.7 Given an equation or graph of a trigonometric function, find applicable characteristics: domain, range, amplitude or vertical stretch, phase shift (sine and cosine only), period, and frequency.

- 3.8 Sketch the graphs of  $y = A \sin(\omega x - \phi) + B$  and  $y = A \cos(\omega x - \phi) + B$ , and identify its applicable characteristics.
- 3.9 Sketch the graphs of  $y = \sec(x)$ ,  $y = \csc(x)$ ,  $y = \tan(x)$ , and  $y = \cot(x)$ .
- 3.10 Given the graph of a sine or cosine function, identify all applicable characteristics. Use that information to write an equation of the function.
- 3.11 Sketch the graph of  $y = \sin^{-1}(x)$ ,  $y = \cos^{-1}(x)$ , and  $y = \tan^{-1}(x)$ , and identify the corresponding domain and range.
- 3.12 Identify and evaluate trigonometric and inverse trigonometric expressions that may be simplified without approximation and without the use of a calculator.
- 3.13 Use a calculator to approximate trigonometric and inverse trigonometric expressions.

#### 4. Analytic Trigonometry

- 4.1 State and use the following fundamental identities: Negative angle identities, Co-function identities, Reciprocal identities, Quotient identities, Pythagorean identities.
- 4.2 State and use the following formulas: Sum and difference of two angles, Double-angle.
- 4.3 Use the Power-reduction identities for sine and/or cosine to write an expression involving even powers of the sine and/or cosine functions as a sum involving only first powers of the cosine function.
- 4.4 Apply the fundamental trigonometric identities (including the sum, difference, and double-angle identities) and algebra to simplify a trigonometric expression.
- 4.5 Apply the fundamental trigonometric identities (including the sum, difference, and double-angle identities) and algebra to verify a trigonometric expression.
- 4.6 Solve trigonometric equations over a given interval, stating exact solutions when possible.
- 4.7 Evaluate and/or simplify expressions involving the composition of a trigonometric function and its inverse.
- 4.8 Evaluate and/or simplify expressions involving the composition of a trigonometric function with the inverse of a different trigonometric function with arguments that are algebraic expressions (including constants).
- 4.9 Solve an oblique triangle using the Law of Sines and/or the Law of Cosines.
- 4.10 Solve related application problems using the Law of Sines and the Law of Cosines.

#### 5. Vectors in Two Dimensions

- 5.1 Express a vector in component form given its initial and terminal points.
- 5.2 Express a vector in component form given its magnitude and direction angle.
- 5.3 Given the component form of a vector, find its magnitude and direction angle.
- 5.4 Obtain the sum of two or more vectors and a scalar multiple of a vector using both geometric and algebraic methods.
- 5.5 Find the dot product of two vectors given in component form.
- 5.6 Find the dot product of two vectors given their magnitude and the angle between them.
- 5.7 Use the dot product to find the angle between two vectors.
- 5.8 Find a vector parallel to a given vector.
- 5.9 Find a vector orthogonal to a given vector.
- 5.10 Given the magnitude and direction angle of two vectors (representing forces, velocities, or displacements), determine the magnitude and direction angle of the resultant vector.
- 5.11 Find the amount of work done by a force in moving an object along a straight line.