Unit 1 Essential Questions and Concepts

Right Triangle Trigonometry, Angles and Their Measures, The Radian, Extending Trigonometry to the Circular Functions, The Unit Circle, Graphing Trigonometric Functions, Inverse Trigonometric Functions, Solving Problems with Trigonometry. Graphing Composite Trig Functions

Listed below is a list of concepts you should understand and questions you should be able to answer (note that relevant example problems can serve as answers to the questions). Consider this as a guideline for your notes. While extensive, this list is not guaranteed to be 100% comprehensive.

Right Triangle Trigonometry (4.2)
- What is the definition of the six basic trig functions in terms of the sides of a right triangle?
  o How does tangent relate to sine and cosine?
  o How does cotangent relate to secant and cosecant?
- How can the six basic trig functions be used to solve right triangles?
- What is the main difference between a trig function and its inverse?
- How can inverse trig functions be used to calculate unknown angles in a right triangle?
- You should memorize the values of the six trig functions for 30, 45, and 60 degrees
  o These are the two special triangles…45-45-90 and 30-60-90
- How can your calculator fool you into thinking a wrong answer is correct?

Angles and Their Measures (4.1)
- What is the definition of a radian? You should be able to explain this in your own words.
- How can you convert from radians to degrees and vice versa?
- How do you select Radian Mode or Degree Mode on your calculator?
  o Which mode is the default mode?
- What is the fundamental difference between a degree and a radian?
- What is the arc length formula? (be sure to be able to define the variables)
- What is angular velocity? How does it differ from linear velocity?
- How does the arc length formula allow us to convert between angular and linear velocity?

Extending Trigonometry to the Circular Functions (4.3)
- When discussing angles in the Cartesian Plane, which axis is always the initial side?
  o Which direction of rotation is positive and which is negative?
- How many radians represent a full revolution?
- How can reflection over the y-axis, origin, and x-axis be used to easily determine the values of the six basic trig functions in any quadrant of the Cartesian Plane?
- Under which conditions are two angles coterminal?
  o Why are $2\pi$ and 360° important numbers when discussing coterminal angles?
- How can the concept of coterminal angles be used to evaluate the six basic trig functions at any value?
- What is the Unit Circle? [besides the greatest thing of all time]
  o Which trig function is represented by the x-axis? The y-axis?
- How can the unit circle help us evaluate trig functions quickly?
- How can the unit circle be used to help us identify angles for which certain trig functions are not define?
- At which angles are tangent, cotangent, secant, and cosecant undefined?
- How can symmetry and reflections be used to help you quickly memorize the unit circle?
- Make sure you memorize the unit circle! You should know all the major angles in both degrees and radians and their corresponding trig values.
Graphing Trigonometric Functions (4.4 and 4.5)

- How does the unit circle and the concept of conterminal angles help us to generate graphs of trig functions where the y-axis represents the value of the function and the x-axis represents the angle?
- For the graphs of the six major trig functions, make sure to know the following:
  - Domain & Range
  - The Boundedness of the function
  - The End Behavior of the function
  - The value of the Absolute Minima and Maxima and their locations
  - The location of any asymptotes
  - The Period of the function
- You should have the parent graphs of the six major trig functions memorized
- For $f(x) = a \cdot \sin(b \cdot x + c) + d$ you should know what the letters $a,b,c,$ and $d$ represent and how changing their values affect the graph when compared to $g(x) = \sin(x)$.
  - You should be able to perform similar tasks with the other 5 trig functions as well
- You should know the definitions of period, frequency, and amplitude

Inverse Trigonometric Functions (4.7) [we only study $\arcsin(x)$, $\arccos(x)$, and $\arctan(x)$]

- You should know that $\text{inverse sine}, \text{arcine}, \arcsin(x), \sin^{-1}(x)$ all represent the same concept.
  - The same idea applies to the other 2 trig functions $[\cos^{-1} x \ and \ \tan^{-1} x]$
  - Note: we do not study the inverse functions of secant, cosecant, and cotangent!
- How can the Unit Circle be used to quickly evaluate inverse trig functions at common points?
- How can you evaluate inverse trig functions if a point not on the unit circle is included?
- How do the graphs of the inverse trig functions relate to the parent graphs of the trig functions?
- Why aren’t the inverse trig functions periodic?
- You should know the domain and range of the three inverse trig functions we study.
- How can the inverse trig functions be represented with algebraic functions?
  - Note! This is a nifty little trick to have for Calculus!

Solving Problems with Trigonometry (4.8)

- How can trigonometry be used to solve problems involving
  - Unknown heights and distances not easily measured
  - Rotational and harmonic motion
  - Cyclic behavioral patterns

Graphs of Composite Trig Functions (4.6)

- You should be able to combine your knowledge of the graphs of the basic algebraic families and of the graphs of sine and cosine to quickly sketch graphs of composite functions.
- You should be able to compose a function that is periodic but not sinusoidal.
- You should be able to compose a function that represents damped harmonic motion.
- You should be able to compose a function that represents a sinusoidal curve rotated absolute the origin.
- You should be able to use a graph and a table of values to determine whether or not a composed function is sinusoidal or damped.

\[^1\text{Time permitting, we will study this topic. Otherwise it will be skipped entirely.}\]