

Upon completion of Honors Pre-Calculus with Trigonometry, students will be able to:

## A. Review Topics

This is a review chapter of important topics from prerequisite classes. These topics should be covered only briefly, progressing rapidly.

1. Categorize numbers as reals, rationals, and irrationals
2. Express basic inequalities
3. Use interval notation
4. Understand basic algebraic properties
5. Use definition of absolute value
6. Apply the properties of exponents
7. Use technology to review scientific notation
8. Simplify and rationalize radicals
9. Rewrite and expand fractional exponents
10. Add, subtract, multiply, and divide polynomials (including synthetic)
11. Factor polynomials—especially common factors and difference of squares
12. Determine the domain of a rational expression
13. Simplify a rational expression—including eliminating compound fractions
14. Solve equations—linear, quadratic, polynomial, absolute value, radical and rational (including completing the square and the quadratic formula)
15. Solve inequalities—linear, absolute value, and rational
16. Graph inequalities on a number line
17. Solve systems of equations using substitution
18. Graphically interpret the no solution case
19. Solve systems using elimination or linear combination
20. Graphically interpret the no solution case
21. Solve higher order systems using multiple substitution
22. Graph the solution to a system of inequalities
23. Use Linear Programming (optional)
24. Try to avoid common errors in algebraic manipulations
25. Apply the distance and midpoint formulas with real-life applications

## **B. Functions**

Students should finish Chapter One with a strong conceptual foundation in functions and manipulating, solving, and graphing them. It is assumed that calculator technology is implemented when conceptual foundation is sufficient.

1. Construct and interpret basic graphs using table of values first then a calculator
2. Manipulate viewing window on calculator
3. Recognize and analyze the graphs of the basic functions: absolute value, quadratics, cubics, square root,  $1/x$ ,  $y-x$ ,  $y=\text{constant}$ ,  $x=\text{constant}$  (intercepts, symmetry)
4. Graph and interpret graphs of linear equations by hand and by using a calculator
5. Determine the equation of a given line
6. Define a function and recognize the difference between a function and a relation
7. Find the domain and range of a function
8. Analyze functions graphically, i.e. domain/range, vertical line test, step functions, greatest integer function, even and odd functions
9. Transformations of graphs—shifts up, down, left, or right and reflections in the axes
10. Find the sum, difference, product, and quotient of functions
11. Evaluate the composite of two functions
12. Define the inverse of a function
13. Verify that two functions are inverses
14. Find an inverse of a function
15. Define one-to-one
16. Graph an inverse function
17. Apply the horizontal line test
18. Optional—Mathematical modeling and types of variation

## **C. Polynomial and Rational Functions**

1. Solve quadratic equations
2. Define continuous functions
3. Apply properties of functions to graphing
4. Apply leading coefficient test to help graph functions
5. Use binomial expansions to write binomial expansions
6. Discuss Intermediate Value Theorem
7. Use synthetic division to divide polynomials
8. Apply Remainder and Factor theorems to synthetic division
9. Apply Des Cartes' Rule of Signs
10. Apply the Rational Zero test
11. Define complex numbers
12. Perform operations on complex numbers
13. Use the conjugate of a complex number

14. Apply the Fundamental Theorem of Algebra
15. Graph a rational function
16. Find the domain, range, and asymptotes of a rational function
17. Define parabola
18. Draw basic parabolas
19. Define ellipse
20. Identify standard form
21. Translate between standard and general form of an ellipse
22. Define hyperbola
23. Identify standard form
24. Graph hyperbolas using asymptotes
25. Define circle
26. Identify standard form
27. Translate between standard and general form of a circle

#### **D. Exponents and Logarithms**

1. Define and graph exponential functions
2. Define  $e$  (the natural base) and evaluate with a calculator
3. Discuss basic exponential growth ( $Pe^{rt}$ )
4. Define, evaluate, and graph logarithmic functions
5. Rewrite logarithmic notation
6. Apply properties of logs
7. Use the Natural Log function
8. Apply the change of base formula
9. Use properties of logs to simplify expressions
10. Solve exponential and logarithmic equations with various bases (not just natural log and not just natural base)

#### **E. Trigonometry**

1. Define these basic trigonometry terms: angles, initial side, terminal side, vertex, standard position, coterminal, radian, degree, angle measure, central angle, obtuse, acute, complementary, supplementary, and reference angle
2. Convert angle measurements between degrees and radians
3. Find arc length based on a circle's radius and central angle
4. Construct and use the unit circle to evaluate the six basic trig functions
5. Memorize the unit circle
6. Define periodic function and period

7. Classify the trig functions as even or odd
8. Evaluate the trig functions with appropriate technology
9. Define the six basic trig functions as fractions
10. Apply the basic trig identities — reciprocal and Pythagorean identities
11. Generalize techniques learned so far to finding trig functions of angles in different ways
12. Graph sine and cosine
13. Define amplitude, period phase shift, and vertical shift
14. Graph sine and cosine without a calculator based on knowledge of graph shifts
15. Graph tangent, secant, cosecant and cotangent
16. Graph these other trig functions with basic translations
17. Define and apply the six inverse trig functions
18. Use the correct ranges for each of the inverse trig functions
19. Solve mental equations based on the inverse trig functions
20. Application of trig functions to real life examples

## **F. Analytic Trigonometry**

1. Identify and know from memory the reciprocal, quotient, Pythagorean, cofunction, and even/odd identities
2. Use these identities to simplify expressions
3. Verify trig identities
4. Solve trig equations giving solutions in the correct range or over  $[0, 2\pi]$
5. Apply the sum and difference formulas for sine, cosine, and tangent
6. Use the sum and difference formulas to prove identities, evaluate trig functions and solve trig equations
7. Apply double and half angle formulas to verify identities and to solve trig equations
8. Apply the Law of Sines to real life problems
9. Find the area of an oblique triangle
10. Define oblique triangle
11. Apply the Law of Cosines to real life problems
12. Use Heron's Area formula