Algebra 2 Learning Targets

What follows is what a student in Algebra 2 should know and be able to do by the end of each semester. It is broken up by unit of study and also includes what portion of the textbook, *Discovering Advanced Algebra*, is used in each unit. Since mathematics is cumulative in nature, many learning targets are expected to be used not only in the unit where they are introduced, but throughout the course.

First Semester:

A. Review and Preparation (Chapter 0)

1. Solve problems using a variety of strategies.
2. Develop strategies for keeping records of the problem solving process. Class notes should be understandable to the student, their classmates and their teacher.
3. Explain one's thought process to others in verbal and written form.
4. Apply mathematical techniques, vocabulary and notation from prior courses including unit analysis, scientific notation, distributive property, and factoring.
5. Solve linear and quadratic equations without a calculator.
6. Solve equations with a calculator using the graphing method.
7. Graph linear functions. Interpret slope and y intercept.

B. Sequences and Series (Chapter 1) Part One

1. Identify patterns.
2. Create mathematical representations of patterns.
3. Investigate the behavior of a recursively defined sequence using a graphing calculator.
4. Determine if a sequence is Arithmetic, Geometric, Neither or Both.
5. Determine the common difference of arithmetic sequences and the common ratio of geometric sequences.
6. Graph discrete sequences and their associated continuous functions.
7. Graph the end behavior of a sequence.
8. Work backwards to determine the missing terms of an arithmetic or geometric sequence.
9. Determine the total money accumulated in an account when interest is computed annually, monthly, daily and continuously.
10. Apply knowledge of recursively defined sequences to exponential growth and decay problems; including compound interest, value of a depreciating item, and amount due on a loan.
11. Compare the total interest and total payments of loans with different terms.
12. Analyze the terms of a loan. How long will it take to repay the loan?
13. Investigate and describe the behavior of sequences in the long run.
14. Determine the leveling off dosage of a drug using recursively defined, shifted geometric sequences.

C. Sequences and Series (Chapter 1) Part Two

1. Explicitly define both arithmetic and geometric sequences.
2. Distinguish between recursively and explicitly defined sequences.
3. Explain the difference between a recursively defined sequence and an explicitly defined sequence.
4. Provide arithmetic, geometric and other examples of recursive and explicit sequences.
5. Write a formula for the nth term of a sequence.
6. Describe the heights of each bounce of a ball using both recursive and explicit formulas.
7. Convert a recursively defined sequence to an explicitly defined sequence.

8. Model a sum using series notation.
9. Convert a series from summation notation to a simple sum of numbers.
10. Determine the sum of a small series without the aid of a calculator.
11. Apply the sum sequence features of the graphing calculator to determine the value of a series.
12. Determine if an infinite series converges or diverges.

Fractal Mini-Unit

13. Apply sequence notation to a fractal.
14. Create a fractal pattern recursively.
15. Identify examples of self-similarity in nature or other applications.

Home-Loan Project

16. Compare loans using a spreadsheet.
17. Determine the amount of a loan payment that is applied toward the principal.
18. Choose a loan and provide rationale.
19. Communicate results in verbal and written form.

D. Introduction to Statistics (Chapter 2)

1. Compute measures of central tendency, mean, median, and mode.
2. Interpret the meaning of the measures of central tendency.
3. Compare two data sets using box plots.
4. Identify outliers and describe their impact on the measures of central tendency.
5. Interpret the 5 summary values of a data set.
6. Compute and interpret the standard deviation of a data set.
7. Describe the spread of data using standard deviation.
8. Create Histograms and box plots
9. Analyze data using percentile rank.

E. Lines and Data Analysis (Chapter 3)

1. Model data using linear equations in slope-intercept, standard and point-slope form.
2. Interpret the meaning of a line's slope and y-intercept.
3. Predict past or future values using the rate of change.
4. Graph lines.
5. Decide which form of the equation of a line is most useful for a given problem.
6. Write the equation of a line given
    a) two points
    b) point and slope
    c) a graph
7. Describe what makes a "good" fit line.
8. Create a line of best fit using technology.
9. Apply the best fit line to interpolate and extrapolate both independent and dependent variables.

Statistics Project – Using all of the above

10. Apply knowledge of statistics to a data set of your choice
11. Interpret the statistics and graphs for your data set, make conclusions and present them to your classmates.

F. Quadratic Functions (Chapter 7)

1. Solve quadratic equations by factoring, completing the square and quadratic formula.
2. Solve a quadratic equation graphically, using a graphing calculator.
3. Graph quadratic functions; determine roots (x-intercepts), vertex (max or min) and y-intercept.
4. Write a quadratic function in standard form, vertex form and factored form.
5. Convert quadratic functions from one form to another.

6. Apply quadratic function knowledge to projectile motion problems.
7. Create a graph of height of an object over time.
8. Distinguish between the path of an object and the graph of its height over time.
9. Create a quadratic model to optimize area and determine the solution using technology.

Second Semester:

G. Functions, Graphs and Transformations (Chapter 4)

1. Graph linear, quadratic, cubic, square root, cube root, semi-circle, exponential and rational parent functions without assistance of technology.
2. Graph vertical and horizontal stretches, shifts and reflections of all parent functions without assistance of technology.
3. Graph the transformation of unusual functions using the fundamentals of transformations.
4. Use symmetry to graphically determine if a function is even, odd, or neither.
5. Describe the end behavior of graphs.
6. Graph applications where neither variable is time. Examples: Determine the correct graph for height vs. volume when filling unusually shaped bottles with water.

H. Polynomial Functions (7.6, 7.7, 7.8)

1. Given a polynomial function, determine its roots and end behavior.
2. Write the equation of a polynomial function based on its graph.
3. Determine the y-intercept of a polynomial function.
4. Describe a double root algebraically, numerically and graphically.
5. Evaluate composition of functions numerically, algebraically and in some cases graphically.

I. Trigonometry (Chapter 10)

1. Know the definition of sine, cosine and tangent.
2. Apply right triangle trigonometry to determine any side or angle of a triangle.
3. Solve angle of elevation and angle of depression problems
4. Apply special right triangles to the unit circle.
5. Thinking in radians, label angles around the unit circle.
6. Convert angles from degrees to radians.
7. Determine co-terminal angles in both degrees and radians.
8. Label the (x,y) coordinate on the unit circle for angles that are multiples of 30, 45, 60, or 90 and use that to determine the cosine, sine or tangent of those angles without using a calculator.
9. With the aid of a calculator, apply the unit circle to determine the sine, cosine or tangent of angles that do not lie on the axes and do not have reference angles from a special right triangle.
10. Be able to determine the sine, cosine or tangent of angles given in radians.
11. Use inverse trig to determine the angle with the given trig ratio.

(10 and 11 will be done with and without a calculator depending on the angle. See #8 and #9 above.)

J. Graphing Trigonometric Functions (Chapter 10)

1. Graph sine, cosine and tangent parent functions without the aid of a calculator.
2. Apply the concepts from the transformations unit to the trig functions.
3. Graph a transformed trig function.
4. Write an equation for a trig function given its graph.
5. Model repetitive behavior using sine or cosine functions. Some examples include height of a person on a Ferris wheel over time and the level of the tides over time.

K. Exponential and Logarithmic Functions (Chapter 5)

1. Graph exponential functions.
2. Apply the rules of exponents.
3. Determine an inverse numerically, algebraically, and graphically.
4. Know exponential functions and logarithmic functions are inverses of each other.
5. Graph a logarithmic function without the aid of a calculator.
6. Convert functions from exponential form to logarithmic form and logarithmic form to exponential form.
7. Solve equations of a variety of types including exponential, logarithmic, power, quadratic and linear.
8. Apply properties of logarithms when solving equations.
9. Use the graph of log function to remember the domain and key values. Domain: x is greater than zero, log 1= 0 and log 0 = undefined.
10. Use log functions and exponential functions to solve real world application problems including exponential growth and decay, Richter scale, and pH problems.

L. **Systems of Equations and Matrices (Chapter 6)**

1. Solve systems of equations without a calculator using substitution.
2. Solve systems of equations graphically using a graphing calculator.
3. Solve linear systems using linear combination.
4. Add, subtract and multiply a matrix by a scalar without a calculator.
5. Understand that multiplying a matrix by its inverse is the mathematical reverse of multiplying.
6. Identify conditions necessary to do each of the following: add or subtract matrices, multiply matrices, compute an inverse.
7. Use a calculator to determine the inverse of a matrix.
8. Write a matrix equation and show how to solve for a matrix variable.
9. Use matrices to solve a system of equations.
10. Set up systems of equations to help solve a word problem.