Waterbury Public Schools
Unit Instructional Tool
Algebra 2
Unit 1

Unit 1: Functions and Inverse Functions

Pacing: 6 weeks + 1 week for re-teaching/enrichment – 30 days/periods + 5 days/periods – 35 days/periods total

Mathematical Practices
Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. *Practices in bold are to be emphasized in the unit.* 1. **Make sense of problems and persevere in solving them.** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. **Model with mathematics.** 5. Use appropriate tools strategically. 6. Attend to precision. 7. **Look for and make use of structure.** 8. **Look for and express regularity in repeated reasoning.**
Standards Overview
Analyze functions using different representations. Build a function that models a relationship between two quantities. Build new functions from existing functions.

Unit 1: Functions and Inverse Functions

Grade High School Standards for Mathematical Practice

The K-12 Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. This page gives examples of what the practice standards look like at the specified grade level.

Standards	*Explanations and Examples*
Students are expected to: **1. Make sense of problems and persevere in solving them**.	High school students start to examine problems by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. By high school, students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. They check their answers to problems using different methods and continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.
Students are expected to: **2. Reason abstractly and quantitatively.**	High school students seek to make sense of quantities and their relationships in problem situations. They abstract a given situation and represent it symbolically, manipulate the representing symbols, and pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Students use quantitative reasoning to create coherent representations of the problem at hand; consider the units involved; attend to the meaning of quantities, not just how to compute them; and know and flexibly use different properties of operations and objects.
Students are expected to: **3. Construct viable arguments and critique the reasoning of others.**	High school students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. High school students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. High school students learn to determine domains to which an argument applies, listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
Students are expected to: **4. Model with mathematics.**	High school students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. High school students making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Unit 1: Functions and Inverse Functions

Students are expected to: **5. Use appropriate tools strategically.**	High school students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. High school students should be sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. They are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts
Students are expected to: **6. Attend to precision**	High school students try to communicate precisely to others by using clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
Students are expected to: **7. Look for and make use of structure.**	By high school, students look closely to discern a pattern or structure. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y. High school students use these patterns to create equivalent expressions, factor and solve equations, and compose functions, and transform figures.
Students are expected to: **8. Look for and express regularity in repeated reasoning**.	High school students notice if calculations are repeated, and look both for general methods and for shortcuts. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, derive formulas or make generalizations, high school students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Unit 1: Functions and Inverse Functions

Alg. 2	**Unit 1**	**Functions and Inverse Functions**	**2 days**			
Standards (CMT/CAPT Correlation)	**Mathematical Practices**	**Explanations and Examples**	**Performance Objectives**	**Resources/Lessons that Support the CT Unit**	**Recommended Strategies**	**Required Technology Activities**
CC.9-12.A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. CT.9-12.1.C.2.a.(1) Represent functions and relations on the coordinate plane.	**MP.2.** Reason abstractly and quantitatively. **MP.4**. Model with mathematics. **MP.5**. Use appropriate tools strategically.	Make a table of values to graph $f(x) = x^3 + 3x + 1$ Graph the function. Represent any function by creating a table of values and graphing the function.	• Write and graph an equation to represent a quadratic relationship between two quantities. • Model a data set using an equation including quadratic relationships. • Choose appropriate scale for the variables.	McDougall Littell Algebra 2: Equations & Applications: 2.3, 2.4 Concepts & Skills: 2.4-2.5 McGraw Hill Algebra 2: 2-4 Khan Academy: Graphing Linear Equations Graph Linear Equations and Inequalities in Two Variables [SMART Notebook lesson]	• Identifying Similarities and Differences • Note Taking • Summarizing • Cooperative Learning • Nonlinguistic Representations • Vocabulary Development • Connect other representations, tabular, contextual, and algebraic to the graph of a quadratic. • Connect to Unit 2, F.BF.1 Write a function that describes a relationship between two quantities. • Graph a quadratic equation in multiple ways by making a table of values; doing transformations; using the vertex, a point, and line of symmetry	www.educationTI.com 9 Ball – for Nspire Baltimore Aquarium Lines – 84(Navigator) Dinner Party Writing Linear Functions with Traffic Tickets

Unit 1: Functions and Inverse Functions

Alg. 2	**Unit 1**	**Functions and Inverse Functions**	**3 days**			
Standards (CMT/CAPT Correlation)	**Mathematical Practices**	**Explanations and Examples**	**Performance Objectives**	**Resources/Lessons that Support the CT Unit**	**Recommended Strategies**	**Required Technology Activities**
CC.9-12 .A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. *CT.9-12 .1.E.3.a.(1)* Determine equivalent representations of an algebraic equation or inequality to simplify and solve problems	**MP.2.** Reason abstractly and quantitatively. **MP.3.** Construct viable arguments and critique the reasoning of others. **MP.7.** Look for and make use of structure.	Examples: • $\frac{x+2}{x+3} = 2$ • $\sqrt{x+2} = 5$ • $\sqrt{3x-7} = -4$ • $\sqrt[7]{2x-5} = 21$	• Understand solving equations as a process of reasoning and explain the reasoning. • Extend to simple rational and radical equations.	McDougall Littell Algebra 2: Equations & Applications: 7.6, 9.6 Concepts & Skills: 7.3, 9.6 McGraw Hill/Glencoe Alg. 2: 6-7, 8-6 Algebra Lab: Solving Radical Equations Solving Rational Equations Khan Academy: Radical Equation Examples Simplifying Radical Expressions 2 Simplifying Radical Expressions 3 Extraneous Solutions to	• Identifying Similarities and Differences • Note Taking • Summarizing • Cooperative Learning • Nonlinguistic Representations • Vocabulary Development	www.education.TI.com: Powers, Roots & Radicals (learn check) Solve Square Root Equation (study cards) Solve Rational Equation (study cards) These Roots Are Radical Finding Extraneous Solutions McGraw Hill/Glencoe Alg. 2: Graphing Technology Lab: p. 436 Graphing Technology Lab: p. 579

				Radical Equations More Involved Radical Equation Example Solving Radical Equations (Question Set) [SMART Response question set]		

Unit 1: Functions and Inverse Functions

Alg. 2	Unit 1	Functions and Inverse Functions	6 days			
Standards (CMT/CAPT Correlation)	**Mathematical Practices**	**Explanations and Examples**	**Performance Objectives**	**Resources/Lessons that Support the CT Unit**	**Recommended Strategies**	**Required Technology Activities**
CC.9-12.F.BF.1 Write a function that describes a relationship between two quantities. *CT.9-12.1.C.2.a.(2)* Identify an appropriate symbolic representation for a function or relation displayed graphically or verbally.	**MP.1**. Make sense of problems and persevere in solving them**.** **MP.2.** Reason abstractly and quantitatively. **MP.3.** Construct viable arguments and critique the reasoning of others**.** **MP.4.** Model with mathematics. **MP.5.** Use appropriate tools strategically. **MP.6**. Attend to precision.	Students will analyze a given problem to determine the function expressed by identifying patterns in the function's rate of change. They will specify intervals of increase, decrease, constancy, and, if possible, relate them to the function's description in words or graphically. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model functions. Examples: • You buy a $10,000 car with an annual interest rate of 6 percent compounded annually and make monthly payments of $250. Express the amount remaining to be paid off as a function of the number of months, using a recursion equation. • A cup of coffee is initially at a temperature of 93° F. The difference between its temperature and the room temperature of 68° F decreases by 9% each minute. Write a function describing the temperature of the coffee as a function of time. • The radius of a circular oil slick after t hours is given in feet by $r = 10t^2 - 0.5t$, for $0 \leq t \leq 10$. Find the area of the oil slick as a function of time.	• Given a linear, exponential, or quadratic context, find an explicit algebraic expression or series of steps to model the context with mathematical representations. • Combine linear, exponential, or quadratic functions using addition, subtraction, or multiplication.	McDougall Littell Algebra 2: Equations & Applications: 7.3 Concepts & Skills: 7.4 McGraw Hill/Glencoe Alg.2: 7-4 Khan Academy: Exponential Growth Function Operations [SMART Notebook lesson] Functional Operations (Question Set) [SMART Response question set] Simplification of Functions (Question set)	• Identifying Similarities and Differences • Note Taking • Summarizing • Cooperative Learning • Nonlinguistic Representations • Vocabulary Development • Use visual patterns (e.g., growing dots, toothpicks) to set up and explore relationships between quantities. • Discuss first and second differences in tables. • For honors classes, consider adding composition of functions.	

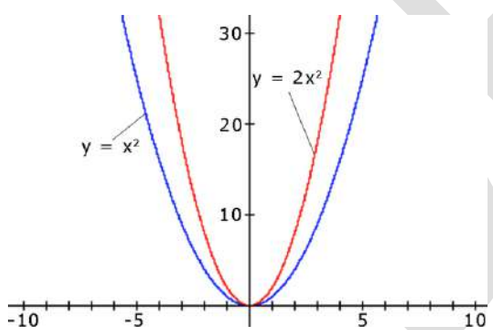
	MP.7. Look for and make use of structure. **MP.8.** Look for and express regularity in repeated reasoning.					

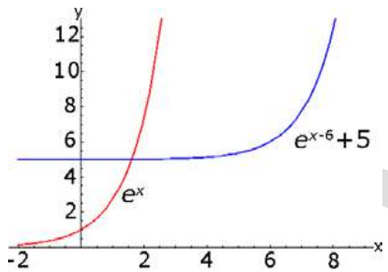
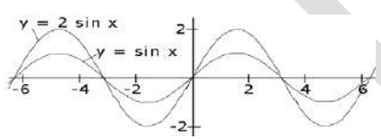
Unit 1: Functions and Inverse Functions

Alg. 2	Unit 1	Functions and Inverse Functions	6 days			
Standards (CMT/CAPT Correlation)	**Mathematical Practices**	**Explanations and Examples**	**Performance Objectives**	**Resources/Lessons that Support the CT Unit**	**Recommended Strategies**	**Required Technology Activities**
CC.9-12.F.BF.1c Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.	**MP.1**. Make sense of problems and persevere in solving them. **MP.2.** Reason abstractly and quantitatively. **MP.3.** Construct viable arguments and critique the reasoning of others. **MP.4.** Model with mathematics **MP.5.** Use appropriate tools strategically.	For example: If T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.	• Composing functions. • Build a function that models a relationship between two quantities	McDougall Littell Algebra 2: Equations & Applications: 7.3 Concepts & Skills: 7.4 McGraw Hill/Glencoe Alg.2: 7-4 Khan Academy: Parametric Equations 1 Functional Operations (Question Set) [SMART Response question set] Simplification of Functions (Question set) Function Homework -- Composite Functions	• Identifying Similarities and Differences • Note Taking • Summarizing • Cooperative Learning • Nonlinguistic Representations • Vocabulary Development	

CT.9-12.1.E.3.a.(2) Combine, compose and invert functions.	**MP.6**. Attend to precision. **MP.7.** Look for and make use of structure.					

Unit 1: Functions and Inverse Functions

Alg. 2	**Unit 1**	**Functions and Inverse Functions**	**2 days**			
Standards (CMT/CAPT Correlation)	**Mathematical Practices**	**Explanations and Examples**	**Performance Objectives**	**Resources/Lessons that Support the CT Unit**	**Recommended Strategies**	**Required Technology Activities**
CC.9-12.F.BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.	**MP.4**. Model with mathematics. **MP.5**. Use appropriate tools strategically. **MP.7.** Look for and make use of structure.	Students will apply transformations to functions and recognize functions as even and odd. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to graph functions. Examples: • Is $f(x) = x^3 - 3x^2 + 2x + 1$ even, odd, or neither? Explain your answer orally or in written format. • Compare the shape and position of the graphs of $f(x) = x^2$ and $g(x) = 2x^2$, and explain the differences in terms of the algebraic expressions for the functions. 	• Perform transformations on quadratic and absolute value functions with and without technology. • Describe the effect of each transformation on functions (e.g., If f(x) is replaced with f(x+k)). • Given the graph of a function, describe all transformations using specific values of k.	McDougall Littell Algebra 2: Equations & Applications: 5.1, 6.3, 8.1-8.3, 14.1, 14.2 Concepts & Skills: 5.1, 5.2, 6.2, 8.1-8.3 McGraw Hill/Glencoe Alg.2: 2-7, 4-7, 12-8 Khan Academy: Tutorials: Connection between even and odd numbers and functions	• Identifying Similarities and Differences • Note Taking • Summarizing • Cooperative Learning • Nonlinguistic Representations • Vocabulary Development • Use graphing technology to explore transformations of functions. • Explore transformations that preserve characteristics of graphs of functions and which do not.	**McDougall Littell Algebra 2: **Equat. & Appl.: 14.1 p. 838 14.2 p. 839 **Concepts & Skills: Activity: 12.3 p. 659 Technology: 12.3 p. 667 McGraw Hill/Glencoe Alg.2: Graphing Technology Labs: p. 108, p. 273, p. 848

		• Describe effect of varying the parameters a, h, and k have on the shape and position of the graph of $f(x) = a(x-h)^2 + k$. Compare the shape and position of the graphs of $f(x) = e^x$ to $g(x) = e^{x-6}+5$, and explain the differences, orally or in written format, in terms of the algebraic expressions for the functions.  • Describe the effect of varying the parameters a, h, and k on the shape and position of the graph $f(x) = ab^{(x+h)} + k$. , orally or in written format. What effect do values between 0 and 1 have? What effect do negative values have? • Compare the shape and position of the graphs of $y = \sin x$ to $y = 2 \sin x$.  	• Recognize which transformations take away the even nature of a quadratic or absolute value function.	Recognizing Odd and Even Functions Practice: Shifting and reflecting functions | Khan Academy		www.education.ti.com: Exploring Transformation of the Quadratic Function Transforming Parabolas Getting Triggy With It Exploring Exponential Functions Absolutely Silver Dollar City Christmas Around the Vertex in 80 Days Basic Trigonometric Transformations Exploring Families of Functions Exploring Odd & Even Functions Just Move It Quadratic Functions Investigations

Unit 1: Functions and Inverse Functions

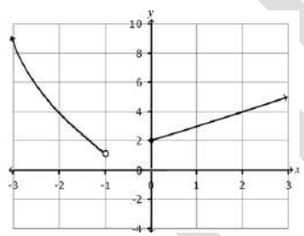
Alg. 2	**Unit 1**	**Functions and Inverse Functions**	**6 days**			
Standards (CMT/CAPT Correlation)	**Mathematical Practices**	**Explanations and Examples**	**Performance Objectives**	**Resources/Lessons that Support the CT Unit**	**Recommended Strategies**	**Required Technology Activities**
CC.9-12.F.BF.4 Find inverse functions. **4a.Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) =2 x^3 or f(x) = (x+1)/(x-1) for x ≠ 1.** 4b.Verify by composition that one function is the inverse of another. 4c.Read values of an inverse function from a graph or a table,	**MP.2.** Reason abstractly and quantitatively. **MP.4.** Model with mathematics. **MP.5.** Use appropriate tools strategically. **MP.7.** Look for and make use of structure.	Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model functions. Examples: • For the function h(x) = $(x - 2)^3$, defined on the domain of all real numbers, find the inverse function if it exists or explain why it doesn't exist. • Graph h(x) and $h^{-1}(x)$ and explain how they relate to each other graphically. • Find a domain for f(x) = $3x^2 + 12x - 8$ on which it has an inverse. Explain why it is necessary to restrict the domain of the function.	Determine whether or not a function has an inverse, and find the inverse if it exists. Understand that creating an inverse of a quadratic function requires a restricted domain.	McDougall Littell Algebra 2: Equations & Applications: 7.3, 7.4 Activity 7.4, p. 421 Concepts & Skills: 7.4, 7.5 Activity 7.5, p.379 McGraw Hill/Glencoe Algebra 2: 6.1, 6.2 Khan Academy: Tutorials: Introduction to Function Inverses Function Inverse Example 1 Function Inverses Example 2 Function Inverses Example 3	• Identifying Similarities and Differences • Note Taking • Summarizing • Cooperative Learning • Nonlinguistic Representations • Vocabulary Development • • • Determine whether or not a function has an inverse, and find the inverse if it exists. • • Understand that creating an inverse of a quadratic function requires a restricted domain. • • •	McDougall Littell Algebra 2: Equations & Applications: p. 430, Graphing Inverse Functions Concepts & Skills: p. 387, Graphing Inverse Functions McGraw Hill/Glencoe Algebra 2: p. 399, Graphing Technology Lab www.education.ti.com: Inverse Functions: What is the inverse of a function? Inverses of Functions Exponential Reflections

given that the function has an inverse. 4d.Produce an invertible function from a non-invertible function by restricting the domain. CT.9-12.1.E.3.a.(2) Combine, compose and invert functions.				Practice: Inverses of functions | Khan Academy GeoGebra Illustrative Mathematics, Temperature Conversions		

Unit 1: Functions and Inverse Functions

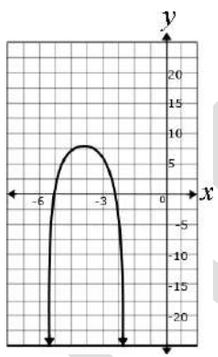
Alg.2	**Unit1**	**Functions and Inverse Functions**	**2 days**			
Standards (CMT/CAPT Correlation)	**Mathematical Practices**	**Explanations and Examples**	**Performance Objectives**	**Resources/Lessons that Support the CT Unit**	**Recommended Strategies**	**Required Technology Activities**
CC.9-12.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *CT.9-12.1.C.3.a.(1)* Model and solve problems with linear, quadratic and absolute value equations and linear inequalities.	**MP.2**. Reason abstractly and quantitatively. **MP.4.** Model with mathematics. **MP.6.** Attend to precision.	Students may explain orally, or in written format, the existing relationships. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.	• Identify domains of functions given a graph. • Identify a domain in a particular context.	McDougall Littell Algebra 2: Equations & Applications: 2.1 Concepts & Skills: 2.1, 7.4 McGraw Hill/Glencoe Algebra 2: 2-1, 7-3 Khan Academy: Domain and Range of a Function Domain and Range 1	• Identifying Similarities and Differences • Note Taking • Summarizing • Cooperative Learning • Nonlinguistic Representations • Vocabulary Development • Discuss contexts where the domain of a function should be limited to a subset of integers, positive or negative values, or some other restriction to the real numbers.	www.education.ti.com: Cell Phone Range Dog Days or Dog Years? Domain & Range Domain & Range (study cards) Domain & Range 2 Domain & Range of Graphs

Unit 1: Functions and Inverse Functions

Alg. 2	**Unit 1**	**Functions and Inverse Functions**	**6 days**			
Standards (CMT/CAPT Correlation)	**Mathematical Practices**	**Explanations and Examples**	**Performance Objectives**	**Resources/Lessons that Support the CT Unit**	**Recommended Strategies**	**Required Technology Activities**
CC.9-12.F.IF.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. **CC.9-12.F.IF.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**	**MP.5.** Use appropriate tools strategically. **MP.6**. Attend to precision. .	Key characteristics include but are not limited to maxima, minima, intercepts, symmetry, end behavior, and asymptotes. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to graph functions. Examples: • Describe key characteristics of the graph of $f(x) = \lvert x - 3 \rvert + 5$. • Sketch the graph and identify the key characteristics of the function described below. $F(x) = \begin{cases} x + 2 \text{ for } x > 0 \\ -x^2 \text{ for } x < -1 \end{cases}$  • Graph the function $f(x) = 2^x$ by creating a table of values. Identify the key characteristics of the graph. • Graph $f(x) = 2 \tan x - 1$. Describe its domain, range, intercepts, and asymptotes.	Graph quadratic functions expressed in various forms by hand. Use technology to model quadratic functions, when appropriate. Graph and find key features of square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	McDougall Littell Algebra 2: Equations & Applications: 2.3, 2.7, 2.8, 5.1, 6.2, 6.8, 7.5 Concepts & Skills: 2.4, 4.6, 5.1, 5.2, 6.2, 7.6 McGraw Hill/Glencoe Algebra 2: 2-6, 6-3 Khan Academy: Tutorials Functional Relationships 1 Representing Functions as Graphs Functions as Graphs Graphs of Square Root Functions	• Identifying Similarities and Differences • Note Taking • Summarizing • Cooperative Learning • Nonlinguistic Representations • Vocabulary Development • Find real-world contexts that motivate the use of step functions. • Compare the absolute value function to its piecewise definition.	McDougall Littell Algebra 2: Equations & Applications: p. 121 Graphing Piecewise Functions Concepts & Skills: p. 211, Transforming Functions McGraw Hill/Glencoe Algebra 2: p. 413, Graphing Nth Roots Functions www.education.ti.com: -Maximum, Minimum, Increasing, Decreasing (study cards) -Absolute Value Match (navigator) -Absolute Value & Piecewise Functions

Standards (CMT/CAPT Correlation)	Mathematical Practices	Explanations and Examples	Performance Objectives	Resources/Lessons that Support the CT Unit	Recommended Strategies	Required Technology Activities
CT.9-12.1.C.2.a.(1) Represent functions and relations on the coordinate plane. CT.9-12.1.C.2.a.(3) Recognize and explain the meaning of the slope and x- and y-intercepts as they relate to a context, graph, table or equation. CT.9-12.1.C.2.a.(4) Evaluate and interpret the graphs of linear, exponential and polynomial functions.		• Draw the graph of $f(x) = \sin x$ and $f(x) = \cos x$. What are the similarities and differences between the two graphs?				

Unit 1: Functions and Inverse Functions

Alg. 2	**Unit 1**	**Functions and Inverse Functions**	**2 days**			
Standards (CMT/CAPT Correlation)	**Mathematical Practices**	**Explanations and Examples**	**Performance Objectives**	**Resources/Lessons that Support the CT Unit**	**Recommended Strategies**	**Required Technology Activities**
CC.9-12.F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	**MP.6.** Attend to precision. **MP.7.** Look for and make use of structure.	For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum. • Examine the functions below. Which function has the larger maximum? How do you know?  $f(x) = -2x^2 - 8x + 20$ Compare intercepts, maxima and minima, rates of change, and end behavior of two quadratic functions, where one is represented algebraically, graphically, numerically in tables, or by verbal descriptions, and the other is modeled using a different representation.	• Compare intercepts, maxima and minima, rates of change, and end behavior of two quadratic functions, where one is represented algebraically, graphically, numerically in tables, or by verbal descriptions, and the other is modeled using a different representation.	**– Sorting Functions -** http://www.insidemathematics.org/index.php/tools-for-teachers/course-1-algebra/mars-tasks-scoring-rubrics-a-analysis the "Sorting Functions" lesson on this page offers an opportunity for students to distinguish among linear, quadratic and exponential graphs, their respective equations, tables, and description.	• Identifying Similarities and Differences • Note Taking • Summarizing • Cooperative Learning • Nonlinguistic Representations • Vocabulary Development • Use technology to transition between forms of a function. • Match functions expressed using different representations that have the same properties. • Compare two functions expressed in different representations. Ask: Which is growing at a faster rate? Which one has a higher initial value? Why does it increase faster than the other? How do you know?	

Unit 1: Functions and Inverse Functions

Concepts **What Students Need to Know**	**Skills** **What Students Need To Be Able To Do**	**Bloom's Taxonomy Levels**

• Functions (expressed symbolically)
  ○ Square root
  ○ Cube root
  ○ Piecewise-defined (includes step and absolute value)
• Key Features
  ○ Intercepts
  ○ intervals
  ➢ increasing or decreasing,
  ➢ positive or negative
  ○ relative maximums and minimums
  ○ symmetries
  ○ end behavior / endpoints
• Technology (graphing complicated functions)
	• Graph
	• Show (key features)
	• Use (technology)
		3
		4
		3

• Functions	• Write (function) • Compose (functions and understand composition in terms of context of the problem)	3 4
• Inverse functions • Equation (of form f(x)=c)	• Find (inverse functions and attend to domain e.g. restrictions) • Solve (equation) • Write (expression)	4 3 3