Greater Brunswick Charter School Algebra 1 Curriculum

CONTENT AREA: Mathematics	Course: Algebra I	UNIT #: 4	UNIT NAME: Functions and Modeling

	STUDENT LEARNING OBJECTIVES	CORRESPONDING CCSS	
1	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	A.APR.3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
2	Use the properties of rational and irrational numbers to explain why the sum or product of two rational numbers is rational; the sum of a rational number and an irrational number is irrational; and the product of a nonzero rational number and an irrational number is irrational.	N.RN.3	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a non-zero rational number and an irrational number is irrational.
3	Sketch the graph of a function that models a relationship between two quantities (expressed symbolically or from a verbal description) showing key features (including intercepts, minimums/maximums, domain, and rate of change) by hand in simple cases and using technology in more complicated cases and relate the domain of the function to its graph.	F.IF.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*
		F.IF.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *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.*
		F.1F.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
4	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*	F.IF.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
5	Calculate (over a specified period if presented symbolically or as a table) or estimate (if presented graphically) and interpret the average rate of change of a function.	F.IF.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
6	Write functions in different but equivalent forms by translating quadratic expressions using methods such as factoring and completing the square to show zeros, extreme values, and symmetry of the graph; interpret these in terms of a context.	F.IF.8a	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

STUDENT LEARNING OBJECTIVES		CORRESPONDING CCSS	
7	Write a function that describes a linear, quadratic or exponential relationship (e.g. growth/decay and arithmetic and geometric sequences) from graphs, tables, or a written description of the relationship, recursively and with an explicit formula, and describe how quantities increase over equal intervals relate these functions to the model.	F.BF.1	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
		F.LE.1	Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals; and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative another.
		F.LE.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
8	Identify the effects of transformations [*f(x) + k, k f(x), f(kx),* and *f(x + k)]* on a function and find the value of *k* given the graphs.	F.BF.3	Identify the effect on the graph of replacing *f(x)* by *f(x) + k, k f(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.*
9	Compare (using graphs and tables) linear, quadratic, and exponential models to determine that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function; include interpret parameters in terms of a context.	F.LE.3	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function
		F.LE.5	Interpret the parameters in a linear or exponential function in terms of a context.

Major **Supporting** **Additional** (identified by PARCC Model Content Frameworks) ***Bold Type indicates grade level fluency requirements.*** *(Identified by PARCC Model Content Frameworks).*

Selected Opportunities for Connections to Mathematical Practices

1. Make sense of problems and persevere in solving them. *

2. Reason abstractly and quantitatively.

SLO 3 Create a graph from a verbal description or symbolic representation reasoning about the relationship between the two quantities.

3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics. *

5. Use appropriate tools strategically.

SLO 3 Use graphing technology when graphing complicated functions and to identify the key features of the graph.

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

9. SLO 5 Continually evaluate the results of calculating the rate of change between two quantities over a period of time.
*MP.1 and MP.4 are overarching practices relevant to Algebra 1. (PARCC Model Content Frameworks)
All of the content presented in this course has connections to the standards for mathematical practices.

Bold type identifies possible starting points for connections to the SLOs in this unit.

Day	Topic	SLO	Learning Objectives	Essential Questions	Suggested Student Activities		Possible Resources
					Whole Group	Small Group / Stations	
1	Readiness for functions		To determine readiness for new unit. To reivew key content.	*How much have I mastered before going on to the next content?*		• Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 p.541-542
2	Graphing quadratic functions	3	To sketch parabolas by using the key concept points of a parabola	*How can I graph a quadratic function without plotting every point or using a graphing calculator?*	*Curve sketching is a major skill because it requires students to examine the function for key elements.*	• Lesson/Guided Practice • Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-1 p. 543-549
3	Graphing quadratic functions	3	To sketch parabolas by using the key concept points of a parabola	*How can I graph a quadratic function without plotting every point or using a graphing calculator?*	*Curve sketching is a major skill because it requires students to examine the function for key elements.*	• Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-1 p.550-551
4	Average rate of change	5	To calculate the average rate of change of a function between two points in a table or on a graph.	*How can I use what I know about slope to calculate the average rate of change from a parabola?*	*This is just doing slope without a straight line. For advanced students you can ask what happens to the slope as the change in x gets closer to 0.*	• Lesson/Guided Practice • Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-1 p. 554 *Make up some additional practice for them to perform the computation. The assessment will have some of this.*
5	Solving quadratic functions by graphing	1	To identify the zeros/roots/solution of a function from its graph.	*What do the x-intercepts on the graph tell me?*	*Most of this section is about graphing, but your text doesn't spend time here finding solutions algebraically. There is value in making sure the students know how the x-intercepts and the solutions to a quadratuc function are related/identical.*	• Lesson/Guided Practice • Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-2 p.555-558 *#10-27 ask to solve by graphing. Suggest you also have them solve those with leading coefficient of 0 by factoring as well.*
6	Solving quadratic functions by graphing	1	To identify the zeros/roots/solution of a function from its graph.	*What do the x-intercepts on the graph tell me?*	*You may want to have students solve quadratics algebraically first, then use the roots, the axis of symmetry, and that y-value at the axis of symmetry to sketch the parabola.*	• Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-2 *Grab some easily factorable quadratics from another text and have them continue their algebraic factoring and graph/curve sketching.*

Day	Topic	SLO	Learning Objectives	Essential Questions	Suggested Student Activities		Possible Resources
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7	Graphing and solving quadratics	1, 3	To review all content and skills to this point.	*Am I ready to know how much I know?*		• Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 p.582 #1-15
8	Graphing and solving quadratics	1, 3				• Review • Assessment	
9	Transformations	3, 6	To determine translations of parabolas by examining the graph and using the vertex form of the function.	*How does the vertex form of the function tell me how far the graph has moved?*	*Vertex form is the terminology in the assessment. It is quickly defined on p. 568. The links do a better job.*	• Lesson/Guided Practice • Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-3 p.564-569
10	Transformations	3, 6, 8	To determine translations of parabolas by examining the graph and using the vertex form of the function.	*How does the vertex form of the function tell me how far the graph has moved?*	*There isn't a lot of quadratic translation work ahead of most of these students, but practice time converting to vertex form and seeing the translation from it is worth the second day.*	• Lesson/Guided Practice • Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-3 p. 569-570
11	Solving a system of linear and qaudratic equations	3	To determine the common solutions to two equations.	*How can I find the common solutions to two equations that aren't the same type?*	*Have students solve by substitution then solve by looking for intersections on the graph.*	• Lesson/Guided Practice • Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-3 p. 572-573
12	Solving quadratic equations by completing the square	6	To solve a quadratic equation by completing the square.	*How does manipulating the equation by completing the square make it easier to solve an equation and graph the function?*	*Completing the square is most useful in graphing for helping to find the vertex form. If you want to move this lesson up to merge with Days 9 and 10 above, that's a viable option.*	• Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-4 p. 574-578
13	Minimum and maximum	4, 6	To find the maximum or minimum values of a quadratic function by finding the y-value at the vertex.	*How do I know whether I'm going to have a minimum or maximum and then what the y-value is there?*	*Vertex form comes in handy here to quickly find the axis of symmetry.*	• Lesson/Guided Practice • Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1

Day	Topic	SLO	Learning Objectives	Essential Questions	Suggested Student Activities		Possible Resources
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14	• Solving quadratic equation using the quadratice formula. • Properties of rational and irrational sums and products.	NA 2	To quickly solve vexing quadratice equations by plugging them into the quadratic formula.	*How can I solve a quadratice equation if I don't want to or can't solve it by factoring or completing the square?*	*This is a one day algebra exercise.* *But it's the best time to address properties of sums and products, since you'l be seeing some irrational numbers here and it is on the assessment.*	• Lesson/Guided Practice • Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-5 p.583-589 *Don't wear them out with all the problems.* GlencoeAlg1 10-2 p.634
15	Maxima, minima, completing the square, quadratic formula	2, 3, 4, 6	To determine mastery level on those topics.	*How is my mastery on these skills?*		• Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 p.582, #16-25
16	Maxima, minima, completing the square, quadratic formula	2, 3, 4, 6			*Don't forget to put a couple problems about sums and products of irrationals on your test, i.e. If a rational number is multiplied by an irrational number, what type of number is the result?*	• Review • Assessment	
17	Identifying relationships from a table of values	5, 7	To use successive differences to identify the type of function and graph the function.	*How can I decide what type of function is described by a table of values before I graph the values?*		• Lesson/Guided Practice • Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-6 p.590-595
18	Identifying relationships from a table of values	5, 7	To use successive differences to identify the type of function and graph the function.	*How can I decide what type of function is described by a table of values before I graph the values?*		• Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-6 p.590-595

Day	Topic	SLO	Learning Objectives	Essential Questions	Suggested Student Activities		Possible Resources
					Whole Group	Small Group / Stations	
19	Rate of change and ultimate value	9	To observe that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.	*What is the difference in the rate of change as linear, quadratic, and exponential functions grow?*	*The book does not address this standard except in a review of 7-7 and 7-8. The goal here would be to provide enough examples of the growth in exponential, quadratic, and linear functions that students will intuitively see that exponential functions will grow (the y-values will be larger) at a much faster rate than linear or quadratice functions.*	• Lesson/Guided Practice • Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 7-7, 7-8 p.444-450
20	Special functions	NA	To be exposed to step functions, greatest integer functions, and absolute value functions	*What situations in real life might generate a step function or an absolute value function?*	*This are not required in the Model Curriculum. They are in your text. Covering them is optional.*	• Lesson/Guided Practice • Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 9-7 p. 598-606
21 22 23	All content in this unit	1, 2, 3, 4, 5, 6, 7, 8	To review all the content and skills in the unit.		*You have the time. Suggst you take a nice walk thorugh the problems on these pages over the next three days.*	• Independent Practice • Intervention/Enrichment • I-Ready	GlencoeAlg1 p.607-610
25	All content in this unit	1, 2, 3, 4, 5, 6, 7, 8				• Review • Assessment	

Word Wall Candidates

Quadratic function	Minimum	Quadratic formula	Step function
Parabola	Maximum	Discriminant	Greatest integer function
Axis of Symmetry	Transformation	Completing the square	Absolute value function
Vertex	Translation	Double root	Exponential function