

High School Algebra II SY 2022/2023

High School Algebra II

	Units of Study			
Unit 1:	Relations and Functions	\$	17 days	1st semester
<u>Unit 2:</u>	Linear Equations, Inequalities, and Systems	\$	20 days	1st semester
<u>Unit 3:</u>	Quadratic Functions	\$	19 days	1st semester
<u>Unit 4/5:</u>	Polynomial Equations and Functions	\$	19 days	1st semester
Unit 6:	Inverses and Radical Functions	\$	17 days	2nd semester
Unit 7:	Exponential Equations	\$	13 days	2nd semester
<u>Unit 8:</u>	Logarithmic Functions	\$	14 days	2nd semester
<u>Unit 9:</u>	Rational Functions		15 days	2nd semester
<u>Unit 10:</u>	Inferential Statistics	\odot	16 days	2nd semester

Appendices

Appendix A: Proficiency Scale Template

Appendix B: Curriculum Refinement Form

Appendix C: North Gibson Priority Standards Vertical Articulation Document

High School Algebra II Priority Standards

	AII.ASE.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
	All.ASE.3	Rewrite algebraic rational expressions in equivalent forms (e.g., using properties of exponents and factoring techniques). Add, subtract, multiply, and divide algebraic rational expressions.
	All.DSP.3	Use technology to find a linear, quadratic, or exponential function that models a relationship for a bivariate data set to make predictions; Interpret the correlation coefficient for linear models.
	All.DSP.6	Understand the Fundamental Counting Principle, permutations, and combinations; apply these concepts to calculate probabilities.
	All.EL.1	Graph exponential and logarithmic functions with and without technology. Identify and describe key features, such as intercepts, domain and range, asymptotes and end behavior. Know that the inverse of an exponential function is a logarithmic function.
	All.EL.5	Solve exponential and logarithmic equations in one variable.
Priority Standards	All.F.4	Explore and describe the effect on the graph of $f(x)$ by replacing $f(x)$ with $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative) with and without technology. Find the value of k given the graph of $f(x)$ and the graph of $f(x) + k$, $k f(x)$, $f(kx)$, or $f(x + k)$.
	All.PR.1	Solve real-world and other mathematical problems involving polynomial equations with and without technology. Interpret the solutions and determine whether the solutions are reasonable.
	All.PR.3	Solve real-world and other mathematical problems involving radical and rational equations. Give examples showing how extraneous solutions may arise.
	All.Q.1	Represent real-world problems that can be modeled with quadratic functions using tables, graphs, and equations; translate fluently among these representations. Solve such problems with and without technology. Interpret the solutions and determine whether they are reasonable.
	All.Q.4	Use the discriminant to determine the number and type of solutions of a quadratic equation. Find all solutions and write complex solutions in the form of a \pm bi for real numbers a and b.
	All.SE.2	Represent and solve real-world systems of linear equations and inequalities in two or three variables algebraically and using technology. Interpret the solution set and determine whether it is reasonable.

			UNITS									
			1	2	3	4/5	6	7	8	9	10	
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	net d sio	2					*					
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	por Fu Fu	5						*	*			
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AR							•					
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0	nct	3					•					
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	iter of Iati s	2		*								
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I -: Additional Standards

Supporting Standards

Standards Breakdown

✓★: Priority Standards

General Description of the Unit					
This unit is a combination of a review of concepts from Algebra 1, along with the introduction to transformations					
Priority Standards	ions and absolute v	Supporting Stand	lards		
• All.F.4: Explore and describe the effective f(x) by replacing $f(x)$ with $f(x) + k$, $kf(x = k)$ for specific values of k (both positive with and without technology. Find the the graph of $f(x)$ and the graph of $f(x)$ f(x + k).	ect on the graph of (), f(kx), and f(x + ve and negative) e value of k given + k, k f(x), f(kx), or	 Supporting Standards All.PR.2: Graph mathematical functions including: polynomial functions; rational functions; square root functions; absolute value functions; and, piecewise-defined functions with technology. Identify and describe features, such as intercepts, domain and range, end behavior, and lines 			
Enduring Understandings		Essential Questic	ons		
 Transformations can shift a parent fur and vertically, as well as dilate and ref. All graphs contain key features that ref. information about the function and/or modeled. Function families often sha features. 	nction horizontally eflect. eveal important situation being re some key	 Are there any characteristics that all functions from the same parent function will share? Why or why not? How do transformations affect the parent function? 			
Key Concepts	Related Concepts	5	Vocabulary		
 I can identify the transformations of a function on a graph. (AII.F.4) I can describe the effects of transformations on parent functions. (AII.F.4) I can determine the value corresponding to various transformations of functions. (AII.F.4) 	 I can graph absolution functions with teorem (AII.PR.2) I can graph piece functions with teorem (AII.PR.2) I can graph math and identify and of features such as and range, end boof symmetry. (AII.PR.2) 	lute value chnology. ewise defined chnology. ematical functions describe key intercepts, domain rehavior, and lines I.PR.2)	 Absolute value function Asymptote Domain End behavior Horizontal shift Horizontal stretch Intercept Line of symmetry Parent function Piecewise function Range Reflection Transformation Vertical shift Vertical stretch 		
Mathematical Processes					
 PS.1 Make sense of problems and period PS.2 Reason abstractly and quantitation 	ersevere in solving ti tivelv.	nem.			
	Reso	urces			
Proficiency Scales	Digital		Manipulatives		
• <u>AII.F.4</u>	• IDOE Examples/	/ <u>Tasks All.F.4</u> / <u>Tasks All.PR.2</u>	 <u>Graph Paper</u> <u>Graphing Calculator</u> <u>Scientific Calculator</u> <u>Virtual Graph Paper</u> 		

School Resources					
Textbook	Formative Assessments				
Textbook Textbook: Indiana Reveal by McGraw-Hill Module 1: Relations and Functions 1.1 Functions and Continuity (SKIP) 1.2 Linearity, Intercepts, and Symmetry: AII.PR.2 1.3 Extrema and End Behavior: AII.PR.2 1.4 Sketching Graphs and Comparing Functions: AII.PR.2 1.5 Graphing Linear Functions and Inequalities: (Review) 1.6 Special Functions (Piecewise and Step Functions): AII.PR.2 1.7 Transformations of Functions: AII.F.4	Formative Assessments				

General Description of the Unit					
This systems unit builds on the exter	sive work students	completed over sys	stems of equations in Algebra 1. The		
beginning of the unit is an opportunit	y to review linear ec	quations; then, stud	ents will solve absolute value		
equations and inequalities for the firs	t time. Next, studen	nts will work with sys	stems involving three equations or		
real-world situations with these syste	ly and with technolo ms.	ogy. Most important	ly, students will model and solve		
Priority Standards		Supporting Stand	lards		
• All.SE.2: Represent and solve real-w	vorld systems of	• All.SE.3: Repres	ent real-world problems using a		
linear equations and inequalities in tw	vo or three	system of linear e	equations in three variables.		
variables algebraically and using tech	nnology. Interpret	Understand that	the algebraic steps to solve a two		
the solution set and determine wheth	er it is reasonable.	variable system of	an be extended to systems of		
		• All PR 4. Solve a	absolute value linear equations and		
		inequalities in on	e variable.		
Enduring Understandings		Essential Questio	ons		
Writing and solving a system of linea	r equations to	• How do systems	of equations compare to systems of		
represent a real-world situation can b	be an efficient	inequalities?			
strategy to find a solution for a real-w	orld situation with	What key factors	should we consider when selecting a		
multiple constraints.	r aquationa ia	method for solvin	g a system of three equations?		
• A typical solution to a system of linea	m of linear	 How many solution usually baye? W/l 	ons do absolute value equations		
inequalities is a set of solutions.			iy :		
• The process for solving a system of e	equations in three				
variables is an extension of the algeb	praic methods of				
solving a system of equations in two	variables.				
 Absolute value equations and inequal solved by splitting the equation into the 	alities can be				
inequalities.	wo equations of				
Key Concepts	Related Concepts	5	Vocabulary		
• I can represent a real-world system	• I can represent re	eal-world problems	 Absolute value 		
of two or three linear equations in	using a system o	f linear equation in	Composition		
two or three variables. (All.SE.2)	three variables. (All.SE.3)	Elimination method		
• I can solve a real-world system of two or three linear equations in two	 I can explain that steps to solve a t 	t the algebraic	Solution Solution		
or three variables algebraically.	svstem can be ex	xtended to solve a	Solution Set Substitution method		
(AII.SE.2)	three variable sys	stem. (AII.SE.3)	System of equations		
 I can solve a real-world system of 	 I can apply the co 	oncept of absolute	System of linear equations		
two or three linear equations in two	value to solve ab	solute value linear	, ,		
or three variables using technology.		variable.			
• I can interpret the solution set to a	• I can discuss the	reason for two			
system of two or three linear	solutions to abso	lute value			
equations in two or three variables	equations. (All.Pl	R.4)			
in context and determine its	• I can solve absol	ute value linear			
reasonableness. (All.SE.2)	reasonableness. (All.SE.2) inequalities in one variable.				
I • I Can represent a real-world system					
of two or three linear inequalities in	(All.PR.4)				
of two or three linear inequalities in two or three variables. (AII.SE.2)	(All.PR.4)				
of two or three linear inequalities in two or three variables. (AII.SE.2) • I can solve a real-world system of	(All.PR.4)				
 of two or three linear inequalities in two or three variables. (AII.SE.2) I can solve a real-world system of two or three linear inequalities in 	(All.PR.4)				
 of two or three linear inequalities in two or three variables. (AII.SE.2) I can solve a real-world system of two or three linear inequalities in two or three variables algebraically. 	(All.PR.4)				
 of two or three linear inequalities in two or three variables. (AII.SE.2) I can solve a real-world system of two or three linear inequalities in two or three variables algebraically. (AII.SE.2) I can solve a real world system of 	(All.PR.4)				
 of two or three linear inequalities in two or three variables. (AII.SE.2) I can solve a real-world system of two or three linear inequalities in two or three variables algebraically. (AII.SE.2) I can solve a real-world system of two or three linear inequalities in 	(All.PR.4)				
 of two or three linear inequalities in two or three variables. (AII.SE.2) I can solve a real-world system of two or three linear inequalities in two or three variables algebraically. (AII.SE.2) I can solve a real-world system of two or three linear inequalities in two or three variables using 	(All.PR.4)				

 I can interpret the solution set to a system of two or three linear inequalities in two or three variables in context and determine its reasonableness. (All.SE.2) Mathematical Processes PS.6 Attend to precision. PS.7 Look for and make use of struct 	ture.		
	Resou	irces	
Proficiency Scales	Digital		Manipulatives
• <u>AII.SE.2</u>	IDOE Examples/	Tasks All.SE.2	Graph Paper
	IDOE Examples/	Tasks All.SE.3	<u>Graphing Calculator</u>
	IDOE Examples/	Tasks All.PR.4	Scientific Calculator Virtual Craph Papar
	Sobool Bo	Souroos	• <u>virtual Graph Paper</u>
Taxtheek	SCHOOLKE		omente
Texibook		Formative Asses	sments
 Iextbook Module 2: Linear Equations, Inequalities, and Systems 2.1 Solving Linear Equations and Inequalities (Review) 2.2 Solving absolute value equations and inequalities: All.PR.4 2.3 Equations of Linear Functions (Review) 2.4 Solving Systems of Equations Graphically: All.SE.2 2.5 Solving Systems of Equations Algebraically: All.SE.2 2.6 Solving Systems of Inequalities: All.SE.2 2.7 Optimization with Linear Programming: All.SE.2 2.8 Systems of Equations in Three Variables: All.SE.2, All.SE.3 2.9 Solving Absolute Value Equations and Inequalities by Graphing: (Optional Extension) 			

General Description of the Unit

In this unit students will extend their us solved quadratic equations and sketch introduced for the first time; additional and complex). While solving quadratic functions with and without technology quadratic equations to translate the q the function in vertex form or factoring forms of the equation to identify differ involving a linear and a quadratic equa all these skills to solve real-world prote	Inderstanding of qui hed graphs of quac lly, students will so c equations is a pai y. Students will applied uadratic function in g to put the function ent key features of lation, solving it bot polems that can be r	adratic equations a dratic functions. Thi lve quadratic equat rt of the unit, the foo ly many of the algel to different forms, s in factored form. S the graph. Addition th algebraically and modeled with quadr	and functions. In Algebra 1, students s year, the discriminant will be ions to find all solutions (both real cus is on graphing quadratic braic skills they've developed with such as completing the square to put Students should use the different hally, they will work with a system graphically. Finally, students will use atic functions.
• All.Q.1: Represent real-world problem	ns that can be	• All.Q.2: Use com	pleting the square to rewrite quadratic
 modeled with quadratic functions usin and equations; translate fluently amor representations. Solve such problems technology. Interpret the solutions and whether they are reasonable. AII.Q.4: Use the discriminant to deter and type of solutions of a quadratic eq solutions and write complex solutions bi for real numbers a and b. 	ng tables, graphs, ng these s with and without d determine mine the number quation. Find all in the form of a ±	 functions in vertex form and graph these functions with and without technology. All.Q.3: Understand that different forms of a quadratic equation can provide different information. Use and translate quadratic functions between standard, vertex, and intercept form to graph and identify key features, including intercepts, vertex, line of symmetry, end behavior, and domain and range. All.SE.1: Solve a system of equations consisting of a linear equation and a quadratic equation in two variables algebraically and graphically with and without technology 	
Enduring Understandings		Essential Questio	ons
 Enduring Understandings Different forms (vertex, standard, factored) and representations (table, graph, equation) of quadratic functions highlight different features of a function. Translating between them can reveal a fuller picture of the function. Quadratic functions can represent real-world situations that are parabolic like determining a product's profit, formulating the speed of an object, calculating the height of a ball thrown in the air, and more. Completing the square can be used for more than just solving a quadratic equation; it can also be used to put a quadratic function in vertex form for graphing. The discriminant comes from the quadratic formula and reveals the number and type of solutions to a quadratic equation. A system of equations involving a linear equation and a quadratic equation can be solved using algebra or by graphing: there will be either 0, 1, or 2 solutions 		 Would you rather vertex, factored, How can quadrat minimize costs? What can the dis quadratic equation How does the pro- equation and a q system of linear end 	be given a quadratic function in or standard form to graph? Why? ic functions maximize profits or criminant reveal about the graph of a on? Decess of solving a system with a linear uadratic equation compare to solving a equations?
Key Concepts	Kelated Concepts	s Anique ef	vocabulary
 I can represent and solve real-world problems that can be modeled with quadratic functions using a table. (All.Q.1) I can represent and solve real-world problems that can be modeled with quadratic functions using a graph. (All.Q.1) I can represent and solve real-world problems that can be modeled with quadratic functions using a graph. (All.Q.1) 	 I can use the tech completing the so quadratic function (All.Q.2) I can graph quad vertex form with t (All.Q.2) I can graph quad vertex form witho (All.Q.2) 	ratic functions in exercise form.	 Completing the square Complex solutions Discriminant Domain End behavior Intercept Intercept form of a quadratic equation Line of symmetry Linear equation

 quadratic functions using an equation. (AII.Q.1) I can translate fluently among tables, graphs, and equations of quadratic functions. (AII.Q.1) I can interpret my solution to a quadratic function and determine its reasonableness. (AII.Q.1) I can identify the discriminant within the quadratic formula. (AII.Q.4) I can use the discriminant to determine the number and type of solutions to a quadratic equation. (AII.Q.4) I can find all solutions to a quadratic equation. (AII.Q.4) I can write complex solutions in the form a ± bi. (AII.Q.4) 	 I can discuss the advantages and information available in the different forms of a quadratic equation. (AII.Q.3) I can translate between standard form, vertex form, and intercept form of a quadratic function. (AII.Q.3) I can identify any intercepts of a quadratic function. (AII.Q.3) I can find the vertex and axis of symmetry of a quadratic function. (AII.Q.3) I can determine the domain and range of a quadratic function. (AII.Q.3) I can solve a system of equations consisting of linear and quadratic equations in two variables algebraically. (AII.SE.1) I can solve a system of equations consisting of linear and quadratic equations in two variables graphically by finding the point(s)s of intersection with technology. (AII.SE.1) I can solve a system of equations consisting of linear and quadratic equations in two variables graphically by finding the point(s)s of intersection with technology. (AII.SE.1) 	 Point of intersection Quadratic Equation Quadratic Formula Quadratic Function Range Standard form of a quadratic equation System of equations Vertex Vertex form of a Quadratic Equation
Mathematical Processes		
 PS.5 Use tools appropriately. PS.8 Look for and express regularity. 	in repeated reasoning	
	Resources	

Proficiency Scales	Digital	Manipulatives
• <u>All.Q.1</u>	IDOE Examples/Tasks All.Q.1	Graph Paper
• <u>All.Q.4</u>	 IDOE Examples/Tasks All.Q.4 	 Graphing Calculator
	 IDOE Examples/Tasks All.Q.2 	 Scientific Calculator
	 IDOE Examples/Tasks All.Q.3 	 <u>Virtual Graph Paper</u>
	IDOE Examples/Tasks All.SE.1	

School Resources					
Textbook	Formative Assessments				
Module 3: Quadratic Functions 3.1 Graphing Quadratic Functions: All.Q.1, All.Q.3, All.DSP.3 3.2 Solving Quadratic Equations by Graphing: All.Q.1, All.Q.3, All.DSP.3 3.3 Complex Numbers (not entirely an Algebra II IAS): All.Q.4 3.4 Solving Quadratic Equations by Factoring: All.Q.1, All.Q.3 3.5 Solving Quadratic Equations by Completing the Square: All.Q.1, Al.Q.2, All.Q.3, All.Q.4 3.6 Using the Quadratic Formula and the Discriminant: All.Q.1, All.Q.3, All.Q.4 3.7 Quadratic Inequalities (SKIP) 3.8 Solving Linear and Nonlinear Systems: All.SEI.1					

General Description of the Unit				
Up until this point, students have mos	stly worked with onl	y one type of polyn	omial: quadratics. Now, students will	
extend their understanding of quadra	tics to polynomials	with higher degrees	. Students will graph polynomial	
functions using technology and will id	lentify key features,	such as extrema, i	ntercepts, and end behavior, from	
intercents with a graphing calculator:	this includes signifi	cant work simplifyir	a algebraic expressions. Finally	
students will solve real-world problem	is that involve polyr	nomial equations.	ig algebraic expressions. I maily,	
Priority Standards		Supporting Stand	ards	
 All.ASE.3: Rewrite algebraic rational equivalent forms (e.g., using propertie and factoring techniques). Add, subtradivide algebraic rational expressions. All.PR.1: Solve real-world and other problems involving polynomial equati without technology. Interpret the solur determine whether the solutions are ready and solutions. 	expressions in es of exponents act, multiply, and mathematical ons with and tions and reasonable.	 All.ASE.4: Rewrite rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x). All.PR.2: Graph mathematical functions including: polynomial functions; rational functions; square root functions; and, piecewise-defined functions with technology. Identify and describe features, such as intercepts, domain and range, end behavior, and lines of symmetry. 		
Enduring Understandings		Essential Questio	ns	
 Rational expressions can be simplified by applying properties of fractions, far properties of exponents. Polynomial functions and their graphs model for many real-world situations, involving finance and business. Many factoring techniques can be applied degree polynomials. Rational expressions with a higher definition of division or sumthatic division. 	d and rearranged ctoring, and s can be a useful especially those plied to higher egree in the be rewritten using	 How do I know when a rational function is simplified? When using a polynomial model for a real-world situation, are the solutions always reasonable? Why or why not? Are there any characteristics that all polynomial functions will share? Why or why not? Why do we want to perform division on polynomials? What new information can it reveal? 		
long division or synthetic division.	Deleted Concents		Veeebuleru	
 Key Concepts I can rewrite algebraic rational expressions in equivalent forms using the properties of exponents. (AII.ASE.3) I can rewrite algebraic rational expressions in equivalent forms using factoring techniques. (AII.ASE.3) I can add and subtract rational expressions with common denominators. (AII.ASE.3) I can add and subtract rational expressions without common denominators. (AII.ASE.3) I can multiply and divide rational expressions. (AII.ASE.3) I can solve real-world polynomial equations without technology. (AII.PR.1) I can solve real-world polynomial equations without technology. (AII.PR.1) 	 Related Concepts I can rewrite rational using long division I can identify the polynomials. (All. I can rewrite rational using synthetic di I can identify the order to perform a (All.ASE.4) I can graph polynwith technology. I can graph math and identify and of features such as and range, end b of symmetry. (All.ASE.4) 	anal expressions onal expressions on. (AII.ASE.4) degree of a .ASE.4) onal expressions ivision. (AII.ASE.4) divisor to use in synthetic division. nomial functions (AII.PR.2) ematical functions describe key intercepts, domain ehavior, and lines .PR.2)	 Algebraic rational expression Asymptote Common denominator Degree Domain End behavior Intercept Line of symmetry Polynomial Polynomial equation Polynomial long division Properties of exponents Range Rational expression Rational numbers Solution Synthetic division 	

 I can solve mathematical problems involving polynomial equations with technology. (AII.PR.1) I can solve mathematical problems involving polynomial equations without technology. (AII.PR.1) I can interpret the solutions to a polynomial equation and determine the reasonableness of them. (AII.PR.1) 			
Mathematical Processes			
 PS.3 Construct convincing arguments PS.7 Look for and make use of struct 	s and critique the rea ure.	asoning of others.	
	Reso	urces	
Proficiency Scales	Digital		Manipulatives
• All.PR.1	IDOE Examples	Tasks All.ASE.3	Graph Paper
• <u>AII.ASE.3</u>	IDOE Examples	Tasks All.PR.1	Graphing Calculator
	IDOE Examples/	Tasks All.ASE.4	<u>Scientific Calculator</u>
	IDOE Examples	<u>Tasks All.PR.2</u>	• <u>Virtual Graph Paper</u>
Taythaak	School R		amonto
Texibook		Formative Asses	Sillents
Module 4: Polynomials and Polynomial 4.1 Polynomial Functions: All.PR.1, All 4.2 Analyzing Graphs of Polynomial Fu All.PR.2 4.3 Operations with Polynomials: All.Pl 4.4 Dividing Monomials: All.ASE.3, All 4.5 Powers of Binomials: All.ASE.3, Al	Functions .PR.2 Inctions: AII.PR.1, R.1 .ASE.4, AII.PR.1 I.PR.1 (Optional)		
Module 5: Polynomial Equations 5.1 Solving Polynomial Equations by G All.PR.2 5.2 Solving Polynomial Equations Alge 5.3 Proving Polynomial Identities (SKIF 5.4 The Remainder and Factor Theoret (Optional/SKIP - PC Standard) 5.5 Roots and Zeros: (Optional/SKIP -	raphing: AII.PR.1, braically: AII.PR.1 ?) ms: PC Standard)		

General Description of the Unit				
In this unit, students work with radical equations and functions. They will start with some number sense as they extend exponents to include rational exponents as a new way of representing radicals. Then students will apply this number sense to simplify expressions involving radicals and rational exponents using the properties of exponents. Then students will extend these techniques to solving radical equations, including ones that are modeling a real-world situation; students will also check for extraneous solutions. Finally, students will graph radical functions (mainly the square root function) using technology and transformations. This will lead into the definition of an inverse function as students explore the relationship between a quadratic function, verify that two functions. Students will work formally with the inverse as they find the inverse of a function, verify that two functions are inverses, and understand the graphical relationship between inverses.				
Priority Standards		Supporting Stand	lards	
 All.ASE.2: Rewrite expressions involvrational exponents using the propertie All.PR.3: Solve real-world and other more problems involving radical and ration examples showing how extraneous solutions in the second se	ving radicals and es of exponents. mathematical nal equations. Give olutions may arise.	 All.ASE.1: Explainteger exponent notation for radic 5^(1/3) is defined want (5^(1/3))^3 must equal 5.) All.F.1: Understa combine function All.F.2: Define all functions are inverse is a reflect contains a point (relation of the fur inverse is a reflect All.PR.2: Graph polynomial fur rational funct absolute valu piecewise-de with technology. intercepts, domain of symmetry. 	in how extending the properties of s to rational numbers allows for a als in terms of rational exponents (e.g. I to be the cube root of 5 because we = $5^{(1/3)3}$ to hold, so $(5^{(1/3)})^3$ and composition of functions and is by composition. Ind find the inverse of a function. Verify erses algebraically and graphically. and that if the graph of a function (a, b), then the graph of the inverse function contains the point (b, a); the ction over the line y = x. mathematical functions including: inctions; ions; functions; ide functions Identify and describe features, such as in and range, end behavior, and lines	
Enduring Understandings		Essential Question	ons	
 Some solutions to radical equations may be extraneous and therefore are invalid solutions to the equation. Rational exponents are another way to represent radicals, where the index of the radical is the denominator of the exponent. Expressing radicals as rational exponents allows exponent rules to be extended to radicals. Inverse functions "undo" the original function; this can be verified algebraically or graphically. The graph of an inverse function is a reflection of the original function over the line y = x. 		 Is it possible to identify a radical equation as having no real roots just by looking at it? Why or why not? Do you prefer to use rational exponent notation or radical notation? Why? What is a real-world situation that can be modeled by a function where the inverse function would also be meaningful? How can an understanding of the graphing relationship between a function and its inverse aid in graphing new parent functions? 		
Key Concepts	Related Concepts	; ;	Vocabulary	
 I can translate expressions between radical and exponent form. (AII.ASE.2) I can simplify expressions written in exponent form with rational exponents using the laws of exponents. (AII.ASE.2) 	 I can relate the properties of exponents with integers as being the same as the properties of exponents with rational numbers. (AII.ASE.1) I can connect rational exponents to their equivalent radical from. (AII.ASE.1) 		 Asymptote Composition of functions Dependent variable Domain End behavior Exponent Exponential expression Extraneous solution 	

 I can solve real-world problems involving rational functions. (AII.PR.3) I can solve real-world problems involving radical functions. (AII.PR.3) I can identify and understand extraneous solutions and the situations in which they arise. (AII.PR.3) 	 I can combine functions by substituting one function in for the other. (AII.F.1) I can understand and explain the process of composing functions. (AII.F.1) I can give a definition for the inverse of a function. (AII.F.2) I can find the inverse of a function. (AII.F.2) I can understand the idea that the inverse of a function "undoes" anything the original function does. (AII.F.2) I can determine whether a function has an inverse. (AII.F.2) I can determine if a function is one-to-one. (AII.F.2) I can verify if two functions are inverses of each other algebraically. (AII.F.2) I can understand the domain of a function is the range of the inverse, and vice versa. (AII.F.3) I can graph a function and its inverse to show that the inverse is a reflection of the function swith technology. (AII.PR.2) I can graph mathematical functions and identify and describe key features such as intercepts, domain and range, end behavior, and lines of symmetry. (AII.PR.2) 	 Function Horizontal line test Independent variable Integer Intercept Inverse function Inverse relationship Line of symmetry One-to-one Power of a power Power of a quotient Product of powers Properties of exponents Quotient of powers Radical Radical expression Rational number Reflection Square-root function
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- PS.2 Reason abstractly and quantitatively.PS.6 Attend to precision.

Resources

Proficiency Scales	Digital	Manipulatives
• <u>AII.ASE.2</u>	 IDOE Examples/Tasks All.ASE.2 	 Absolute Value Function
• <u>AII.PR.3</u>	 IDOE Examples/Tasks All.PR.3 	Transformations
	 IDOE Examples/Tasks All.ASE.1 	 <u>Graph Paper</u>
	 IDOE Examples/Tasks All.F.1 	 Graphing Calculator
	 IDOE Examples/Tasks All.F.2 	 Scientific Calculator
	 IDOE Examples/Tasks All.F.3 	 Virtual Graph Paper
	 IDOE Examples/Tasks All.PR.2 	

School Resources			
Textbook	Formative Assessments		
 Module 6: Inverses and Radical Functions 6.1 Operations on Functions (Function Compositions): All.F.1 6.2 Inverse Relations and Functions: All.F.2, All.F.3 6.3 nth Roots and Rational Exponents: All.ASE.1, All.ASE.2, All.PR.3 6.4 Graphing Radical Functions: All.F.4, All.PR.2, All.PR.3 6.5 Operations with Radical Expressions: All.ASE.1, All.ASE.2, All.PR.3 6.6 Solving Radical Equations: All.ASE.1, All.ASE.2, All.PR.2, All.PR.3 			

General Description of the Unit			
In this unit, students will build on their	r competency with e	exponential relation	ships by identifying an exponential
relationship, finding the rate of chang	e and classifying it	as growth or decay	, and simplifying exponential
expressions. Then they solve expone	ential equations and	graph exponential	functions with and without
technology. Finally, bivariate data is r	nodeled with linear	, quadratic, and exp	oonential functions.
Priority Standards		Supporting Stand	ards
 All.EL.1: Graph exponential and log with and without technology. Identify 	arithmic functions	 All.EL.2: Identify exponential funct 	the percent rate of change in ions Classify them as representing
features, such as intercepts, domain	and range,	exponential grow	th or decay.
asymptotes and end behavior. Know	that the inverse of	All.EL.3: Use the overcosions to do	e properties of exponents to rewrite
• All.EL.5: Solve exponential and loga	arithmic equations	functions.	
in one variable.		• All.EL.6: Repres	ent real-world problems using
• All.DSP.3: Use technology to find a li exponential function that models a re	Inear, quadratic, or lationship for a	problems with tec	chnology. Interpret the solutions and
bivariate data set to make predictions correlation coefficient for linear mode	s; Interpret the ls.	determine whethe	er they are reasonable.
• All.F.4: Explore and describe the effe	ect on the graph of		
f(x) by replacing f(x) with f(x) + k, kf(x k) for specific values of k (both positiv), f(kx), and f(x +		
with and without technology. Find the	value of k given		
the graph of $f(x)$ and the graph of $f(x)$	+ k, k f(x), f(kx), or		
Enduring Understandings		Essential Questio	ins
 Exponential functions describe a com 	mon ratio at which	What are key feat	tures of an exponential equation that
variables change. This ratio results in	either growth or	help reveal a pati	n for solving it?
e Exponential functions can be graphed		 How does the cha that in an expense 	ange in a linear function differ from
transformations; sometimes the equa	tion will first need	Do exponential fu	inctions have a single parent function?
to be rearranged using the properties	of exponents.	Why or why not?	0.1
Models for data can be used to make	predictions; it is	What features of	a bivariate data set should be
exponential) for each data set.	, linear, quadratic,	model?	ect the best function-type to use a
Key Concepts	Related Concepts	5	Vocabulary
• I can use technology to fit a linear,	• I can identify the	percent rate of	Asymptote
quadratic, or exponential model to a	change in an exp	onential function.	Bivariate data
relationship for a bivariate data set.	(All.EL.2)		 Correlation coefficient
(AII.DSP.3)	 I can classify an effective as repro- 	exponential	Decay rate
appropriate model for a bivariate	decay based upo	on the percent rate	 Domain End behavior
data set. (All.DSP.3)	of change. (All.E	L.2)	Exponential decay
• I can use technology to compute	• I can distinguish	between the	Exponential equation
(All.DSP.3)	by which someth	rate and the factor ing grows or	 Exponential function Exponential growth
• I can interpret the correlation	decays. (All.EL.2	2) portion of	• Factor
for a bivariate data set. (All.DSP.3)	exponents to rew	rite expressions	Growth rate
• I can graph exponential functions	for exponential fu	Inctions. (AII.EL.3)	Horizontal stretch
 I can graph exponential functions 	exponential funct	ions. (All.EL.3)	Initial value
without technology. (All.EL.1)	• I can represent re	eal-world problems	Intercepts
 I can identify and describe key 	using exponentia	l functions in one	Inverse Inverse Inverse
teatures of exponential functions	variable. (All.EL.	b)	Parent function
range and asymptotic and end	using logarithmic	functions in one	Percent rate of change
behavior. (All.EL.1)	variable. (All.EL.	6)	Properties of exponents

 I can solve exponential equations in one variable. (AII.EL.5) I can identify the transformations of a function on a graph. (AII.F.4) I can describe the effects of transformations on parent functions. (AII.F.4) I can determine the value corresponding to various transformations of functions. (AII.F.4) 	 I can solve real-world exequations using technol (AII.EL.6) I can interpret my solution exponential equation and determine the reasonab (AII.EL.6) 	xponential logy. on to an nd pleness of it.	 Quadratic function Range Reflection Solution Transformation Vertical shift Vertical stretch
Mathematical Processes			
 PS.3 Construct convincing arguments PS.4 Model with mathematics 	s and critique the reasoning	g of others.	
	Resources		
Proficiency Scales	Digital		Manipulatives
• All.DSP.3	IDOE Examples/Tasks	All.DSP.3	Curve Fitting
• All.EL.1	IDOE Examples/Tasks	All.EL.1	Graph Paper
• <u>All.EL.5</u>	IDOE Examples/Tasks	All.EL.5	Graphing Calculator
• <u>All.F.4</u>	 IDOE Examples/Tasks 	All.F.4	Line of Best Fit
	IDOE Examples/Tasks	All.EL.2	<u>Scientific Calculator</u>
	IDUE Examples/Tasks All.EL.3		Univariate Data Displays
	School Posour		• <u>Virtual Graph Paper</u>
Taythaak	School Resour	utivo Accocc	monte
Texibook	FOIII	lative Assess	sments
Module 7: Exponential Functions 7.1 Graphing Exponential Functions: A All.EL.2, All.DSP.3 7.2 Solving Exponential Equations and Inequalities): All.EL.5 7.3 Special Exponential Functions: All. 7.4 Geometric Sequences and Series (7.5 Modeling Data: All.DSP.3	II.F.4, AII.EL.1, Inequalities (SKIP EL.1, AII.EL.3 SKIP)		

General Description of the Unit			
Now the concept of a logarithm is introduced, and the properties of exponents are extended to simplify			
logarithmic expressions. Then they s	olve logarithmic equ	lations and graph l	ogarithmic functions with and without
technology; this includes using transf	ormations when ap	propriate, identifyin	g key features, and recognizing the
inverse relationship between expone	ntial and logarithmic	c functions. Finally,	students will solve real-world
situations that can be modeled with e	exponential and loga		
Priority Standards		Supporting Stand	lards
• All.EL.1: Graph exponential and log	arithmic functions	• All.EL.4: Use the	e properties of exponents to derive the
with and without technology. Identify	and describe key	properties of loga	arithms. Evaluate exponential and
reatures, such as intercepts, domain	and range, that the inverse of		essions.
an exponential function is a logarithm	nic function	• All.EL.0. Reples	logarithmic functions and solve such
• All EL.5: Solve exponential and loga	rithmic equations	problems with ter	chology Interpret the solutions and
in one variable.	oqualiono	determine wheth	er they are reasonable.
Enduring Understandings		Essential Questic	ons
Exponential functions and logarithmic	c functions are	 How are exponent 	ntial functions and logarithmic
inverses; therefore, their graphs are i	reflections over the	functions related	?
line y=x.		Why are logarith	ms important?
 Using the fact that exponential function 	ons and		
logarithmic functions are inverses, the	e properties of		
exponents can be extended to logarit	thms.		Γ
Key Concepts	Related Concepts	5	Vocabulary
 I can graph logarithmic functions 	 I can use the property 	perties of	Asymptote
with technology. (All.EL.1)	exponents to der	ive the properties	Domain
• I can graph logarithmic functions	of logarithms. (Al	I.EL.4)	End behavior
without technology. (AII.EL.1)	• I can evaluate ex		Initial value
• I can identify and describe key		.CL.4)	Intercepts
such as intercents domain and	• I call evaluate log	FI 4)	Inverse
range, and asymptotic and end	 I can represent re 	eal-world problems	
behavior. (All.EL.1)	using logarithmic	functions in one	Logarithmic function
• I can solve logarithmic equations in	variable. (All.EL.	6)	Properties of exponents
one variable. (All.EL.5)	• I can solve real-w	orld logarithmic	Properties of logarithms
	equations using t	echnology.	Range
	(All.EL.6)		Solution
	I can interpret my solution to a		
	the reasonable as	ion and determine	
			1

Mathematical Processes

- PS.1 Make sense of problems and persevere in solving them.
 PS.4 Model with mathematics.

Resources				
Proficiency Scales	Digital	Manipulatives		
• <u>AII.EL.1</u>	IDOE Examples/Tasks All.EL.1	Graph Paper		
• <u>AII.EL.5</u>	 IDOE Examples/Tasks All.EL.5 	 Graphing Calculator 		
	 IDOE Examples/Tasks All.EL.4 	 Scientific Calculator 		
	 IDOE Examples/Tasks All.EL.6 	 <u>Virtual Graph Paper</u> 		

School Resources				
Textbook	Formative Assessments			
Module 8: Logarithmic Functions 8.1 Logarithms and Logarithmic Functions: All.EL.1, All.EL.4, All.EL.6 8.2 Properties of Logarithms: All.EL.4, All.EL.5, All.EL.6 8.3 Common Logarithms: All.EL.5, All.EL.6 8.4 Natural Logarithms: All.EL.5, All.EL.6 8.5 Using Exponential and Logarithmic Functions: All.EL.5, All.EL.6				

General Description of the Unit

This unit focuses on solving and graphing rational equations; solving equations should include an exploration into extraneous solutions. Additionally, students will write and solve rational equations that model a real-world situation. Finally, students will graph rational equations using technology and will identify key features.

Notes: Section 9.5 is an optional section; direct and indirect variation are the only topics that need to be considered. Section 9.6 only needs to include rational equations and does not need to include rational inequalities. All graphing can be done with technology.

Priority Standards	e with teenhology.	Supporting Stand	lards
 All.ASE.3: Rewrite algebraic rational equivalent forms (e.g., using propertie and factoring techniques). Add, subtr divide algebraic rational expressions. All.PR.3: Solve real-world and other problems involving radical and ration examples showing how extraneous s 	expressions in es of exponents act, multiply, and mathematical nal equations. Give olutions may arise.	 All.PR.2: Graph polynomial funct square root fu absolute valu piecewise-de with technology. intercepts, domain of symmetry. 	mathematical functions including: inctions; ions; unctions; ie functions; and, fined functions Identify and describe features, such as in and range, end behavior, and lines
Enduring Understandings		Essential Questio	ns
 Rational expressions can be simplified and rearranged by applying properties of fractions, factoring, and properties of exponents. Some solutions to rational and radical equations may be extraneous and therefore are invalid solutions to the equation 		 How do I know when a rational function is simplified? Are there any characteristics that all rational functions will share? Why or why not? Is it possible to identify a rational equation as having no real roots just by looking at it? Why or why not? 	
Key Concepts	Related Concepts	5	Vocabulary
 I can rewrite algebraic rational expressions in equivalent forms using the properties of exponents. (AII.ASE.3) I can rewrite algebraic rational expressions in equivalent forms using factoring techniques. (AII.ASE.3) I can add and subtract rational expressions with common denominators. (AII.ASE.3) I can add and subtract rational expressions without common denominators. (AII.ASE.3) I can multiply and divide rational expressions. (AII.ASE.3) I can solve real-world problems involving rational functions. (AII.PR.3) I can solve mathematical problems involving rational functions. (AII.PR.3) I can solve mathematical problems involving rational functions. (AII.PR.3) I can solve mathematical problems involving rational functions. (AII.PR.3) I can solve mathematical problems involving rational functions. (AII.PR.3) I can identify and understand extraneous solutions and the situations in which they arise. (AII.PR.3) 	 I can graph polyn with technology. I can graph ratior technology. (AII.F I can graph squar with technology. I can graph absol functions with technology. I can graph piece functions with technology. I can graph piece functions with technology. I can graph math and identify and of features such as and range, end b of symmetry. (AII.F) 	aomial functions (AII.PR.2) hal functions with PR.2) re root functions (AII.PR.2) lute value shnology. ewise defined shnology. ematical functions describe key intercepts, domain ehavior, and lines .PR.2)	 Absolute value function Algebraic rational expression Asymptote Common denominator Domain End behavior Extraneous solution Intercept Line of symmetry Piecewise function Polynomial function Properties of exponents Range Rational function Rational numbers Square-root function

Mathematical Processes			
 PS.1 Make sense of problems and period 	ersevere in solving tl	nem.	
 PS.7 Look for and make use of struct 	ture.		
	Reso	urces	
Proficiency Scales	Digital		Manipulatives
• All.ASE.3	IDOE Examples	Tasks All.ASE.3	Graph Paper
• All.PR.3	IDOE Examples	Tasks All.PR.3	Graphing Calculator
	IDOE Examples	Tasks All.PR.2	 <u>Scientific Calculator</u>
			<u>Virtual Graph Paper</u>
	School R	esources	
Textbook		Formative Assess	sments
Module 9: Rational Functions 9.1 Multiplying and Dividing Rational E All.ASE.3 9.2 Adding and Subtracting Rational E All.ASE.3 9.3 Graphing Reciprocal Functions: All 9.4 Graphing Rational Functions: All.P 9.5 Variation: All.PR.2 (Optional) 9.6 Solving Rational Equations and Ine Inequalities): All.PR.3	xpressions: xpressions: I.PR.2 R.2 equalities (SKIP		

General Description of the Unit

In this unit, students work with statistics involving both univariate and bivariate data, two topics with which students have had extensive exposure in past courses. For univariate data, the key new topics for students are standard deviation and variance. The other analysis tools (measures of center, range, inter-quartile range, outliers) have been taught in previous grades. Students will also explore best practices in statistics and will apply these practices to design experiments.

For probability, students will utilize the fundamental counting principle, permutations, and combinations to calculate probabilities of various events. Students will examine the difference between independent, mutually exclusive, and dependent events and use these concepts to calculate probabilities. Finally, students will compare theoretical models with the results of a simulation.

Priority Standards		Supporting Standards		
• All.DSP.6: Understand the Fundame Principle, permutations, and combina concepts to calculate probabilities.	ntal Counting tions; apply these	 All.DSP.1: Disting random sampling bias in sampling, controlled and red a good survey an simple experiment answer questions sample results. All.DSP.2: Interp measures of cent (range, inter-quar variance). Unders statistical summa All.DSP.4: Using specified model is a theoretical mod to show the relation of the show the relation All.DSP.5: Under events, and condi- concepts to calcular 	guish between random and non- methods, identify possible sources of describe how such bias can be duced, evaluate the characteristics of d well-designed experiment, design its or investigations to collect data to a of interest, and make inferences from ret and compare univariate data using er (mean and median) and spread tile range, standard deviation, and stand the effects of outliers on the ry of the data. the results of a simulation, decide if a s consistent to those results. Construct el and apply the law of large numbers onship between the two models. rstand dependent and independent itional probability; apply these late probabilities.	
Enduring Understandings		Essential Questio	ns	
 Enduring Understandings Analyzing the spread, center, and outliers of data along with graphical displays gives a statistical summary of the data set. Models for data can be used to make predictions; it is important to pick the best model (e.g., linear, quadratic, exponential) for each data set. It is important to have well designed experiments; sampling methods, survey questions, and experiment protocols all need to be considered. When two events are dependent, one event influences the probability of the other and needs to be considered when calculating the probability of both events. Theoretical probability is the expected probability that an event happens; experimental probability is the result from an actual experiment. These two probabilities can be compared to find discrepancies in the results. 		 Why is it important to be able to represent data using graphs and measures of central tendency? How are measures of central tendency different from standard deviation? Why is it important to know if events are dependent or independent when calculating probabilities? How can probabilities be used to analyze and make fair decisions? In an excellent simulation, will the theoretical probability and experimental probability be the same? Why or why not? 		
Key Concepts	Related Concepts		Vocabulary	

- I can effectively communicate the Fundamental Counting Principle. (AII.DSP.6)
- I can distinguish between a permutation and a combination. (AII.DSP.6)
- I can apply the properties of permutations and combinations to calculate probabilities. (AII.DSP.6)
- I can understand the necessity for and use of factorial notation. (AII.DSP.6)
- I can use factorial notation when calculating permutations and combinations. (AII.DSP.6)

- I can determine whether a sampling method was random or non-random. (AII.DSP.1)
- I can identify various sampling methods, including, but not limited to, simple random sampling, stratified random sampling, stratified and convenience sampling. (AII.DSP.1)
- I can determine if there is bias present in a sampling method. (AII.DSP.1)
- I can suggest ways to control and prevent bias in sampling. (AII.DSP.1)
- I can give qualities of a good survey or experiment. (All.DSP.1)
- I can use the results from a sample to make inferences about a population. (AII.DSP.1)
- I can design simple experiments to collect data to answer questions. (AII.DSP.1)
- I can interpret and compare univariate data using measures of center, including median and mean. (AII.DSP.2)
- I can interpret and compare univariate data using measures of spread, including range, interquartile range, standard deviation, and variance. (AII.DSP.2)
- I can identify outliers, if any, in a data set. (AII.DSP.2)
- I can effectively communicate the effects of outliers on the statistical summary of univariate data. (AII.DSP.2)
- I can use the results of a simulation to decide if a specified model is consistent to those results. (AII.DSP.4)
- I can construct a theoretical model. (AII.DSP.4)
- I can apply the law of large numbers to show the relationship between a theoretical model and an empirical model. (AII.DSP.4)
- I can distinguish between dependent, independent events and conditional probability. (AII.DSP.5)
- I can apply properties of dependent events and independent events to calculate probabilities. (AII.DSP.5)

- Bias
- Combination
- Conditional probability
- Dependent event
- Empirical model
- Experiment
- Factorial
- Fundamental Counting Principle
- Independent event
- Inference
- Interquartile range (IQR)
- Law of Large Numbers
- Mean
- Median
- Non Random sampling
- Outlier
- Permutation
- Random sampling
- Range
- Simulation
- Standard deviation
- Survey
- Theoretical model
- Univariate data
- Variance

Mathematical Processes

• PS.2 Reason abstractly and quantitatively.

• PS.3 Construct convincing arguments and critique the reasoning of others.

Resources						
Proficiency Scales	Digital		Manipulatives			
• <u>AII.DSP.6</u>	IDOE Examples/Tasks All.DSP.6		Graph Paper			
	 IDOE Examples/Tasks All.DSP.1 		<u>Scientific Calculator</u>			
	IDOE Examples/Tasks All.DSP.2		• <u>Spinner</u>			
	IDOE Examples/Tasks All.DSP.4		Univariate Data Displays Virtual Graph Paper			
• IDUE Examples/Tasks All.DSP.5 • Virtual Graph Paper						
Taxthook			amonto			
Texibook		Formative Asses:	sments			
Module 10: Inferential Statistics 10.1 Random Sampling: AII.DSP.1 10.2 Using Statistical Experiments: AII.DSP.4 Supplement: Probability DSP.5 and DSP.6 10.3 Analyzing Population data: AII.DSP.2 10.4 Normal Distributions: AII.DSP.2 10.5 Estimating Population Parameters: AII.DSP.1						