# Algebra 2: Year at a Glance

## First Semester

| **Unit**  | **Functions** **On-Level: ≈ 29 days** **Honors: ≈ 27 days**  | **Quadratic Functions, Equations, and Relations** **On-Level: ≈ 50 days** **Honors: ≈ 43 days**  |
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| **TEKS**  |  **2A**, 2B, 2D, **6C**, 6D, **6E**, **6F**, **7I**, 8B, 8C   |  **3A**, 3B, **3C**, 3D, **3E**, 3F, 3G, 4A, **4B**, **4D**, 4E, **4F**, 4H, 7A, 8B, 8C  |
| **Stage One Snapshot**  | * Use mathematical notation (inequality, set, interval, function, and inverse notation)
* Analyze key attributes of graphs (intercepts, domain, range, symmetry, max/min values)
* Transform function graphs
* Inverse functions (graph, write, prove using compositions, and analyze relationships)
* Evaluate composite functions
* Absolute value function family and equations
 | * Identify attributes of quadratic functions in different forms and converting between forms
* Write the equation of a parabola in various forms using given attributes
* Fit quadratic functions to data
* Perform operations with complex numbers
* Solve quadratic equations and inequalities with various methods
* Solve systems of equations and inequalities (3 variable, linear-quadratic, linear inequalities)
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## Second Semester

| **Unit**  | **Polynomial Functions, Expressions and Equations** **On-Level: ≈ 16 days** **Honors: ≈ 8 days (First Semester)** **Honors: ≈ 11 days (Second Semester),**  | **Rational Functions, Expressions, and Equations** **On-Level: ≈ 17 days** **Honors: ≈ 20 days**  |
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| **TEKS**  |  **2A,** **6A**, 7A, 7B, **7C**, 7D, **7E**  |  **2A,** **6G,** 6H, **6I,** 6J, **6K,** 6L, **7F**  |
| **Stage One Snapshot**  | * Graph and transform cubic functions
* Add, subtract, multiply, factor, and divide polynomials (1st Sem for Honors)

+ Graph polynomial functions of higher order + Solve polynomial equations of higher order   | * Solve problems involving inverse variation
* Graph rational functions by transformations and attributes
* Multiply and divide rational expressions
* Add and subtract rational expressions
* Solve rational equations
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| **Unit**  | **Radical Functions, Expressions, and Equations** **On-Level: ≈ 22 days** **Honors: ≈ 18 days**  | **Exponential and Logarithmic Functions and Equations** **On-Level: ≈ 29 days** **Honors: ≈ 32 days**  |
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| **TEKS**  |  **2A**, 2B, **2C**, **4C**, 4E, **4F**, 4G, **6A**, **6B**, **7G**, **7H**  |  **2A**, **2C**, **5A**, 5B, **5C**, **5D**, 5E, 8A, 8B, 8C  |
| **Stage One Snapshot**  | * Analyze the relationship involving the inverse functions of quadratic and cubic functions
* Graph and transform square root and cube root functions
* Fit square root functions to data
* Radical expressions and rational exponents
* Solve radical equations
 | * Write explicit and recursive rules for geometric sequences
* Identify exponential growth and decay functions
* Graph and transform logarithmic and exponential functions with different bases (e.g. 2, 10, and *e*)
* Fit exponential functions to data
* Choose among linear, quadratic, and exponential models
* Define and evaluate logarithmic functions
* Use properties of logarithms (power, product, quotient) • Solve exponential and logarithmic equations

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# Texas Essential Knowledge and Skills

A2.(1) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

1. apply mathematics to problems arising in everyday life, society, and the workplace;
2. use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;
3. select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;  **(D)** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;
4. create and use representations to organize, record, and communicate mathematical ideas;
5. analyze mathematical relationships to connect and communicate mathematical ideas; and
6. display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

A2.(2) **Attributes of functions and their inverses**. The student applies mathematical processes to understand that functions have distinct key attributes & understand the relationship between a function & its inverse. The student is expected to:

Ⓡ **(A)** graph the functions *f(x)=*√*x, f(x)=*1*/x, f(x)=x*3*, f(x)=* 3√*x, f(x)=bx, f(x)=|x|,* and *f(x)=logb (x)* where *b* is 2, 10, and *e*, and, when applicable, analyze the key attributes such as domain, range, intercepts, symmetries, asymptotic behavior, and maximum and minimum given an interval;

(B) graph and write the inverse of a function using notation such as *f* -1 (*x*);

Ⓡ **(C)** describe and analyze the relationship between a function and its inverse (quadratic and square root, logarithmic and exponential), including the restriction(s) on domain, which will restrict its range; and

(D) use the composition of two functions, including the necessary restrictions on the domain, to determine if the functions are inverses of each other.

A2.(3) **Systems of equations and inequalities**. The student applies mathematical processes to formulate systems of equations and inequalities, use a variety of methods to solve, and analyze reasonableness of solutions. The student is expected to:

Ⓡ **(A)** formulate systems of equations, including systems consisting of three linear equations in three variables and systems consisting of two equations, the first linear and the second quadratic;

Ⓡ **(B)** solve systems of three linear equations in three variables by using Gaussian elimination, technology with matrices, and substitution;

1. solve, algebraically, systems of two equations in two variables consisting of a linear equation and a quadratic equation;
2. determine the reasonableness of solutions to systems of a linear equation and a quadratic equation in two variables;
3. formulate systems of at least two linear inequalities in two variables;
4. solve systems of two or more linear inequalities in two variables; and
5. determine possible solutions in the solution set of systems of two or more linear inequalities in two variables.

A2.(4) **Quadratic and square root functions, equations, and inequalities**. The student applies mathematical processes to understand that quadratic and square root functions, equations, and quadratic inequalities can be used to model situations, solve problems, and make predictions. The student is expected to:

(A) write the quadratic function given three specified points in the plane;

Ⓡ **(B)** write the equation of a parabola using given attributes, including vertex, focus, directrix, axis of symmetry, and direction of opening;

Ⓡ **(C)** determine the effect on the graph of *f(x) =* √*x* when *f(x)* is replaced by *af(x), f(x) + d, f(bx)*, and *f(x* - *c)* for specific positive and negative values of *a, b, c,* and *d*;

1. transform a quadratic function *f(x) = ax*2 *+ bx + c* to the form *f(x) = a(x - h)*2 *+ k* to identify the different attributes of *f(x)*;
2. formulate quadratic and square root equations using technology given a table of data;

Ⓡ **(F)** solve quadratic and square root equations;

(G) identify extraneous solutions of square root equations; and (H) solve quadratic inequalities.

A2.(5) **Exponential and logarithmic functions and equations**. The student applies mathematical processes to understand that exponential & logarithmic functions can be used to model situations & solve problems. The student is expected to:

Ⓡ **(A)** determine the effects on the key attributes on the graphs of *f(x) = bx* and *f(x) = logb (x)* where *b* is 2, 10, and *e* when *f(x)* is replaced by *af(x), f(x) + d,* and *f(x - c)* for specific positive and negative real values of *a, c,* and *d*;

1. formulate exponential and logarithmic equations that model real-world situations, including exponential relationships written in recursive notation;
2. rewrite exponential equations as their corresponding logarithmic equations and logarithmic equations as their corresponding exponential equations;

Ⓡ **(D)** solve exponential equations of the form *y = abx* where *a* is a nonzero real number and *b* is greater than zero and not equal to one and single logarithmic equations having real solutions; and (E) determine the reasonableness of a solution to a logarithmic equation.

A2.(6) **Cubic, cube root, absolute value and rational functions, equations, and inequalities**. The student applies mathematical processes to understand that cubic, cube root, absolute value and rational functions, equations, and inequalities can be used to model situations, solve problems, and make predictions. The student is expected to:  **(A)** analyze the effect on the graphs of *f(x) = x*3 and *f(x)* = 3√*x* when *f(x)* is replaced by *af(x), f(bx), f(x - c)*, and *f(x)* + *d* for specific positive and negative real values of *a, b, c,* and *d*;

1. solve cube root equations that have real roots;
2. analyze the effect on the graphs of *f(x) = |x|* when *f(x)* is replaced by *af(x), f(bx)*, *f(x-c)*, and *f(x)* + *d* for specific positive and negative real values of *a, b, c,* and *d*;
3. formulate absolute value linear equations;

Ⓡ **(E)** solve absolute value linear equations;

1. solve absolute value linear inequalities;
2. analyze the effect on the graphs of f(x) = 1/x when *f(x)* is replaced by *af(x), f(bx)*, *f(x*-*c)*, and *f(x)* + *d* for specific positive and negative real values of *a, b, c,* and *d*;
3. formulate rational equations that model real-world situations;

Ⓡ **(I)** solve rational equations that have real solutions;

1. determine the reasonableness of a solution to a rational equation;
2. determine the asymptotic restrictions on the domain of a rational function and represent domain and range using interval notation, inequalities, and set notation; and

Ⓡ (L) formulate and solve equations involving inverse variation.

A2.(7) **Number and algebraic methods**. The student applies mathematical processes to simplify and perform operations on expressions and to solve equations. The student is expected to:

1. add, subtract, and multiply complex numbers;
2. add, subtract, and multiply polynomials;
3. determine the quotient of a polynomial of degree three and of degree four when divided by a polynomial of degree one and of degree two;
4. determine the linear factors of a polynomial function of degree three and of degree four using algebraic methods;

Ⓡ **(E)** determine linear and quadratic factors of a polynomial expression of degree three and of degree four, including factoring the sum and difference of two cubes and factoring by grouping;

Ⓡ **(F)** determine the sum, difference, product, and quotient of rational expressions with integral exponents of degree one and of degree two;

 **(G)** rewrite radical expressions that contain variables to equivalent forms;

Ⓡ **(H)** solve equations involving rational exponents; and

 **(I)** write the domain and range of a function in interval notation, inequalities, and set notation.

A2.(8) **Data**. The student applies mathematical processes to analyze data, select appropriate models, write corresponding functions, and make predictions. The student is expected to:

(A) analyze data to select the appropriate model from among linear, quadratic, and exponential models; (B) use regression methods available through technology to write a linear function, a quadratic function, and an exponential function from a given set of data; and

Ⓡ (C) predict and make decisions and critical judgments from a given set of data using linear, quadratic, and exponential models.