

# Algebra II

## Mathematical process standards

**1.** The student uses mathematical processes to acquire and demonstrate mathematical understanding [AII.1](#)

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**A** apply mathematics to problems arising in everyday life, society, and the workplace [AII.1.A](#)

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**B** use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining the solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution [AII.1.B](#)

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**C** 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 [AII.1.C](#)

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**D** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate [AII.1.D](#)

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**E** create and use representations to organize, record, and communicate mathematical ideas [AII.1.E](#)

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**F** analyze mathematical relationships to connect and communicate mathematical ideas [AII.1.F](#)

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**G** display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication [AII.1.G](#)

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## Attributes of functions and their inverses [AII.2](#)

**2.** The student applies mathematical processes to understand that functions have distinct key attributes and understand the relationship between a function and its inverse [AII.2](#)

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**A** graph the functions  $f(x)=\sqrt{x}$ ,  $f(x)=1/x$ ,  $f(x)=x^3$ ,  $f(x)=\sqrt[3]{x}$ ,  $f(x)=bx$ ,  $f(x)=|x|$ , and  $f(x)=\log_b(x)$  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 [AII.2.A](#)

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**B** graph and write the inverse of a function using notation such as  $f^{-1}(x)$  [AII.2.B](#)

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**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 [AII.2.C](#)

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**D** use the composition of two functions, including the necessary restrictions on the domain, to determine if the functions are inverses of each other [AII.2.D](#)

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**Systems of equations and inequalities**

**3.** The student applies mathematical processes to formulate systems of equations and inequalities, use a variety of methods to solve, and analyze reasonableness of solutions [AII.3](#)

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**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 [AII.3.A](#)

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**B** solve systems of three linear equations in three variables by using Gaussian elimination, technology with matrices, and substitution [AII.3.B](#)

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**C** solve, algebraically, systems of two equations in two variables consisting of a linear equation and a quadratic equation [AII.3.C](#)

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**D** determine the reasonableness of solutions to systems of a linear equation and a quadratic equation in two variables [AII.3.D](#)

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**E** formulate systems of at least two linear inequalities in two variables [AII.3.E](#)

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**F** solve systems of two or more linear inequalities in two variables [AII.3.F](#)

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**G** determine possible solutions in the solution set of systems of two or more linear inequalities in two variables [AII.3.G](#)

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**Quadratic and square root functions, equations, and inequalities**

**4.** 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 [AII.4](#)

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**A** write the quadratic function given three specified points in the plane [AII.4.A](#)

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**B** write the equation of a parabola using given attributes, including vertex, focus, directrix, axis of symmetry, and direction of opening [AII.4.B](#)

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**C** determine the effect on the graph of  $f(x) = \sqrt{x}$  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  $d$  [AII.4.C](#)

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**D** 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  $f(x)$  [AII.4.D](#)

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**E** formulate quadratic and square root equations using technology given a table of data [AII.4.E](#)

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**F** solve quadratic and square root equations [AII.4.F](#)

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**G** identify extraneous solutions of square root equations [AII.4.G](#)

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**H** solve quadratic inequalities [AII.4.H](#)

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**Exponential and logarithmic functions and equations**

**5.** The student applies mathematical processes to understand that exponential and logarithmic functions can be used to model situations and solve problems [AII.5](#)

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**A** determine the effects on the key attributes on the graphs of  $f(x) = b^x$  and  $f(x) = \log_b(x)$  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  $d$  [AII.5.A](#)

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**B** formulate exponential and logarithmic equations that model real-world situations, including exponential relationships written in recursive notation [AII.5.B](#)

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**C** rewrite exponential equations as their corresponding logarithmic equations and logarithmic equations as their corresponding exponential equations [AII.5.C](#)

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**D** solve exponential equations of the form  $y = ab^x$  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 [AII.5.D](#)

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**E** determine the reasonableness of a solution to a logarithmic equation [AII.5.E](#)

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**Cubic, cube root, absolute value and rational functions, equations, and inequalities**

**6.** 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 [AII.6](#)

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**A** analyze the effect on the graphs of  $f(x) = x^3$  and  $f(x) = \sqrt[3]{x}$  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  $d$  [AII.6.A](#)

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**B** solve cube root equations that have real roots [AII.6.B](#)

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**C** 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  $d$  [AII.6.C](#)

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**D** formulate absolute value linear equations [AII.6.D](#)

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**E** solve absolute value linear equations [AII.6.E](#)

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**F** solve absolute value linear inequalities [AII.6.F](#)

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**G** 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  $d$  [AII.6.G](#)

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**H** formulate rational equations that model real-world situations [AII.6.H](#)

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**I** solve rational equations that have real solutions [AII.6.I](#)

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**J** determine the reasonableness of a solution to a rational equation [AII.6.J](#)

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**K** determine the asymptotic restrictions on the domain of a rational function and represent domain and range using interval notation, inequalities, and set notation [AII.6.K](#)

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**L** formulate and solve equations involving inverse variation [AII.6.L](#)

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**Number and algebraic methods**

**7.** The student applies mathematical processes to simplify and perform operations on expressions and to solve equations [AII.7](#)

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**A** add, subtract, and multiply complex numbers [AII.7.A](#)

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**B** add, subtract, and multiply polynomials [AII.7.B](#)

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**C** 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 [AII.7.C](#)

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**D** determine the linear factors of a polynomial function of degree three and of degree four using algebraic methods [.7.D](#)

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**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 [.7.E](#)

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**F** determine the sum, difference, product, and quotient of rational expressions with integral exponents of degree one and of degree two [.7.F](#)

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**G** rewrite radical expressions that contain variables to equivalent forms [AII.7.G](#)

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**H** solve equations involving rational exponents [AII.7.H](#)

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**I** write the domain and range of a function in interval notation, inequalities, and set notation [AII.7.I](#)

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**Data**

**8.** The student applies mathematical processes to analyze data, select appropriate models, write corresponding functions, and make predictions [AII.8](#)

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**A** analyze data to select the appropriate model from among linear, quadratic, and exponential models [AII.8.A](#)

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**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 [AII.8.B](#)

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**C predict and make decisions and critical judgments from a given set of data using linear, quadratic, and exponential models** **AII.8.C**