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§111.33. Algebra II (One-Half to One Credit).

- (a) Basic understandings.
- (1) Foundation concepts for high school mathematics. As presented in Grades K-8, the basic understandings of number, operation, and quantitative reasoning; patterns, relationships, and algebraic thinking; geometry; measurement; and probability and statistics are essential foundations for all work in high school mathematics. Students continue to build on this foundation as they expand their understanding through other mathematical experiences.
 - (2) Algebraic thinking and symbolic reasoning. Symbolic reasoning plays a critical role in algebra; symbols provide powerful ways to represent mathematical situations and to express generalizations. Students study algebraic concepts and the relationships among them to better understand the structure of algebra.
 - (3) Functions, equations, and their relationship. The study of functions, equations, and their relationship is central to all of mathematics. Students perceive functions and equations as means for analyzing and understanding a broad variety of relationships and as a useful tool for expressing generalizations.
 - (4) Relationship between algebra and geometry. Equations and functions are algebraic tools that can be used to represent geometric curves and figures; similarly, geometric figures can illustrate algebraic relationships. Students perceive the connections between algebra and geometry and use the tools of one to help solve problems in the other.

- (5) Tools for algebraic thinking. Techniques for working with functions and equations are essential in understanding underlying relationships. Students use a variety of representations (concrete, numerical, algorithmic, graphical), tools, and technology, including, but not limited to, powerful and accessible hand-held calculators and computers with graphing capabilities and model mathematical situations to solve meaningful problems.
- (6) Underlying mathematical processes. Many processes underlie all content areas in mathematics. As they do mathematics, students continually use problem-solving, computation in problem-solving contexts, language and communication, connections within and outside mathematics, and reasoning, as well as multiple representations, applications and modeling, and justification and proof.

(b) **Foundations for functions:** knowledge and skills and performance descriptions.

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| <ul style="list-style-type: none"> (1) The student uses properties and attributes of functions and applies functions to problem situations. | <p>Following are performance descriptions.</p> <ul style="list-style-type: none"> (A) For a variety of situations, the student identifies the mathematical domains and ranges and determines reasonable domain and range values for given situations. (B) In solving problems, the student collects data and records results, organizes the data, makes scatterplots, fits the curves to the appropriate parent function, interprets the results, and proceeds to model, predict, and make decisions and critical judgments. |
| <ul style="list-style-type: none"> (2) The student understands the importance of the skills required to manipulate symbols in order to solve problems and uses the necessary algebraic skills required to simplify algebraic expressions and solve equations and inequalities in problem situations. | <p>Following are performance descriptions.</p> <ul style="list-style-type: none"> (A) The student uses tools including matrices, factoring, and properties of exponents to simplify expressions and transform and solve equations. (B) The student uses complex numbers to describe the solutions of quadratic equations. (C) The student connects the function notation of $y =$ and $f(x) =$. |
| <ul style="list-style-type: none"> (3) The student formulates systems of equations and inequalities from problem situations, uses a variety of methods to solve them, and analyzes the solutions in terms of the situations. | <p>Following are performance descriptions.</p> <ul style="list-style-type: none"> (A) The student analyzes situations and formulates systems of equations or inequalities in two or more unknowns to solve problems. (B) The student uses algebraic methods, graphs, tables, or matrices, to solve systems of equations or inequalities. |

- (C) For given contexts, the student interprets and determines the reasonableness of solutions to systems of equations or inequalities.

(c) **Algebra and geometry:** knowledge and skills and performance descriptions.

- (1) The student connects algebraic and geometric representations of functions.

Following are performance descriptions.

- (A) The student identifies and sketches graphs of parent functions, including linear ($y = x$), quadratic ($y = x^2$), square root ($y = \sqrt{x}$), inverse ($y = 1/x$), exponential ($y = a^x$), and logarithmic ($y = \log_a x$) functions.
- (B) The student extends parent functions with parameters such as m in $y = mx$ and describes parameter changes on the graph of parent functions.
- (C) The student recognizes inverse relationships between various functions.

- (2) The student knows the relationship between the geometric and algebraic descriptions of conic sections.

Following are performance descriptions.

- (A) The student describes a conic section as the intersection of a plane and a cone.
- (B) In order to sketch graphs of conic sections, the student relates simple parameter changes in the equation to corresponding changes in the graph.
- (C) The student identifies symmetries from graphs of conic sections.
- (D) The student identifies the conic section from a given equation.
- (E) The student uses the method of completing the square.

(d) **Quadratic and square root functions:** knowledge and skills and performance descriptions.

- (1) The student understands that quadratic functions can be represented in different ways and translates among their various representations.

Following are performance descriptions.

- (A) For given contexts, the student determines the reasonable domain and range values of quadratic functions, as well as interprets and determines the reasonableness of solutions to quadratic equations and inequalities.

- (2) The student interprets and describes the effects of changes in the parameters of quadratic functions in applied and mathematical situations.
 - (B) The student relates representations of quadratic functions, such as algebraic, tabular, graphical, and verbal descriptions.
 - (C) The student determines a quadratic function from its roots or a graph.

Following are performance descriptions.

- (A) The student uses characteristics of the quadratic parent function to sketch the related graphs and connects between the $y = ax^2 + bx + c$ and the $y = a(x - h)^2 + k$ symbolic representations of quadratic functions.
- (B) The student uses the parent function to investigate, describe, and predict the effects of changes in a , h , and k on the graphs of $y = a(x - h)^2 + k$ form of a function in applied and purely mathematical situations.

- (3) The student formulates equations and inequalities based on quadratic functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation.

Following are performance descriptions.

- (A) The student analyzes situations involving quadratic functions and formulates quadratic equations or inequalities to solve problems.
- (B) The student analyzes and interprets the solutions of quadratic equations using discriminants and solves quadratic equations using the quadratic formula.
- (C) The student compares and translates between algebraic and graphical solutions of quadratic equations.
- (D) The student solves quadratic equations and inequalities.

- (4) The student formulates equations and inequalities based on square root functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation.

Following are performance descriptions.

- (A) The student uses the parent function to investigate, describe, and predict the effects of parameter changes on the graphs of square root functions and describes limitations on the domains and ranges.
- (B) The student relates representations of square root functions, such as algebraic, tabular, graphical, and verbal descriptions.

- (C) For given contexts, the student determines the reasonable domain and range values of square root functions, as well as interprets and determines the reasonableness of solutions to square root equations and inequalities.
- (D) The student solves square root equations and inequalities using graphs, tables, and algebraic methods.
- (E) The student analyzes situations modeled by square root functions, formulates equations or inequalities, selects a method, and solves problems.
- (F) The student expresses inverses of quadratic functions using square root functions.

(e) **Rational functions:** knowledge and skills and performance descriptions.

The student formulates equations and inequalities based on rational functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation.

Following are performance descriptions.

- (1) The student uses quotients to describe the graphs of rational functions, describes limitations on the domains and ranges, and examines asymptotic behavior.
- (2) The student analyzes various representations of rational functions with respect to problem situations.
- (3) For given contexts, the student determines the reasonable domain and range values of rational functions, as well as interprets and determines the reasonableness of solutions to rational equations and inequalities.
- (4) The student solves rational equations and inequalities using graphs, tables, and algebraic methods.
- (5) The student analyzes a situation modeled by a rational function, formulates an equation or inequality composed of a linear or quadratic function, and solves the problem.
- (6) The student uses direct and inverse variation functions as models to make predictions in problem situations.

(f) **Exponential and logarithmic functions:** knowledge and skills and performance descriptions.

The student formulates equations and inequalities based on exponential and logarithmic functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation.

Following are performance descriptions.

- (1) The student develops the definition of logarithms by exploring and describing the relationship between exponential functions and their inverses.
- (2) The student uses the parent functions to investigate, describe, and predict the effects of parameter changes on the graphs of exponential and logarithmic functions, describes limitations on the domains and ranges, and examines asymptotic behavior.
- (3) For given contexts, the student determines the reasonable domain and range values of exponential and logarithmic functions, as well as interprets and determines the reasonableness of solutions to exponential and logarithmic equations and inequalities.
- (4) The student solves exponential and logarithmic equations and inequalities using graphs, tables, and algebraic methods.
- (5) The student analyzes a situation modeled by an exponential function, formulates an equation or inequality, and solves the problem.

Source: The provisions of this §111.33 adopted to be effective September 1, 1996, 21 TexReg 7371.

§111.34. Geometry (One Credit).

(a) Basic understandings.

- (1) Foundation concepts for high school mathematics. As presented in Grades K-8, the basic understandings of number, operation, and quantitative reasoning; patterns, relationships, and algebraic thinking; geometry; measurement; and probability and statistics are essential foundations for all work in high school mathematics. Students continue to build on this foundation as they expand their understanding through other mathematical experiences.
- (2) Geometric thinking and spatial reasoning. Spatial reasoning plays a critical role in geometry; shapes and figures provide powerful ways to represent mathematical situations and to express generalizations about space and spatial relationships. Students use geometric thinking to understand mathematical concepts and the relationships among them.
- (3) Geometric figures and their properties. Geometry consists of the study of geometric figures of zero, one, two, and three dimensions and the relationships among them. Students study properties and relationships having to do with size, shape, location, direction, and orientation of these figures.