Major Work of Secondary Mathematics II

The purpose of this document is to provide a brief overview of the most essential content in the grade level along with a progression of how the content was addressed in the prior grade level and will prepare students for content in the future grade level. This is not a comprehensive list of content in the grade level as defined in the Utah Core Standards, but rather highlights the major work of the grade level.

Major Work of Grade Band: Grades 9 - 11

- Create, interpret, manipulate, and solve algebraic equations.
- Understand, compare, and represent functions (defined by rates of change, multiple representations and building functions)
- Describe characteristics of functions (definition of function, transformations, features of functions)
- Understand, apply, and prove congruence and similarity as defined in terms of geometric transformations

Vertical Alignment of Major Work

Major Work: Solve Algebraic Equations (linear, exponential, and quadratic)

***Prior grades*:** In Secondary Math I, students Interpret the structure of linear and exponential expressions (SI.A.SSE.1). Create equations and inequalities in one two or more variables and use them to solve problems (SI.A.CED.1-4). Solve equations and inequalities in one or two variables and systems of linear equations exactly and approximately (numerically, algebraically, and graphically) with pairs of linear equations in two variables (SI.A.REI.3,5-6).

Secondary Math II: Create and Solve Equations (linear, exponential, and quadratic): Rewrite and reveal aspects of expressions (SII.A.SSE.1-3). Create and solve equations, inequalities, and systems of equations, extending to include quadratic relationships (SII.A.CED.1,2; A.REI.4,7). Extend the number system to include complex numbers when real solutions do not exist. (SII.N.RN.1-3; SII.N.CN.7,8).

***Future grades*:** Perform arithmetic operations on polynomials, extending beyond the quadratic polynomials and including rationals and understand the relationship between zeros and factors (SIII.A.APR.1-7). Solve polynomial, rational, radical, logarithmic and trigonometric functions (SIII.A.REI.2; SIII.F.BF.4; SIII.F.TF.7; SIII.A.CED.1-4).

Major Work: Understand, Compare, and Represent Functions

Prior grades: Students use function notation to represent linear and exponential functions, including arithmetic and geometric sequences. Understand, compare, and represent linear and exponential functions (SI.F.BF.1-3; SI.F.LE.2) including: Calculate and interpret the average rate of change of a function (SI.F.IF.6; SI.S.ID.7). Interpret and compare different representations of functions (SI.F.IF.7,9), Represent and solve equations and inequalities graphically (SI.A.REI.10-12). Distinguish between situations that can be modeled with linear functions and with exponential functions (SI.F.LE.1).

Secondary Math II: Understand and Represent Functions: Compare key characteristics of quadratic functions to those of linear and exponential functions. Interpret different forms of quadratic functions. Expand experience to include absolute value, step, and functions that are piecewise-defined (SII.F.IF.4,5,7-9; SII.F.BF.1,3).

Future grades: Building on prior knowledge of functions, students will extend to polynomial, rational, trigonometric, logarithmic and inverse functions. Create and interpret various representations of functions (SIII.A.CED.2,4; SIII.F.IF.6-9; SIII.F.BF.1; SIII.F.LE.3).

Major Work: Describe Characteristics of Functions

Prior grades: Students described characteristics of a linear or exponential functions (SI.F.IF.1-3). Interpret key features of graphs that model a relationship between two quantities (SI.IF.4-5), and compare (on a graph or a table) the relationship between linear and exponential functions (SI.F.LE.3) and interpret the parameters of such functions in terms of context (SI.F.LE.5; SI.S.ID.6).

Secondary Math II: *Describe Characteristics of Functions:* Interpret and analyze quadratic functions (SII.F.IF.4-6) using different representations (SII.F.IF.7-9). Build a function that models a relationship between two quantities (SII.F.BF.1). Build new functions from existing functions (SII.F.BF.3).

Future grades: Extend to all available function types as well as the normal curve to identify key characteristics. (SIII.F.IF.4-7; SIII.F.BF.3; SIII.F.TF.5; SIII.S.ID.4; SIII.A.REI.11).

Major Work: Prove Congruence and Similarity in terms of Geometric Transformations

Prior grades: In prior grades, students explored properties of rotations, reflections, and translations that maintain congruent figures (8.G.1-4). In Secondary Math I, students applied properties of rigid motions to extend understanding of congruence and correspondence to determine congruency (SI.G.CO.6-8). Represent and compare transformations in the plane (SI.G.CO.2-5) and prove simple geometric theorems algebraically (SI.G.GPE.4-5,7).

Secondary Math II: Prove Congruence and Similarity in terms of geometric transformations: Verify properties of dilations (SII.G.SRT.1), decide whether two figures are similar (SII.G.SRT.2), and prove geometric theorems related to congruence (SII.G.CO.9-11) and similarity and develop trigonometric ratios for sides of right triangles (SII.G.SRT.4-8).

Future Grades: In Secondary Math III, students will extend their understanding of similarity and congruence of right triangles to the unit circle and apply to general triangles as well (SIII.F.TF,1-3; SIII.G.SRT.9-11). They will continue modeling with geometry and applying geometric principles.

Mathematical Modeling:

Mathematical modeling is a "process that uses mathematics to represent, analyze, make predictions or otherwise provide insight into real-world phenomena" (GAIMME, 2016). It is a conceptual priority at the high school level and is a curricular goal that is incorporated regularly. Standards that are marked with a (★) indicate distinct opportunities to engage with modeling in the *Utah Core Standards*. Modeling activities may extend across multiple standards.
The following relate to modeling in Secondary Mathematics II:
- *Produce, interpret, and use expressions, equations and functions to model real-world phenomena (SII.A.SSE.1,3; SII.F.IF.4-6; SII.BF.1);*
- *Graph and analyze functions (SII.F.IF.4-7; SII.BF.1);*
- *Relate characteristics of functions to graphical key features and quantitative relationships (SII.F.IF.4,5,7); and*
- *Apply geometric concepts in modeling situations (SII.G.GMD.3).*

"Modeling can be used to motivate curricular requirements and can highlight the importance and relevance of mathematics in answering important questions" (GAIMME, 2016).

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