# Mathematics for ACT and SAT

## Version Description

In Mathematics for ACT and SAT, instructional time will emphasize six areas:

(1) extending understanding of functions to linear, quadratic and exponential functions and using them to model and analyze real-world relationships;
(2) developing understanding of the complex number system, including complex numbers as roots of polynomial equations;
(3) extending knowledge of ratios, proportions and functions to data and financial contexts;
(4) solve problems involving univariate and bivariate data and make inferences from collected data;
(5) relationships and theorems involving two-dimensional figures using Euclidean geometry and coordinate geometry;
(6) graph and apply trigonometric relations and functions.

Curricular content for all subjects must integrate critical-thinking, problem-solving, and workforce-literacy skills; communication, reading, and writing skills; mathematics skills; collaboration skills; contextual and applied-learning skills; technology-literacy skills; information and media-literacy skills; and civic-engagement skills.

*All clarifications stated, whether general or specific to Mathematics for ACT and SAT, are expectations for instruction of that benchmark.*

## General Notes

Florida's Benchmarks for Excellent Student Thinking (B.E.S.T.) Standards: This course includes Florida's B.E.S.T. ELA Expectations (EE) and Mathematical Thinking and Reasoning Standards (MTRs) for students. Florida educators should intentionally embed these standards within the content and their instruction as applicable. For guidance on the implementation of the EEs and MTRs, please visit https://www.cpalms.org/Standards/BEST_Standards.aspx and select the appropriate B.E.S.T. Standards package.

English Language Development ELD Standards Special Notes Section: Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link: http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf.

## General Information

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| Course Number: XXXXXXX | Course Type: Core Academic Course |
| Course Length: Year (Y) | Course Level: 2 |
| Course Attributes: Class Size Core Required | Grade Level(s): 9, 10, 11, 12 |
| Graduation Requirement: Mathematics | Number of Credits: One (1) credit |
| Educator Certification: Mathematics (Grades 6-12) | |

## Course Standards and Benchmarks

### Mathematical Thinking and Reasoning

***MA.K12.MTR.1.1 Actively participate in effortful learning both individually and collectively.***

Mathematicians who participate in effortful learning both individually and with others:

- Analyze the problem in a way that makes sense given the task.
- Ask questions that will help with solving the task.
- Build perseverance by modifying methods as needed while solving a challenging task.
- Stay engaged and maintain a positive mindset when working to solve tasks.
- Help and support each other when attempting a new method or approach.

Clarifications:
Teachers who encourage students to participate actively in effortful learning both individually and with others:

- Cultivate a community of growth mindset learners.
- Foster perseverance in students by choosing tasks that are challenging.
- Develop students' ability to analyze and problem solve.
- Recognize students' effort when solving challenging problems.

### *MA.K12.MTR.2.1 Demonstrate understanding by representing problems in multiple ways.*

Mathematicians who demonstrate understanding by representing problems in multiple ways:

- Build understanding through modeling and using manipulatives.
- Represent solutions to problems in multiple ways using objects, drawings, tables, graphs and equations.
- Progress from modeling problems with objects and drawings to using algorithms and equations.
- Express connections between concepts and representations.
- Choose a representation based on the given context or purpose.

<u>Clarifications:</u>
Teachers who encourage students to demonstrate understanding by representing problems in multiple ways:

- Help students make connections between concepts and representations.
- Provide opportunities for students to use manipulatives when investigating concepts.
- Guide students from concrete to pictorial to abstract representations as understanding progresses.
- Show students that various representations can have different purposes and can be useful in different situations.

### *MA.K12.MTR.3.1 Complete tasks with mathematical fluency.*

Mathematicians who complete tasks with mathematical fluency:

- Select efficient and appropriate methods for solving problems within the given context.
- Maintain flexibility and accuracy while performing procedures and mental calculations.
- Complete tasks accurately and with confidence.
- Adapt procedures to apply them to a new context.
- Use feedback to improve efficiency when performing calculations.

<u>Clarifications:</u>
Teachers who encourage students to complete tasks with mathematical fluency:

- Provide students with the flexibility to solve problems by selecting a procedure that allows them to solve efficiently and accurately.
- Offer multiple opportunities for students to practice efficient and generalizable methods.
- Provide opportunities for students to reflect on the method they used and determine if a more efficient method could have been used.

### *MA.K12.MTR.4.1 Engage in discussions that reflect on the mathematical thinking of self and others.*

Mathematicians who engage in discussions that reflect on the mathematical thinking of self and others:

- Communicate mathematical ideas, vocabulary and methods effectively.
- Analyze the mathematical thinking of others.
- Compare the efficiency of a method to those expressed by others.
- Recognize errors and suggest how to correctly solve the task.
- Justify results by explaining methods and processes.
- Construct possible arguments based on evidence.

Clarifications:
Teachers who encourage students to engage in discussions that reflect on the mathematical thinking of self and others:

- Establish a culture in which students ask questions of the teacher and their peers, and error is an opportunity for learning.
- Create opportunities for students to discuss their thinking with peers.
- Select, sequence and present student work to advance and deepen understanding of correct and increasingly efficient methods.
- Develop students' ability to justify methods and compare their responses to the responses of their peers.

### *MA.K12.MTR.5.1 Use patterns and structure to help understand and connect mathematical concepts.*

Mathematicians who use patterns and structure to help understand and connect mathematical concepts:

- Focus on relevant details within a problem.
- Create plans and procedures to logically order events, steps or ideas to solve problems.
- Decompose a complex problem into manageable parts.
- Relate previously learned concepts to new concepts.
- Look for similarities among problems.
- Connect solutions of problems to more complicated large-scale situations.

Clarifications:
Teachers who encourage students to use patterns and structure to help understand and connect mathematical concepts:

- Help students recognize the patterns in the world around them and connect these patterns to mathematical concepts.
- Support students to develop generalizations based on the similarities found among problems.
- Provide opportunities for students to create plans and procedures to solve problems.
- Develop students' ability to construct relationships between their current understanding and more sophisticated ways of thinking.

***MA.K12.MTR.6.1 Assess the reasonableness of solutions.***

Mathematicians who assess the reasonableness of solutions:

- Estimate to discover possible solutions.
- Use benchmark quantities to determine if a solution makes sense.
- Check calculations when solving problems.
- Verify possible solutions by explaining the methods used.
- Evaluate results based on the given context.

Clarifications:

Teachers who encourage students to assess the reasonableness of solutions:

- Have students estimate or predict solutions prior to solving.
- Prompt students to continually ask, "Does this solution make sense? How do you know?"
- Reinforce that students check their work as they progress within and after a task.
- Strengthen students' ability to verify solutions through justifications.

***MA.K12.MTR.7.1 Apply mathematics to real-world contexts.***

Mathematicians who apply mathematics to real-world contexts:

- Connect mathematical concepts to everyday experiences.
- Use models and methods to understand, represent and solve problems.
- Perform investigations to gather data or determine if a method is appropriate.
- Redesign models and methods to improve accuracy or efficiency.

Clarifications:

Teachers who encourage students to apply mathematics to real-world contexts:

- Provide opportunities for students to create models, both concrete and abstract, and perform investigations.
- Challenge students to question the accuracy of their models and methods.
- Support students as they validate conclusions by comparing them to the given situation.
- Indicate how various concepts can be applied to other disciplines.

## ELA Expectations

***ELA.K12.EE.1.1 Cite evidence to explain and justify reasoning.***

***ELA.K12.EE.2.1 Read and comprehend grade-level complex texts proficiently.***

***ELA.K12.EE.3.1 Make inferences to support comprehension.***

***ELA.K12.EE.4.1 Use appropriate collaborative techniques and active listening skills when engaging in discussions in a variety of situations.***

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| ***ELA.K12.EE.5.1*** | ***Use the accepted rules governing a specific format to create quality work.*** |
| ***ELA.K12.EE.6.1*** | ***Use appropriate voice and tone when speaking or writing.*** |

**English Language Development**

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| ***ELD.K12.ELL.MA*** | ***Language of Mathematics*** |
| ELD.K12.ELL.MA.1 | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics. |

## Number Sense and Operations

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| ***MA.912.NSO.2*** | ***Represent and perform operations with expression within the complex number system.*** |
| MA.912.NSO.2.1 | Extend previous understanding of the real number system to include the complex number system. Add, subtract, multiply and divide complex numbers. |

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| ***MA.912.NSO.4*** | ***Represent and perform operations with matrices.*** |
| MA.912.NSO.4.1 | Given a mathematical or real-world context, represent and manipulate data using matrices. |
| MA.912.NSO.4.3 | Solve mathematical and real-world problems involving addition, subtraction and multiplication of matrices. |

<u>Benchmark Clarifications:</u>
*Clarification 1:* Instruction includes identifying and using the additive and multiplicative identities for matrices.

## Algebraic Reasoning

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| ***MA.912.AR.2*** | ***Write, solve and graph linear equations, functions and inequalities in one and two variables.*** |
| MA.912.AR.2.1 | Given a real-world context, write and solve one-variable multi-step linear equations. |

MA.912.AR.2.4 Given a table, equation or written description of a linear function, graph that function, and determine and interpret its key features.

Benchmark Clarifications:

*Clarification 1:* Key features are limited to domain, range, intercepts and rate of change.
*Clarification 2:* Instruction includes the use of standard form, slope-intercept form and point-slope form.
*Clarification 3:* Instruction includes cases where one variable has a coefficient of zero.
*Clarification 4:* Instruction includes representing the domain and range with inequality notation, interval notation or set-builder notation.
*Clarification 5:* Within the Algebra 1 course, notations for domain and range are limited to inequality and set-builder notations.

MA.912.AR.2.6 Given a mathematical or real-world context, write and solve one-variable linear inequalities, including compound inequalities. Represent solutions algebraically or graphically.

*Algebra 1 Example:* The compound inequality $2x \leq 5x + 1 < 4$ is equivalent to $-1 \leq 3x$ and $5x < 3$, which is equivalent to $-\frac{1}{3} \leq x < \frac{3}{5}$.

MA.912.AR.2.8 Given a mathematical or real-world context, graph the solution set to a two-variable linear inequality.

Benchmark Clarifications:
*Clarification 1:* Instruction includes the use of standard form, slope-intercept form and point-slope form and any inequality symbol can be represented.
*Clarification 2:* Instruction includes cases where one variable has a coefficient of zero.

## ***MA.912.AR.3 Write, solve and graph quadratic equations, functions and inequalities in one and two variables.***

MA.912.AR.3.1 Given a mathematical or real-world context, write and solve one-variable quadratic equations over the real number system.

Benchmark Clarifications:
*Clarification 1:* Within the Algebra 1 course, instruction includes the concept of non-real answers, without determining non-real solutions.
*Clarification 2:* Within this benchmark, the expectation is to solve by factoring techniques, taking square roots, the quadratic formula and completing the square.

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| MA.912.AR.3.2 | Given a mathematical or real-world context, write and solve one-variable quadratic equations over the real and complex number systems. |

Benchmark Clarifications:
*Clarification 1:* Within this benchmark, the expectation is to solve by factoring techniques, taking square roots, the quadratic formula and completing the square.

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| MA.912.AR.3.3 | Given a mathematical or real-world context, write and solve one-variable quadratic inequalities over the real number system. Represent solutions algebraically or graphically. |
| MA.912.AR.3.7 | Given a table, equation or written description of a quadratic function, graph that function, and determine and interpret its key features. |

Benchmark Clarifications:
*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; vertex; and symmetry.
*Clarification 2:* Instruction includes the use of standard form, factored form and vertex form, and sketching a graph using the zeros and vertex.
*Clarification 3:* Instruction includes representing the domain and range with inequality notation, interval notation or set-builder notation.
*Clarification 4:* Within the Algebra 1 course, notations for domain and range are limited to inequality and set-builder.

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| MA.912.AR.3.8 | Solve and graph mathematical and real-world problems that are modeled with quadratic functions. Interpret key features and determine constraints in terms of the context.<br><br>*Algebra 1 Example*: The value of a classic car produced in 1972 can be modeled by the function $V(t) = 19.25t^2 - 440t + 3500$, where $t$ is the number of years since 1972. In what year does the car's value start to increase? |

Benchmark Clarifications:
*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; vertex; and symmetry.
*Clarification 2:* Instruction includes the use of standard form, factored form and vertex form.
*Clarification 3:* Instruction includes representing the domain and range with inequality notation, interval notation or set-builder notation.
*Clarification 4:* Within the Algebra 1 course, notations for domain, range and constraints are limited to inequality and set-builder.

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| MA.912.AR.3.9 | Given a mathematical or real-world context, write two-variable quadratic inequalities to represent relationships between quantities from a graph or a written description. |

Benchmark Clarifications:
*Clarification 1*: Instruction includes the use of standard form, factored form and vertex form where any inequality symbol can be represented.

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| MA.912.AR.3.10 | Given a mathematical or real-world context, graph the solution set to a two- variable quadratic inequality. |

Benchmark Clarifications:
*Clarification 1*: Instruction includes the use of standard form, factored form and vertex form where any inequality symbol can be represented.

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| ***MA.912.AR.4*** | ***Write, solve and graph absolute value equations, functions and inequalities in one and two variables.*** |
| MA.912.AR.4.2 | Given a mathematical or real-world context, write and solve one-variable absolute value inequalities. Represent solutions algebraically or graphically. |
| MA.912.AR.4.4 | Solve and graph mathematical and real-world problems that are modeled with absolute value functions. Interpret key features and determine constraints in terms of the context. |

Benchmark Clarifications:
*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; vertex; end behavior and symmetry.
*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

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| ***MA.912.AR.5*** | ***Write, solve and graph exponential and logarithmic equations and functions in one and two variables.*** |

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| MA.912.AR.5.7 | Solve and graph mathematical and real-world problems that are modeled with exponential functions. Interpret key features and determine constraints in terms of the context.<br><br>*Example:* The graph of the function $f(t) = e^{5t+2}$ can be transformed into the straight line $y = 5t + 2$ by taking the natural logarithm of the function's outputs. |

Benchmark Clarifications:
*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; constant percent rate of change; end behavior and asymptotes.
*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.
*Clarification 3:* Instruction includes understanding that when the logarithm of the dependent variable is taken and graphed, the exponential function will be transformed into a linear function.
*Clarification 4:* Within the Mathematics for Data and Financial Literacy course, problem types focus on money and business.

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| MA.912.AR.5.9 | Solve and graph mathematical and real-world problems that are modeled with logarithmic functions. Interpret key features and determine constraints in terms of the context. |

Benchmark Clarifications:
*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; and asymptotes.
*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

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| ***MA.912.AR.6*** | ***Solve and graph polynomial equations and functions in one and two variables.*** |
| MA.912.AR.6.1 | Given a mathematical or real-world context, when suitable factorization is possible, solve one-variable polynomial equations of degree 3 or higher over the real and complex number systems. |
| MA.912.AR.6.5 | Sketch a rough graph of a polynomial function of degree 3 or higher using zeros, multiplicity and knowledge of end behavior. |

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| MA.912.AR.6.6 | Solve and graph mathematical and real-world problems that are modeled with polynomial functions of degree 3 or higher. Interpret key features and determine constraints in terms of the context. |

Benchmark Clarifications:
*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; relative maximums and minimums; symmetry; and end behavior.
*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

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| ***MA.912.AR.7*** | ***Solve and graph radical equations and functions in one and two variables.*** |
| MA.912.AR.7.2 | Given a table, equation or written description of a square root or cube root function, graph that function and determine its key features. |

Benchmark Clarifications:
*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; and relative maximums and minimums.
*Clarification 2:* Instruction includes representing the domain and range with inequality notation, interval notation or set-builder notation.

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| MA.912.AR.7.3 | Solve and graph mathematical and real-world problems that are modeled with square root or cube root functions. Interpret key features and determine constraints in terms of the context. |

Benchmark Clarifications:
*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; and relative maximums and minimums.
*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

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| MA.912.AR.7.4 | Solve and graph mathematical and real-world problems that are modeled with radical functions. Interpret key features and determine constraints in terms of the context. |

Benchmark Clarifications:
*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; and relative maximums and minimums.
*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

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| | ***MA.912.AR.9*** | ***Write and solve a system of two- and three-variable equations and inequalities that describe quantities or relationships.*** |

MA.912.AR.9.2 Given a mathematical or real-world context, solve a system consisting of a two-variable linear equation and a non-linear equation algebraically or graphically.

MA.912.AR.9.3 Given a mathematical or real-world context, solve a system consisting of two-variable linear or non-linear equations algebraically or graphically.

Benchmark Clarifications:

*Clarification 1:* Within the Algebra 2 course, non-linear equations are limited to quadratic equations.

MA.912.AR.9.5 Graph the solution set of a system of two-variable inequalities.

Benchmark Clarifications:

*Clarification 1:* Within the Algebra 2 course, two-variable inequalities are limited to linear and quadratic.

MA.912.AR.9.10 Solve and graph mathematical and real-world problems that are modeled with piecewise functions. Interpret key features and determine constraints in terms of the context.

*Example:* A mechanic wants to place an ad in his local newspaper. The cost, in dollars, of an ad $x$ inches long is given by the following peicewise function. Find the cost of an ad that would be 16 inches long.

$$C(x) = \begin{cases} 12x, & x < 5 \\ 60 + 8(x-5), & x \geq 5 \end{cases}$$

Benchmark Clarifications:

*Clarification 1:* Key features are limited to domain, range, intercepts, asymptotes and end behavior.

*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

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| ***MA.912.AR.10*** | ***Solve problems involving sequences and series.*** |
| MA.912.AR.10.1 | Given a mathematical or real-world context, write and solve problems involving arithmetic sequences.<br><br>*Example:* Tara is saving money to move out of her parent's house. She opens the account with $250 and puts $100 into a savings account every month after that. Write the total amount of money she has in her account after each month as a sequence. In how many months will she have at least $3,000? |
| MA.912.AR.10.2 | Given a mathematical or real-world context, write and solve problems involving geometric sequences.<br><br>*Example:* A bacteria in a Petri dish initially covers 2 square centimeters. The bacteria grows at a rate of 2.6% every day. Determine the geometric sequence that describes the area covered by the bacteria after 0, 1, 2, 3 … days. Determine using technology, how many days it would take the bacteria to cover 10 square centimeters. |

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| ***MA.912.F.1*** | ***Understand, compare and analyze properties of functions.*** |
| MA.912.F.1.3 | Calculate and interpret the average rate of change of a real-world situation represented graphically, algebraically or in a table over a specified interval. |

Benchmark Clarifications:
*Clarification 1:* Instruction includes making the connection to determining the slope of a particular line segment.

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| MA.912.F.1.7 | Compare key features of two functions each represented algebraically, graphically, in tables or written descriptions. |

Benchmark Clarifications:
*Clarification 1:* Key features include domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior and asymptotes.

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| ***MA.912.F.2*** | ***Identify and describe the effects of transformations on functions. Create new functions given transformations.*** |
| MA.912.F.2.2 | Identify the effect on the graph of a given function of two or more transformations defined by adding a real number to the $x$- or $y$-values or multiplying the $x$- or $y$-values by a real number. |

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| MA.912.F.2.3 | Given the graph or table of $f(x)$ and the graph or table of $f(x) + k$, $kf(x)$, $f(kx)$ and $f(x + k)$, state the type of transformation and find the value of the real number $k$. |

Benchmark Clarifications:
*Clarification 1:* Within the Algebra 1 course, functions are limited to linear, quadratic and absolute value.

### ***MA.912.FL.1*** ***Build mathematical foundations for financial literacy.***

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| MA.912.FL.1.1 | Extend previous knowledge of operations of fractions, percentages and decimals to solve real-world problems involving money and business. |

Benchmark Clarifications:
*Clarification 1:* Problems include discounts, markups, simple interest, tax, tips, fees, percent increase, percent decrease and percent error.

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| MA.912.FL.1.2 | Extend previous knowledge of ratios and proportional relationships to solve real-world problems involving money and business.<br>*Example:* A local grocery stores sells trail mix for \$1.75 per pound. If the grocery store spends \$0.82 on each pound of mix, how much will the store gain in gross profit if they sell 6.4 pounds in one day?<br>*Example:* If Juan makes \$25.00 per hour and works 40 hours per week, what is his annual salary? |

### ***MA.912.GR.1*** ***Prove and apply geometric theorems to solve problems.***

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| MA.912.GR.1.1 | Prove relationships and theorems about lines and angles. Solve mathematical and real-world problems involving postulates, relationships and theorems of lines and angles. |

Benchmark Clarifications:
*Clarification 1:* Postulates, relationships and theorems include vertical angles are congruent; when a transversal crosses parallel lines, the consecutive angles are supplementary and alternate (interior and exterior) angles and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment’s endpoints.
*Clarification 2:* Instruction includes constructing two-column proofs, pictorial proofs, paragraph and narrative proofs, flow chart proofs or informal proofs.
*Clarification 3:* Instruction focuses on helping a student choose a method they can use reliably.

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| | ***MA.912.GR.3*** | ***Use coordinate geometry to solve problems or prove relationships.*** |

MA.912.GR.3.2 — Given a mathematical context, use coordinate geometry to classify or justify definitions, properties and theorems involving circles, triangles or quadrilaterals.

*Example:* Given Triangle ABC has vertices located at $(-2, 2)$, $(3, 3)$ and $(1, -3)$, respectively, classify the type of triangle ABC is.

*Example:* If a square has a diagonal with vertices $(-1, 1)$ and $(-4, -3)$, find the coordinate values of ther vertices of the other diagonal and show that the two diagonals are perpendicular.

Benchmark Clarifications:
*Clarification 1:* Instruction includes using the distance or midpoint formulas and knowledge of slope to classify or justify definitions, properties and theorems.

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| | ***MA.912.GR.7*** | ***Apply geometric and algebraic representations of conic sections.*** |

MA.912.GR.7.1 — Given a conic section, describe how it can result from the slicing of two cones.

MA.912.GR.7.4 — Given a mathematical or real-world context, derive and create the equation of a parabola using key features.

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| | ***MA.912.T.1*** | ***Define and use trigonometric ratios, identities or functions to solve problems.*** |

MA.912.T.1.7 — Simplify expressions using trigonometric identities.

Benchmark Clarifications:
*Clarification 1:* Identities are limited to Double-Angle, Half-Angle, Angle Sum and Difference, Pythagorean Identities, Sum Identities and Product Identities.

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| | ***MA.912.T.3*** | ***Graph and apply trigonometric relations and functions.*** |

MA.912.T.3.1 — Given a mathematical or real-world context, choose sine, cosine or tangent trigonometric functions to model periodic phenomena with specified amplitude, frequency, horizontal shift and midline.

MA.912.T.3.2 — Given a table, equation or written description of a trigonometric function, graph that function and determine key features.

Benchmark Clarifications:
*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; relative maximums and minimums; symmetry; end behavior; periodicity; midline; amplitude; shift(s) and asymptotes.
*Clarification 2:* Instruction includes representing the domain and range with inequality notation, interval notation or set-builder notation.

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| MA.912.T.3.3 | Solve and graph mathematical and real-world problems that are modeled with trigonometric functions. Interpret key features and determine constraints in terms of the context. |

Benchmark Clarifications:
*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; relative maximums and minimums; symmetry; end behavior; periodicity; midline; amplitude; shift(s) and asymptotes.
*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.
*Clarification 3:* Instruction includes using technology when appropriate.

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| ***MA.912.DP.2*** | ***Solve problems involving univariate and bivariate numerical data.*** |
| MA.912.DP.2.1 | For two or more sets of numerical univariate data, calculate and compare the appropriate measures of center and measures of variability, accounting for possible effects of outliers. Interpret any notable features of the shape of the data distribution. |

Benchmark Clarifications:
*Clarification 1:* The measure of center is limited to mean and median. The measure of variation is limited to range, interquartile range, and standard deviation.
*Clarification 2:* Shape features include symmetry or skewness and clustering.
*Clarification 3:* Within the Probability and Statistics course, instruction includes the use of spreadsheets and technology.

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| MA.912.DP.2.5 | Given a scatter plot that represents bivariate numerical data, assess the fit of a given linear function by plotting and analyzing residuals. |

Benchmark Clarifications:
*Clarification 1:* Within the Algebra 1 course, instruction includes determining the number of positive and negative residuals; the largest and smallest residuals; and the connection between outliers in the data set and the corresponding residuals.

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| ***MA.912.DP.5*** | ***Determine methods of data collection and make inferences from collected data.*** |
| MA.912.DP.5.2 | Explain how random sampling produces data that is representative of a population. |

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| MA.912.DP.5.3 | Compare and contrast sampling methods. |

Benchmark Clarifications:
*Clarification 1:* Instruction includes understanding the connection between probability and sampling methods.
*Clarification 2:* Sampling methods include simple random, stratified, cluster, systematic, judgement, quota and convenience.

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| MA.912.DP.5.5 | Determine if a specific model is consistent within a given process by analyzing the data distribution from a data-generating process. |
| MA.912.DP.5.6 | Determine the appropriate design, survey, experiment or observational study, based on the purpose. Articulate the types of questions appropriate for each type of design. |
| MA.912.DP.5.8 | Draw inferences about two populations using data and statistical analysis from two random samples. |
| MA.912.DP.5.11 | Evaluate reports based on data from diverse media, print and digital resources by interpreting graphs and tables; evaluating data-based arguments; determining whether a valid sampling method was used; or interpreting provided statistics.<br><br>*Example:* A local news station changes the $y$-axis on a data display from 0 to 10,000 to include data only within the range 7,000 to 10,000. Depending on the purpose, this could emphasize differences in data values in a misleading way. |

Benchmark Clarifications:
*Clarification 1:* Instruction includes determining whether or not data displays could be misleading.