Mathematics Calculator Guidance

Algebra I

TN Standard	Standards Scope and Clarification	Calculator Tested Subpart	Non-Calculator Tested Subpart	enVision Algebra I Lesson(s)	Notes
Link to Calculator Step Guide					
A1.N.Q.A.1 Use units as a way to understand real-world problems.* **a.** Choose and interpret the scale and the origin in graphs and data displays.* **b.** Use appropriate quantities in formulas, converting units as necessary.*	*Apply this standard to any real-world problems studied within the scope of this course.*	✓		3-2, 6-2	Calculators can be leveraged when interpreting scale and origin in graphs and data displays.
A1.N.Q.A.1c Define and justify appropriate quantities within a context for the purpose of modeling.* ***Formerly A1.N.Q.A.2***	*Apply this standard to any real-world problems studied within the scope of this course.*	-	-	1-3	Historically, no items appeared on practice assessments, therefore, instruction should prepare students for mastery with or without the aid of a calculator. Calculators can be leveraged when performing calculations and for graphical representations of certain models.
A1.N.Q.A.1d Choose an appropriate level of accuracy when reporting quantities.* ***Formerly A1.N.Q.A.3***	*Apply this standard to any real-world problems studied within the scope of this course.*	-	-	6-3	Historically, no items appeared on practice assessments, therefore, instruction should prepare students for mastery with or without the aid of a calculator.

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					Calculators can be leveraged when performing calculations.
A1.A.SSE.A.1 Interpret expressions that represent a quantity in terms of its context.★ **a.** Interpret parts of an expression, such as terms, factors, and coefficients. **b.** Interpret complicated expressions by viewing one or more of their parts as a single entity.	*For example, interpret* $P(1 + r)^n$ *as the product of P and a factor not depending on P.* *For example, one truck can transport A cubic feet, and a second truck can transport B cubic feet. The first truck makes x trips to a job site, while the second makes y trips. Interpret the expression Ax + By in terms of the context.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*	✓		7-4, 7-5, 7-6, 7-7, 9-3, 6-3	Graphing calculators can be used to find the gcd (greatest common divisor) between two numbers.

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A1.A.APR.A.1 Add, subtract, and multiply polynomials. Use these operations to demonstrate that polynomials form a closed system that adhere to the same properties of operations as the integers.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*	✓	✓	7-1, 7-2, 7-3	Calculators can be utilized to support students in performing basic calculations related to addition, subtraction, and multiplication
A1.A.CED.A.1 Create equations and inequalities in one variable and use them to solve problems in a real-world context.*	*Tasks are limited to linear, quadratic, and absolute value equations and inequalities.*	✓		1-2, 1-3, 1-5, 1-6, 1-7, 9-4, 9-6	Graphing calculators can be used to explore, check, and visualize graphically the solution to equations and inequalities.
A1.A.CED.A.2 Create equations and inequalities in two variables to represent relationships between quantities and use them to solve problems in a real-world context. Graph equations with two variables on coordinate axes with labels and scales and use the graphs to make predictions.*	*Tasks are limited to linear, quadratic, and absolute value equations and inequalities.*	✓	✓	2-3, 2-4, 6-3, 8-1	Graphing calculators can be utilized by students to graph equations with two variables and interpret labels and scales utilizing the window feature.

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A1.A.CED.A.3 Create individual and systems of equations and/or inequalities to represent constraints in a contextual situation and interpret solutions as viable or non-viable.*	*For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*	✓		1-5, 1-6, 2-3, 4-2, 4-3, 4-4, 4-5	Graphing calculators can be utilized to support students in performing basic calculations and visualizing the graphical representation of real world models.
A1.A.CED.A.4 Rearrange formulas to isolate a quantity of interest using algebraic reasoning.*	*Tasks are limited to formulas involving linear, quadratic, and absolute value expressions. For example, rearrange the formula for the perimeter of a rectangle to isolate the length or width.*	✓		1-4	Graphing calculators can be utilized to support students in performing basic calculations.
A1.A.REI.A.1 Understand solving equations as a process of reasoning and explain the reasoning. Construct a viable argument to justify a solution method.	*Tasks are limited to linear, quadratic, and absolute value equations with integer exponents.*	✓	✓	1-1, 1-2, 1-3	Graphing calculators can be utilized to support students in performing basic calculations.

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A1.A.REI.B.2 Solve linear and absolute value equations and inequalities in one variable. **a.** Solve linear equations and inequalities, including compound inequalities, in one variable. Represent solutions algebraically and graphically. **b.** Solve absolute value equations and inequalities in one variable. Represent solutions algebraically and graphically.	*Equations and inequalities should include integer, rational, and/or irrational coefficients. If coefficients are irrational, rationalization of a denominator is not required. Tasks may or may not have a real-world context.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*	✓		1-2, 1-3, 1-5, 1-6, 1-7	Graphing calculators can be utilized to support students in performing basic calculations and by verifying solutions two equations and inequalities.
A1.A.REI.B.3 Solve quadratic equations and inequalities in one variable. **a.** Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when a	*Tasks may or may not have a real-world context.*	✓		9-1, 9-2, 9-4, 9-6, TN-3, 9-5, 9-7	Graphing calculators can be utilized to support the visualization of quadratic equations in vertex form and support students with identifying key features of the graph while connecting those key features to the equation. Students can also verify solutions to quadratic equations using a graphing calculator by visually inspecting the x-intercepts.

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quadratic equation has solutions that are not real numbers. **b.** Solve quadratic inequalities using the graph of the related quadratic equation.					
A1.A.REI.C.4 Write and solve a system of linear equations in real-world context.*	*Systems are limited to at most two equations in two unknowns.*	✓		4-1, 4-2, 4-3	Graphing calculators can be utilized to identify the point of intersection.
A1.A.REI.D.5 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	*There are no assessment limits for this standard. The entire standard is assessed in this course.*	-	-	4-1	Historically, no items appeared on practice assessments, therefore, instruction should prepare students for mastery with or without the aid of a calculator. Calculators can be leveraged for understanding various graphical representations of equations in two variables and identifying solution sets.

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A1.A.REI.D.6 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x). Find approximate solutions by graphing the functions or making a table of values, using technology when appropriate.*	*Include cases where f(x) and/or g(x) are linear, quadratic, absolute value, and exponential functions. For example, f(x) = 3x + 5 and g(x) = x^2 + 1. When finding solutions approximately, students may be expected to produce graphs of functions that are linear, quadratic, exponential, or absolute value, but may be given graphs of other function types. Exponential functions are limited to domains in the integers.*	✓		9-7, 6-3	Graphing calculators can be utilized to determine the point of intersection(s) of a system of equations.
A1.A.REI.D.7 Graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*	-	-	4-5, 4-4	Historically, no items appeared on practice assessments, therefore, instruction should prepare students for mastery with or without the aid of a calculator. Calculators can be leveraged for understanding graphical representations of a linear inequality in two variables and of systems of inequalities.

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A1.F.IF.A.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).	*There are no assessment limits for this standard. The entire standard is assessed in this course.*		✓	3-1, 3-2	Graphing calculators can be used to visualize various relations and functions to assist in determining, graphically, whether a relation is a function.

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A1.F.IF.A.2 Use function notation. **a.** Use function notation to evaluate functions for inputs in their domains, including functions of two variables.* **b.** Interpret statements that use function notation in terms of a context.*	*There are no assessment limits for this standard. The entire standard is assessed in this course.* *Use function notation with various functions of two variables. See functions as defined symbolically (e.g., f(a,b) = 3ab – a or a newly defined symbol like a % b = 3ab – a).*	✓		3-2, TN-1, 8-4	Graphing calculators can be used to store values in variables thus assisting in evaluating functions.
A1.F.IF.A.3 Understand geometric formulas as functions.*	*Limit to linear functions. For example, see geometric formulas such as interior angle sum, perimeter of a square, and circumference of a circle as linear functions.*			TN-2	Historically, this standard has not appeared on the TCAP practice assessment. Instruction should prepare students to demonstrate mastery with and without the aid of the calculator.
A1.F.IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of	*Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*	✓		5-1, 6-2, 8-3, 10-1, 10-2, 10-3, 6-5	Graphing calculators can be leveraged to visualize key features of functions and analyze tables.

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the relationship. ★	*Tasks are limited to linear functions, absolute value functions, quadratic functions, and exponential functions with integer exponents.*				
A1.F.IF.B.5 Relate the domain of a function to its graph and, where applicable, to the context of the function it models.*	*For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function. Tasks are limited to linear functions, piecewise functions(including step and absolute value functions), quadratic functions, and exponential functions with integer exponents.*	✓		3-2, 5-2, 5-3, 6-2	Graphing calculators can assist in determining the domain of a function from viewing its graph.

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A1.F.IF.B.6 Calculate and interpret the average rate of change of a function (presented algebraically or as a table) over a specified interval. Estimate and interpret the rate of change from a graph.*	*Tasks are limited to linear functions, piecewise functions (including step and absolute value functions), quadratic functions, and exponential functions with integer exponents.*	-	-	5-1, 6-3, 8-1	Historically, no items appeared on practice assessments, therefore, instruction should prepare students for mastery with or without the aid of a calculator. Calculators can be leveraged by utilizing the table feature for estimating the average rate of change from a graph.
A1.F.IF.C.7 Graph functions expressed algebraically and show key features of the graph by hand and using technology.*	*Function types are limited to linear functions, quadratic functions, absolute value functions, and exponential functions with integer exponents.*	✓	✓	3-3, 5-4, 8-1, 8-2, 10-4, 10-5, 5-1, 8-3	Graphing calculators can be leveraged to view key features of graphs, including, but not limited to, viewing maximum and minimum points and intercepts.

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A1.F.IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.* **a**. Rewrite quadratic functions to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a real-world context.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*	-	-	9-5, 8-3, 9-2	Historically, no items appeared on practice assessments, therefore, instruction should prepare students for mastery with or without the aid of a calculator. Calculators can be leveraged by utilizing it to conceptualize the relationship between the factored form of a polynomial and the graphical representation of the zeros of the polynomial.
A1.F.IF.C.9 Compare properties of functions represented algebraically, graphically, numerically in tables, or by verbal descriptions.* **a**. Compare properties of two different functions. Functions may be of different types and/or represented in different ways.* **b**. Compare properties of the same function on two different intervals or represented in two different ways.*	*Functions may or may not have a real-world context. Function types are limited to linear functions, quadratic functions, absolute value functions, and exponential functions with integer exponents.*	✓		6-5, 5-1, 6-2, 6-3, 8-1, 8-2, 8-3	Graphing calculators can be utilized to compare two functions represented graphically.

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A1.F.BF.A.1 Build a function that describes a relationship between two quantities. **a.** Determine steps for calculation, a recursive process, or an explicit expression from a context.	*Tasks are limited to linear and exponential relationships. For example, create a function from a visual pattern and describe how each component of their function relates to characteristics of figures in the pattern.*	✓		3-3, 3-4, 6-4, 10-6, 10-7, 8-4	Graphing calculators can be leveraged by utilizing the table and graphing feature for analyzation and by performing various calculations.
A1.F.BF.B.2 Identify the effect on the graph of replacing *f(x)* by *f(x) + k, kf(x), f(kx), and f(x + k)* for specific values of *k* (both positive and negative); find the value of *k* given graphs.	*Experiment with cases and illustrate an explanation of the effects on the graph using technology. Tasks are limited to absolute value and quadratic functions.*	✓	✓	5-4, 8-1, 8-2, 10-4, 10-5, 3-3	Graphing calculators can be used to identify the effect of various transformations on a parent function both graphically and by viewing the table.

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A1.F.LE.A.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. **a.** Know that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. **b.** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **c.** Recognize situations in which a quantity grows or decays by a constant factor per unit interval relative to another.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*	-	-	3-4, 6-2, 8-5, 6-2, 6-3	Historically, no items appeared on practice assessments, therefore, instruction should prepare students for mastery with or without the aid of a calculator. Calculators can be leveraged when modeling linear functions and exponential functions.
A1.F.LE.A.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.	*Tasks are limited to constructing linear and exponential functions in simple context (not multi-step).*	✓		2-1, 2-2, 3-4, 6-3, 6-4, 3-2	Graphing calculators can be used to calculate both arithmetic and geometric sequences.

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A1.F.LE.B.3 Interpret the parameters in a linear or exponential function in terms of a context.	*For example, the total cost of an electrician who charges 35 dollars for a house call and 50 dollars per hour would be expressed as the function y = 50x + 35. If the rate were raised to 65 dollars per hour, describe how the function would change. For example, a population is modeled by a function y = 30000 (1.04)x. Interpret the value 30000 as the initial population and 1.04 as a 4% increase per year.*	✓		3-2, 6-3	Graphing calculators can be utilized to verify predictions and determinations about the changes in various parameters of linear or exponential function.
A1.S.ID.A.1 Use measures of center to solve real world and mathematical problems.	*Measures of center should include mean (including weighted averages), median, and mode. For example, a course has 6 tests during the semester. If your average, after the first 5 tests, is 85, what must you score on the 6th test to have at least an 87 semester average?*	✓		11-1, 11-2, 11-3	Graphing calculators can be utilized to create various stat plots when given data points.

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A1.S.ID.A.2 Use statistics appropriate to the shape of the data distribution to compare center (mean, median, and/or mode) and spread (range, interquartile range) of two or more different data sets.*	*Students may be given a numerical data set or a visual and/or verbal depiction of a data set. Shapes of distribution are limited to: uniform, symmetric, right skewed, and left skewed.*		✓	11-2, 11-3, 11-4	Graphing calculators can be used to calculate and analyze measures of central tendency as well as view distributions.
A1.S.ID.A.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points.	*Students may be given a numerical data set or a visual and/or verbal depiction of the data set.*	✓		11-1, 11-2, 11-3, 11-4	Graphing calculators can be used to analyze data and view distributions creating a deep conceptual understanding of why median and interquartile range are more appropriate for skewed data sets and why the mean and standard deviation are best used with approximately bell-shaped distributions.
A1.S.ID.B.4 Represent data from two quantitative variables on a scatter plot and describe how the variables are related. Fit a function to the data; use functions fitted to data to solve problems in the context of the data.*	*Fitted functions are limited to linear, exponential, and quadratic functions.*	✓		3-5, 3-6, 8-4, 8-5, 11-5	Graphing calculators can be utilized to create scatterplots and support student understanding of how variables are related. Additionally, the graphing calculator can determine a line of best fit given the data points from a scatterplot.

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A1.S.ID.C.5 Interpret the rate of change and the constant term of a linear model in the context of data.*	*There are no assessment limits for this standard. The entire standard is assessed in this course.*		✓	2-1, 2-2, 3-5	Graphing calculators can be used to support interpreting key features of linear models such as slope and y-intercept in the context of the data. This exploration can support student understanding of the reasonableness of model.
A1.S.ID.C.6 Use technology to compute the correlation coefficient of a linear model; interpret the correlation coefficient in the context of the data.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*	✓		3-6	Graphing calculators can be utilized to determine the correlation coefficient.
A1.S.ID.C.7 Explain the differences between correlation and causation. Recognize situations where an additional factor may be affecting correlated data.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*		✓	3-6	Graphing calculators can be utilized to visualize scatterplots in discussion related to correlation and causation.

(Note: Some standards may have been previously tested on the calculator and non-calculator subparts of the TCAP.

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