Assessments

Arizona High School Mathematics Performance Level Descriptors (For ACT)

The following descriptors represent the range of student performances on the ACT® Mathematics test that are associated with each performance level. Descriptors are organized according to categories from the Arizona Mathematics Standards.

Category	Minimally Proficient	Partially Proficient	Proficient	Highly Proficient
Number & Quantity	Students scoring at the *Minimally Proficient* level, are developing the ability to demonstrate the following skills: Apply the order of operations, apply context to round up or down as appropriate for a given situation, and use ratios and conversions. Identify equivalent numerical expressions, including those with whole number exponents, radicals, and scientific notation. Design, set up, and solve a proportion (including unit conversions) to determine a solution.	Students scoring *Partially Proficient* can likely demonstrate some of the following skills: *Partially Proficient* students apply the order of operations, apply context to round up or down as appropriate for a given situation, and use ratios and conversions. They can identify equivalent numerical expressions, including those with whole number exponents, radicals, and scientific notation. Students that are partially proficient can set up and solve a proportion (including unit conversions) to determine a solution as well as use simple sequences of operations to determine if a solution is an appropriate representation for the given context (e.g., place value estimation, combining like terms, and changing fractions to common denominators).	Students scoring *Proficient* can likely demonstrate the mathematics skills in the *Partially Proficient* level of **Number & Quantity** and can likely demonstrate some of the following skills: *Proficient* students can estimate, apply, and calculate a sequence of operations using irrational and rational numbers (e.g., negative integers, radicals, exponents, and fractions). Students work on problems in context after interpreting numerical relationships and their properties from context and using that to express the relationship. They can determine reasonable solutions to routine problems and interpret those problems in context by applying patterns, ratios, and proportions to solve for missing information. Students should be able to identify, choose, and interpret the scale and the origin in graphs and data displays.	Students scoring *Highly Proficient* can likely demonstrate the mathematics skills in the *Partially Proficient* level and the *Proficient* level of **Number & Quantity** and can likely demonstrate some of the following skills: *Highly Proficient* students can interpret and solve multipart problems and problems with sophisticated contexts. These problems may be beyond the Algebra 2 standards and may be aligned to Precalculus and Plus standards. *Highly Proficient* students apply proportional reasoning to complex, abstract situations. They can find solutions to complex problems that require multiple steps and operations. They can apply that knowledge to determine an appropriate solution within a context. They can convert units within a problem and use rational, irrational, and complex number systems and their properties to represent solutions. Students can work with abstract calculations while adjusting parameters in order to perform those calculations. They can also work with values that involve radicals, rational exponents, scientific notation, unit conversions, absolute value, and extended ratios. Students can flexibly interpret varied numerical relationships, notation, and key characteristics in order to apply them to sequences of calculations with problems that have rich context or high levels of abstraction. Students can extend to work on topics such as vector operations and matrices.

Category	Minimally Proficient	Partially Proficient	Proficient	Highly Proficient
Algebra	Students scoring at the *Minimally Proficient* level, are developing the ability to demonstrate the following skills: Solve a sequence of operations to find a solution to a contextual problem and determine an appropriate solution. Identify equivalent expressions using exponent properties. Use substitution with whole numbers to evaluate a variety of expressions, including quadratic. Solve linear equations in one variable with integer coefficients, including those utilizing the distributive property.	Students scoring *Partially Proficient* can likely demonstrate some of the following skills: *Partially Proficient* students can perform a sequence of operations to find a solution to a contextual problem and determine an appropriate solution. Students can identify equivalent expressions using exponent properties. They can use substitution with whole numbers to evaluate a variety of expressions, including quadratic. Students can solve linear equations in one variable with integer coefficients, including those utilizing the distributive property. They can identify a linear inequality in one variable that models a context.	Students scoring *Proficient* can likely demonstrate the mathematics skills in the *Partially Proficient* level of **Algebra** and can likely demonstrate some of the following skills: *Proficient* students can interpret the structure of an expression. Students can solve a linear inequality in one variable and a literal equation for a specific variable. They can solve a quadratic equation in a variety of ways. They should be able to use the zeros of a quadratic to identify the corresponding graph. Students should be able to explain each step in solving any equation and justify their solution method. Students can evaluate absolute value expressions given an integer value. They can determine if an equation or a system of equations has no real solution. Students can identify the slope of a line from an equation. They should be able to identify the graphs corresponding to equations and inequalities in two variables. Students should be able to solve a system of equations, including those within a context. They should be able to determine if a situation has constraints and if solutions are nonviable.	Students scoring *Highly Proficient* can likely demonstrate the mathematics skills in the *Partially Proficient* level and the *Proficient* level of **Algebra** and can likely demonstrate some of the following skills: *Highly Proficient* students can interpret and solve multipart problems and problems with sophisticated contexts. These problems may be beyond the Algebra 2 standards and may be aligned to Precalculus and Plus standards. *Highly Proficient* students can work with nonroutine problems and extend their thinking beyond the high school standards. They can create a linear equation from a context involving profit and loss. Students can perform operations involving scientific notation, polynomial expressions, and rational expressions. Students can extend their knowledge of equivalent expressions to both rational and absolute value expressions. They can add rational expressions with unlike denominators and determine if a rational expression is undefined at a particular value of x. Students can factor a quadratic equation and then use the solutions to complete additional parts of a problem. They can identify the equation of a quadratic relation given the vertex and x-intercepts. They should be able to identify the relationship between the zeros and factors of higher order polynomials. Students have a deep understanding of proportional relationships and can use that understanding to solve problems using ratios. Students can use a system of equations to solve problems with geometric shapes in the coordinate plane. They can solve problems with conic sections that include identifying equations and key features.

Category	Minimally Proficient	Partially Proficient	Proficient	Highly Proficient
Functions	Students scoring at the *Minimally Proficient* level, are developing the ability to demonstrate the following skills: Interpret and evaluate a function for a given integer input. Identify the key features of a function, (e.g., slope, average rate of change, horizontal or vertical shift, and zeros of a function) from an equation, graph, or table.	Students scoring *Partially Proficient* can likely demonstrate some of the following skills: *Partially Proficient* students can interpret and evaluate a function for a given integer input. They can identify the key features of a function, (e.g., slope, average rate of change, horizontal or vertical shift, and zeros of a function) from an equation, graph, or table. Students can find the next few terms from a sequence in and out of context.	Students scoring *Proficient* can likely demonstrate the mathematics skills in the *Partially Proficient* level of **Functions** and can likely demonstrate some of the following skills: *Proficient* students can represent, interpret, and solve problems in and out of context involving linear functions and systems of linear functions with information coming from context, graphs, and tables. Students use relationships between slopes and intercepts to build linear functions with specified properties (e.g., parallel and perpendicular lines). Students will understand coordinate quantities and rates (including slope) and their application to linear and quadratic relationships in context, graphically, and out of context. They can recognize equivalent representations of polynomial functions and their features. They can evaluate functions, interpret and use function notation, and interpret sequences (recursive and explicit) and series to solve problems. Students can relate an angle measure to the ratios of sine, cosine, and tangent as well as use an inverse function to solve problems. Students should be able to compare functions (linear, quadratic, and exponential) and their properties represented in different ways.	Students scoring *Highly Proficient* can likely demonstrate the mathematics skills in the *Partially Proficient* level and the *Proficient* level of **Functions** and can likely demonstrate some of the following skills: *Highly Proficient* students can interpret and solve multipart problems and problems with sophisticated contexts. These problems may be beyond the Algebra 2 standards and may be aligned to Precalculus and Plus standards. *Highly Proficient* students can flexibly interpret varied relationships, notation, equations, and key characteristics of functions in order to apply them to a sequence of calculations with problems that have rich context or high levels of abstraction. Students can interpret many functions, describing the nature of the function (including end behavior), its attributes and features, its solutions, and its constraints. The various functions include: linear functions (including unit rate and slope); quadratic functions (including zeros); rational and radical functions with regards to graphs (including asymptotes), expressions, and equations; trigonometric functions with regards to relationships and identities; piecewise functions from context and from the coordinate plane, including evaluating; exponential functions with regards to sequences, properties, and logarithms; and conic sections with regards to equations and graphs. Students can interpret sequences and series using equations and expressions involving subscripts. They can describe sequences algebraically, interpreting them from context and applying the interpretation to solve nonroutine problems. Students can build and compose functions of many types and perform operations with those functions. They should be able to perform transformations on functions.

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Geometry	Students scoring at the *Minimally Proficient* level, are developing the ability to demonstrate the following skills: Read and interpret various diagrams, figures, and notations. Identify parts of congruent figures from a congruence statement and identify coordinates after a simple transformation. Use geometric formulas to find area or volume when values are given directly for all needed measures. Know precise geometric definitions in order to interpret and work with figures.	Students scoring *Partially Proficient* can likely demonstrate some of the following skills: *Partially Proficient* students read and interpret various diagrams, figures, and notations. They can identify parts of congruent figures from a congruence statement and can identify coordinates after a simple transformation. Students use geometric formulas to find area or volume when values are given directly for all needed measures. They should know precise geometric definitions in order to interpret and work with figures.	Students scoring *Proficient* can likely demonstrate the mathematics skills in the *Partially Proficient* level of **Geometry** and can likely demonstrate some of the following skills: *Proficient* students apply transformations, including similarity and congruence correspondence within geometric figures. They can identify transformations (including sequences of transformations) that create images and use theorems. They can recognize and apply geometric theorems (including congruence and similarity) with regards to triangles, area, volume, density, and right triangle trigonometry in and out of context. Students have knowledge of right triangles and can identify missing parts. They use the Pythagorean theorem in and out of context to solve for triangle unknowns, along with additional formulas and mathematical relationships. Students will apply a sequence of operations, often including fractional values, proportions, and ratios, after interpreting algebraic and geometric relationships. They can identify a coordinate value from context, without visual cues. They can use the coordinate plane to solve problems involving midpoint, distance, linear functions, quadrilaterals, and segments. Students use relationships between slopes and intercepts to build linear functions with specified properties (e.g., parallel and perpendicular lines). Students can interpret and apply angle relationships formed by parallel lines, as well as interpret and apply geometric measurement to simple and composite figures with various unknowns. They can solve geometric measurement problems with given lengths. Students can interpret geometric symbology and can use it to solve problems. They will use geometric relationships (like vertical angles and the measures of interior angles) to solve problems in context and on the coordinate grid. Students should be able to make and analyze geometric constructions with a variety of tools. Students should construct, interpret, and use relationships within circles and use circle attributes (e.g., angles, segments, chords, etc.) to solve problems or to solve for missing measures. They should identify and create the equation of a circle given the necessary information and should analyze the relationship between two-dimensional cross-sections and three-dimensional figures.	Students scoring *Highly Proficient* can likely demonstrate the mathematics skills in the *Partially Proficient* level and the *Proficient* level of **Geometry** and can likely demonstrate some of the following skills: *Highly Proficient* students can interpret and solve multipart problems and problems with sophisticated contexts. These problems may be beyond the Algebra 2 standards and may be aligned to Precalculus and Plus standards. *Highly Proficient* students can interact with geometric figures (including circles) involving area (including sectors), perimeter, and volume of multipart contextual problems as well as abstract problems. They will interpret and convert these measures (including degrees and radians) from algebraic relationships and functions in order to use the formulas and find missing dimensions. Students are knowledgeable in right triangle similarity and trigonometric ratios and can apply trigonometry to non-right triangles, including the law of sines, the law of cosines, and the area of a triangle. Students can determine geometric measurements from properties of composite figures and can determine missing values from given properties that are related to the figure. This may include breaking a composite figure into simpler figures. Students can strategically employ geometric properties and theorems to interpret and understand problems, (e.g., lines, angles, triangles, circles, polygons, etc.).

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Statistics & Probability	Students scoring at the *Minimally Proficient* level, are developing the ability to demonstrate the following skills: Determine information from visual stimuli and contextual situations with statistics and probability. Read, interpret, and use various diagrams (including Venn diagrams) and charts (including charts with counts, frequencies, and percentages). Find the probability of simple and compound events to determine an outcome and determine how many combinations a sample space can create. Calculate statistical measures and apply information from a sample to estimate the proportional population response.	Students scoring *Partially Proficient* can likely demonstrate some of the following skills: *Partially Proficient* students can determine information from visual stimuli and contextual situations with statistics and probability. They can read, interpret, and use various diagrams (including Venn diagrams) and charts (including charts with counts, frequencies, and percentages). Students can find the probability of simple and compound events to determine an outcome and determine how many combinations a sample space can create. They can calculate statistical measures and can apply information from a sample to estimate the proportional population response.	Students scoring *Proficient* can likely demonstrate the mathematics skills in the *Partially Proficient* level of **Statistics & Probability** and can likely demonstrate some of the following skills: *Proficient* students can interpret and solve survey and sample problems in context, applying them to the population. They can interpret the sample space (including a sample space that is not obvious) of complex probability problems to answer questions of likelihood. Students can interpret problems, with or without diagrams (including histograms), charts, or graphs, using probability and statistics to calculate values in different contexts. They can interpret and express constraints and relationships and calculate statistical measures and find data values given the statistical measures. Students can account for the effect of outliers within a data set and analyze information in order to determine the best fit (e.g., with linear relationships). Students should be able to analyze relationships with respect to residuals and correlation and should be able to interpret a situation to distinguish between causation and correlation.	Students scoring *Highly Proficient* can likely demonstrate the mathematics skills in the *Partially Proficient* level and the *Proficient* level of **Statistics & Probability** and can likely demonstrate some of the following skills: *Highly Proficient* students can interpret and solve multipart problems and problems with sophisticated contexts. These problems may be beyond the Algebra 2 standards and may be aligned to Precalculus and Plus standards. *Highly Proficient* students can analyze information in order to determine the best fit (e.g., with linear and nonlinear relationships). They can flexibly interpret probabilities and data in order to apply them to sequences of formulas, properties, and calculations with problems that have rich statistical context or high levels of abstraction. Students can use conditional probability, including permutations and combinations with a given situation. They can interpret and use an understanding of events (e.g., compound, mutually exclusive, and independent) and consider them in terms of sets and subsets. Students can interpret and infer from data the probabilities and measures with data displays in context and can use multiple points of data to model variations of rate of change. Students can solve problems that require converting units and using decimals and percentages to find statistical measures (including measures of spread and center). They can interpret, explain, find, and use statistical measures from graphs, tables, lists, and context for multipart and nonroutine problems (including weighted averages). Students use increasing levels of skills to solve problems, and they recognize that using frequency tables appropriately for probability or statistical measures is important.