

Algebra Performance Level Descriptors

Limited

A student performing at the **Limited Level** demonstrates a minimal command of Ohio's Learning Standards for Algebra. A student at this level has an emerging ability to demonstrate reasoning with numbers, quantities, expressions, and equations to solve problems, to write and analyze functions to model and solve problems, and to summarize and interpret data on one or two variables.

A student whose performance lies within the **Limited Level** typically can:

- Carry out some routine procedures to solve straightforward one-step problems;
- Recognize solutions to some simple computation, straightforward problems;
- Compute accurately a few grade level numbers and operations;
- Recognize a few grade level mathematical concepts, terms and properties, and use previous grade level mathematical concepts, terms and properties.

A student at the **Limited Level** can:

- Identify units in familiar formulas involving whole numbers;
- Identify parts of simple linear expressions: terms, factors and coefficients;
- Solve simple linear equations with integer coefficients and inequalities with whole number coefficients in one variable situations, with integer constants and whole number solutions;
- Solve linear equations in two variables to describe a familiar situation using whole numbers supported by algebra manipulatives or diagrams;
- Find square roots of perfect squares;
- Use algebra manipulatives or diagrams and the relationship of polynomials to whole numbers to add and subtract polynomials with like terms;
- Given a straightforward linear relationship in context, write a function;
- Given a graph of a simple function modeling a linear relationship between two quantities, determine where the function is increasing, decreasing, positive, or negative;
- Graph linear functions and show whole number intercepts;
- Match graphs of linear equations to tables of solutions;
- Calculate the average rate of change (slope) of linear functions given tables and/or graphs;
- Describe the comparison of center (median, mean) of two different data sets.

Basic

A student performing at the **Basic Level** demonstrates partial command of Ohio's Learning Standards for Algebra. A student at this level has a general ability to demonstrate reasoning with numbers, quantities, expressions, and equations to solve problems, to write and analyze functions to model and solve problems, and to summarize and interpret data on one or two variables.

A student whose performance falls within the **Basic Level** typically can:

- Carry out routine procedures;
- Solve simple problems using visual representations;
- Compute accurately some grade level numbers and operations;
- Recall and recognize some grade level mathematical concepts, terms and properties, and use more previous grade level mathematical concepts, terms and properties.

A student at the **Basic Level** can:

- Choose and interpret units in formulas;
- Given a situation, context, or problem, students will identify, and use appropriate quantities for representing the situation;
- Identify parts of simple linear expressions in terms of the context the quantity represents: terms, factors and coefficients;
- Create linear equations in two variables and inequalities in one variable and use them to solve simple routine problems;
- Evaluate given possible solutions as viable or non-viable options in a modeling context;
- Solve simple linear equations and inequalities with integer coefficients in one variable situations;
- Solve one-step linear equations with coefficients represented by letters, including formulas;
- Solve routine quadratic equations with integer solutions;
- Add and subtract polynomials and multiply polynomials by constants, both supported by manipulatives or visual models;
- Solve simple systems of two linear equations in two variables exactly algebraically;
- Graph the solutions to a linear inequality in two variables as a half-plane;
- Understand that the graph of a function f is the graph of the equation $y = f(x)$;
- Given a graph of a function that models a linear relationship between two quantities, interpret key features: intercepts; intervals where the function is increasing, decreasing, positive, or negative;
- Calculate the average rate of change (slope) of a linear function as a table over a specified interval;
- Recognize the difference between a linear and exponential situation represented by a graph or equation;
- Represent given data in a different statistical model;
- Interpret key features of a scatterplot (linear or nonlinear, correlation).

Proficient

A student performing at the **Proficient Level** demonstrates an appropriate command of Ohio's Learning Standards for Algebra. A student at this level has a consistent ability to demonstrate reasoning with numbers, quantities, expressions, and equations to solve problems, to write and analyze functions to model and solve problems, and to summarize and interpret data on one or two variables.

A student whose performance falls within the **Proficient Level** typically can:

- Solve most routine and straightforward problems accurately;
- Compute accurately with most grade level numbers and operations;
- Apply most grade level mathematical concepts, terms and properties, and,
- Use informal (visual representation and language) and some formal reasoning.

A student at the **Proficient Level** can:

- Choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays;
- Interpret parts of a simple exponential expression, such as terms, factors, coefficients, bases, and exponents in terms of its context;
- Recognize the structure of a quadratic expression to identify ways to rewrite it to better represent the purpose;
- Factor a quadratic expression to reveal the zeros of the function it defines;
- Create exponential equations in one or two variables and use them to solve routine problems;
- Graph equations on coordinate axes with appropriate labels and scales;
- Solve multi-step linear equations and inequalities with integer coefficients in one variable situations;
- Solve multistep linear equations with coefficients represented by letters, including formulas;
- Select a viable argument to justify a solution method for a simple linear equation;
- Solve quadratic equations with integer coefficients and constants by factoring or quadratic formula, where solutions may be rational;
- Solve quadratic equations with integer coefficients and constants by completing the square where $a = 1$;
- Add and subtract polynomials and multiply monomials by polynomials;
- Multiply binomials;
- 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);
- Solve a system of linear inequalities in two variables graphically;
- For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities; sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries;
- Relate the domain of a function to its graph;
- Calculate the average rate of change (slope) of a linear function presented symbolically and/or graphically over a specified interval;
- Recognize the difference between linear and exponential situations from real-world contexts or a variety of representations;
- Graph quadratic functions and show intercepts, maxima, and minima;
- Given two functions represented in different ways, (algebraically, graphically, numerically in tables, or by verbal descriptions), compare the properties of the two functions;
- Use statistics appropriate to the shape of the data distribution to compare center (median, mean) of two or more different data sets;
- Summarize categorical data for two categories in two-way frequency tables;
- Interpret joint relative frequencies in the context of the data;
- Fit a linear function for a scatter plot that suggests a linear association;
- Distinguish between correlation and causation;
- Compute (using technology) the correlation coefficient of a linear fit.

Accelerated

A student performing at the **Accelerated Level** demonstrates a strong command of Ohio's Learning Standards for Algebra. A student at this level has a superior ability to demonstrate reasoning with numbers, quantities, expressions, and equations to solve problems, to write and analyze functions to model and solve problems, and to summarize and interpret data on one or two variables.

Students whose performance falls within the **Accelerated Level** typically can:

- Accurately solve routine and straightforward problems;
- Solve a variety of routine and multi-step problems;
- Compute accurately and efficiently with familiar numbers;
- Recognize connections between mathematical concepts, terms and properties, and use informal and some formal reasoning with symbolic representation.

A student at the **Accelerated Level** can:

- Interpret linear expressions by viewing one or more of their parts as a single entity in respect to the context;
- Use the structure of an exponential expression to identify ways to rewrite it;
- Create quadratic and exponential equations and inequalities in one or two variables and use them to solve routine problems;
- Solve multi-step linear equations and inequalities with rational coefficients in one variable situations;
- Solve multistep linear equations with coefficients represented by letters, including formulas, which could include factoring or distributive property;
- Construct a viable argument to justify a solution method for a system of linear equations;
- Solve quadratic equations with rational coefficients and constants by factoring or completing the square;
- Solve a system consisting of a linear equation and a quadratic equation in two variables graphically, and algebraically in simpler cases;
- Multiply binomials by trinomials;
- Find the approximate solutions of the equation $f(x) = g(x)$ by finding the x-coordinates where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect, including cases where $f(x)$ and/or $g(x)$ are linear or exponential;
- Create an explicit function to define an arithmetic sequence;
- 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 the relationship. Key features include: end behavior;
- Relate the domain of a function to the quantitative relationship it describes;
- Interpret the average rate of change of a function over a specified interval;
- Graph exponential functions, showing end behavior;
- Interpret zeros, extreme values, and symmetry of the graph of a quadratic function in terms of a context;
- Use the process of completing the square in a quadratic function, where $a = 1$, to show extreme values and symmetry of the graph;
- Use statistics appropriate to the shape of the data distribution to compare spread (interquartile range, standard deviation) of two or more different data sets;
- Interpret conditional relative frequencies in the context of the data;
- Find and use linear models to solve problems in the context of the data;
- Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

Advanced

A student performing at the **Advanced Level** demonstrates a distinguished command of Ohio's Learning Standards for Algebra. A student at this level has a sophisticated ability to demonstrate reasoning with numbers, quantities, expressions, and equations to solve problems, to write and analyze functions to model and solve problems, and to summarize and interpret data on one or two variables.

A student whose performance falls within the **Advanced Level** typically can:

- Solve routine and straightforward problems accurately and efficiently;
- Solve a variety of non-routine multi-step problems;
- Compute accurately and efficiently;
- Recognize, apply and justify mathematical concepts, terms and properties and their connections, and use more formal reasoning and symbolic representation (precise mathematical language).

A student at the **Advanced Level** can:

- Accurately multiply polynomials of any number of terms using rules of exponents;
- Interpret exponential expressions by viewing one or more of their parts as a single entity in relationship to the context;
- Create quadratic and exponential equations and inequalities in one or two variables and use them to accurately solve routine and non-routine problems;
- Find and interpret solutions as viable or non-viable options in a modeling context;
- Construct a viable argument to justify a solution method for a quadratic equation;
- Choose an appropriate method to solve a quadratic equation, according to the initial form of the equation, which could include simplifying initial expressions and with possible complex solutions;
- Accurately and efficiently solve a system consisting of a linear equation and a quadratic equation in two variables algebraically;
- Interpret statements that use function notation in terms of a context;
- Create an explicit function to define a geometric sequence;
- Recognize a recursive function that defines a sequence from a context;
- Interpret the parameters in a linear or exponential function in terms of a context;
- Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers);
- Use functions suggested by the data to solve problems in the context of the data.