Grade 8 Mathematics
Performance Level Descriptors

Limited

A student performing at the **Limited Level** demonstrates a minimal command of Ohio's Learning Standards for Grade 8 Mathematics. A student at this level has an emerging ability to formulate and reason about expressions and equations, use functions to describe quantitative relationships, and analyze two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and to understand and apply the Pythagorean Theorem.

A student whose performance falls 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:

- Graph proportional relationships, interpreting the unit rate as the slope;
- Determine the slope of a line given a graph;
- Solve straightforward one or two step linear equations with integer coefficients;
- Construct a scatter plot;
- Recognize a straight line can be used to describe a linear association on a scatter plot;
- Identify the slope and y-intercept of a linear model on a scatter plot;
- Identify whether a relation is a function from a graph or a mapping;
- Compare properties (i.e. slope, y-intercept, values) of two functions in a graph;
- Given a straightforward qualitative description of a functional relationship between two quantities, sketch a graph;
- Create a single translation of a geometric figure;
- Identify two congruent figures;
- Identify if two figures are related by a dilation, translation, rotation, or reflection;
- Identify pairs of equivalent angles when parallel lines are cut by a transversal;
- Use the Pythagorean Theorem to calculate the hypotenuse in mathematical problems;
- Identify square roots of non-square numbers and pi as irrational numbers;
- Use the properties of natural number exponents to generate equivalent numerical expressions;
- Evaluate square roots of small perfect squares;
- Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large quantities.

Basic

A student performing at the **Basic Level** demonstrates partial command of Ohio's Learning Standards for Grade 8 Mathematics. A student at this level has a general ability to formulate and reason about expressions and equations, use functions to describe quantitative relationships, and analyze two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and to understand and apply the Pythagorean Theorem.

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:

- Graph proportional relationships, interpreting the unit rate as the slope and compare two different proportional relationships using the same representation;
- Solve straightforward multi-step linear equations with rational coefficients;
- Solve a system of simple linear equations by inspection and graphically;
- Construct a scatter plot and describe the pattern as positive, negative or no relationship;
- Draw a straight line on a scatter plot that closely fits the data points;
- Construct a two-way table of categorical data;
- Given tables of ordered pairs, determine if the relation is a function;
- Compare properties (i.e. slope, y-intercept, values) of two functions each represented in the same way (algebraically, graphically, or verbal descriptions);
- Create an image of a geometric figure using a reflection over an axis and/or multiple translations;
- Create dilations of figures by a given whole number scale factor;
- Calculate unknown side lengths using the Pythagorean Theorem given a picture of a right triangle;
- Apply the Pythagorean Theorem to find the distance between two points in a coordinate system with the right triangle drawn;
- Find the volume of a cone, cylinder or sphere given the height and/or radius;
- Identify between which two whole number values a square root of a non-square number is located;
- Apply the properties of natural number exponents to solve simple mathematical problems;
- Calculate the cube root of small perfect cubes;
- Use scientific notation to represent and compare very large and very small quantities.

Proficient

A student performing at the **Proficient Level** demonstrates an appropriate command of Ohio's Learning Standards for Grade 8 Mathematics. A student at this level has a consistent ability to formulate and reason about expressions and equations, use functions to describe quantitative relationships, and analyze two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and to understand and apply the Pythagorean Theorem.

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:

- Graph proportional relationships, interpreting the unit rate as the slope and compare two different proportional relationships using different representations;
- Solve routine multi-step linear equations with rational coefficients and variables on both sides and provide examples of equations that have one solution, infinitely many solutions, or no solutions;
- Solve a system of linear equations algebraically;
- Describe patterns in scatterplots for routine contexts, such as: clustering, outliers, positive or negative association, linear association, and/or nonlinear association;
- Interpret and describe relative frequencies for possible associations from a two-way table representing a routine situation;
- Complete a table to show a relation that is or is not a function;
- Compare properties (i.e. slope, y-intercept, values) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or verbal descriptions);
- Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values;
- Construct a function to model a linear relationship between two quantities;
- Describe a sequence of rigid transformations between two congruent figures;
- Create and describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates and coordinate notation;
- Recognize that a dilation produces a similar figure;
- Understand and explain the proof of the Pythagorean Theorem and its converse;
- Apply the Pythagorean Theorem to real-world situations that can be modeled in two dimensions to determine unknown side lengths;
- Determine missing angle measures in triangles with exterior angles and/or angles formed by parallel lines cut by a transversal;
- Solve real-world and mathematical problems involving the volumes of cones, cylinders and spheres;

- Identify rational and irrational numbers and convert less familiar rational numbers (repeating decimals) to fraction form;
- Place irrational numbers on a number line;
- Apply the properties of integer exponents to solve mathematical problems;
- Use square root and cube root symbols to represent solutions of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number;
- Express how many times a number written as an integer power of 10 is than another number written as an integer power of 10;
- Solve routine problems that require performing operations with numbers expressed in scientific notation, including numbers written in both decimal and scientific notation and interprets scientific notation that has been generated by technology.

Accelerated

A student performing at the **Accelerated Level** demonstrates a strong command of Ohio's Learning Standards for Grade 8 Mathematics. A student at this level has a superior ability to formulate and reason about expressions and equations, use functions to describe quantitative relationships, and analyze two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and to understand and apply the Pythagorean Theorem.

A student 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:

- Apply understanding of slope to solve routine problems graphically and algebraically;
- Strategically choose and use procedures to solve linear equations in one variable;
- Justify why an equation has one solution, infinitely many solutions, or no solution;
- Use linear equations and systems of linear equations to represent, analyze and solve a variety of problems;
- Compare more than one trend line for the same scatter plot;
- Create and use a linear model based on a set of bivariate data to solve a problem in a routine context;
- Justify whether two functions represented in different ways are equivalent or not by comparing their properties;
- Explain why a dilation produces a similar figure and that rigid transformations maintain angle measure and side lengths;
- Give an informal argument that a triangle can only have one 90 angle;
- Understand and explain the proof of the Pythagorean Theorem and its converse in multiple ways;
- Apply the Pythagorean Theorem in multi-step mathematical and real-world problems in two and three dimensions;
- Solve real-world and mathematical problems involving the volume of a composite solid including a cone, cylinder or sphere.
  Place irrational numbers on a number line in an abstract setting using variables;
- Use square root and cube root symbols to represent solutions to real-world problems resulting from equations of the form $x^2 = p$ and $x^3 = p$;
- Solve problems involving the conversion between decimal notation and scientific notation and the comparison of numbers written in different notations.

Advanced

A student performing at the **Advanced Level** demonstrates a distinguished command of Ohio's Learning Standards for Grade 8 Mathematics. A student at this level has a sophisticated ability to formulate and reason about expressions and equations, use functions to describe quantitative relationships, and analyze two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and to understand and apply the Pythagorean Theorem.

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:

- Apply understanding of slope to solve non-routine problems graphically and algebraically;
- Strategically and efficiently use linear equations and systems of linear equations to represent, analyze and solve a variety of problems;
- Compare more than one trend line for the same scatter plot and justify the best one;
- Construct and interpret scatter plots for bivariate measurements data to investigate patterns of association between two quantities;
- Create and use a linear model based on a set of bivariate data to solve problems in a variety of non-routine contexts;
- Interpret, describe and compare relative frequencies to identify patterns of association in given contexts;
- Explain why a function is linear or nonlinear;
- Interpret qualitative features of a function in a context;
- Strategically and efficiently choose different ways to represent functions in solving a variety of problems;
- Justify why two figures are congruent and/or similar;
- Solve a variety of real-world and mathematical problems involving the angles in triangles and those formed by when parallel lines are cut by a transversal, and give informal arguments;
- Informally explain the derivation of the formulas for cones, cylinders, and spheres;
- Notice and explain the patterns that exist when writing rational numbers (repeating decimals) as fractions;
- Explain how to get more precise approximations of square roots;
- Use properties of integer exponents to order or evaluate multiple numerical expressions with integer exponents;
- Explain how square roots and cube roots relate to each other and to their radicands;
- Calculate and interpret values written in scientific notation within new and unfamiliar contexts.