Geometry Performance Level Descriptors

Limited

A student performing at the **Limited Level** demonstrates a minimal command of Ohio's Learning Standards for Geometry. A student at this level has an emerging ability to use geometric transformations to prove congruence of triangles and theorems, to derive and use geometric relationships in similar triangles and trigonometric ratios in right triangles, to derive and use geometric measurements and relationships involving circles, and to understand and use concepts involving conditional probability and rules of probability.

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:

- Recognize definitions of angle, circle, perpendicular lines, parallel lines, and line segment;
- Given a geometric figure and a rotation, reflection, or translation, identify the transformed figure;
- Given four points on the coordinate plane, determine if the points create a rectangle with horizontal and vertical sides;
- Use slope criteria to determine if given lines are parallel or perpendicular;
- Use coordinates to compute perimeters of polygons with sides that are horizontal or vertical;
- Given a line segment length and a scale factor, determine the dilated line segment measure;
- Identify central angles and find their measures given the measure of their intercepted arcs;
- Recognize an equation of a circle;
- Use volume formulas to find volumes of cylinders, pyramids, cones, and spheres, given all needed measurements, to solve simple problems;
- Identify the sample space (the set of outcomes) using characteristics of the outcomes;
- Complete two-way frequency tables of data when two categories are associated with each object being classified.

Basic

A student performing at the **Basic Level** demonstrates partial command of Ohio's Learning Standards for Geometry. A student at this level has a general ability to use geometric transformations to prove congruence of triangles and theorems, to derive and use geometric relationships in similar triangles and trigonometric ratios in right triangles, to derive and use geometric measurements and relationships involving circles, and to understand and use concepts involving conditional probability and rules of probability.

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:

- Know precise definitions of angle, circle, perpendicular lines, parallel lines, and line segment;
- Use geometric descriptions of rigid motions to transform figures;
- Given two triangles, determine if the two triangles are congruent based upon sides and angles;
- Complete a proof of a theorem about lines and angles, triangles, or parallelograms by identifying one or two statements or reasons missing from the proof;
- Use the slope criteria for parallel or perpendicular lines to solve geometric problems;
- Use coordinates to compute areas of triangles and rectangles with horizontal and/or vertical sides;
- Identify the step or steps needed to complete a given construction using a variety of tools and methods;
- Use scale factors to reduce and enlarge drawings on grids to produce dilations;
- Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar;
- Complete a straight-forward proof of a theorem involving proportionality of lengths within a triangle or among triangles by identifying one or two statements or reasons missing from the proof;
- Use congruence criteria for triangles to solve simple mathematical problems;
- Apply concepts of density based on area in modeling situations;
- Identify inscribed angles and circumscribed angles;
- Solve problems involving the volumes of cylinders, pyramids, cones, and spheres, given all necessary measurements;
- Identify the shapes of two-dimensional cross-sections of three-dimensional objects;

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- Describe events as subsets of a sample space (the set of outcomes) using categories of the outcomes;
- Use two-way frequency tables of data when two categories are associated with each object being classified as a sample space to determine probabilities;
- Recognize independence of events in everyday language and everyday situations;
- Apply the addition rule for probability for events that are mutually exclusive.

Proficient

A student performing at the **Proficient Level** demonstrates an appropriate command of Ohio's Learning Standards for Geometry. A student at this level has a consistent ability to use geometric transformations to prove congruence of triangles and theorems, to derive and use geometric relationships in similar triangles and trigonometric ratios in right triangles, to derive and use geometric measurements and relationships involving circles, and to understand and use concepts involving conditional probability and rules of probability.

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:

- Recognize precise definitions of angle, circle, perpendicular lines, parallel lines, and line segment based on the undefined notions of point, line, distance along a line and distance around a circular arc;
- Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure;
- Describe a sequence of transformations that will carry a given figure onto itself or another polygon;
- Given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent;
- Complete a proof of a theorem about lines and angles, triangles, or parallelograms requiring a routine proof;
- Use coordinates to prove/disprove that a figure defined by four given points in the coordinate plane is a rectangle Use the slope criteria for parallel and perpendicular lines to solve geometric problems algebraically;
- Use coordinates to compute perimeters of polygons and areas of triangles and rectangles (e.g. distance formula);Perform and/or explain a routine geometric construction procedure;
- Complete a routine proof of a theorem involving proportionality of lengths within a triangle or among triangles;
- Use congruence and similarity criteria for triangles to solve routine problems;
- Explain the relationship between sine and cosine of complementary angles;
- Use trigonometric ratios or the Pythagorean Theorem to solve routine real world problems involving right triangles;
- Use congruence and similarity criteria for triangles to describe relationships in geometric figures;
- Apply concepts of density based on volume in modeling situations;
- Use geometric methods to solve routine design problems limited by constraints or restrictions;
- Use the measures of geometric shapes and their properties to describe real-world objects;
- Use the properties of similarity transformations to justify the AA criterion for two triangles to be similar;
- Use transformations between two or more circles to show similarity;
- Find the measures of inscribed angles and circumscribed angles given the measures of their intercepted arcs;
- Write the equation of a circle given its center and radius;
- Use volume formulas involving finding a measurement (e.g. height or radius) of cylinders, pyramids, cones, and spheres, given the volume and other measurements, to solve problems;
- Determine the measure of an angle in degrees or radians;
- Describe events as unions, intersections, or complements of other events using the terminology "or," "and," "not";
- Determine the independence of two events in terms of the product of their probabilities;
- Understand the conditional probability of A given B as P(A and B)/P(B);
- Determine and interpret independence of two events using products of probabilities, conditional probabilities, and two-way frequency tables;
- Recognize conditional probability in everyday language and everyday situations;
- Apply the addition rule for probability for events that are not mutually exclusive.

Accelerated

A student performing at the **Accelerated Level** demonstrates a strong command of Ohio's Learning Standards for Geometry. A student at this level has a superior ability to use geometric transformations to prove congruence of triangles and theorems, to derive and use geometric relationships in similar triangles and trigonometric ratios in right triangles, to derive and use geometric measurements and relationships involving circles, and to understand and use concepts involving conditional probability and rules of probability.

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:

- Specify, using numeric values, a sequence of transformations that will carry a given figure onto another;
- Analyze and correct a proof of a theorem about lines and angles, triangles, or parallelograms;
- Use coordinates to prove/disprove that a given point lies on the circle centered on the origin and containing another given point;
- Explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides;
- Use triangle similarity to construct a proof of a theorem involving proportionality of lengths within a triangle or among triangles;
- Use congruence and similarity criteria for triangles to prove relationships in geometric figures;
- Use trigonometric ratios and the Pythagorean Theorem to solve routine real-world problems involving complex figures;
- Use geometric methods to model design problems limited by constraints or restrictions;
- Construct a proof of properties of angles for a quadrilateral inscribed in a circle;
- Use the formula for the area of a sector of a circle to solve routine problems;
- Use properties of circles to solve routine problems related to the equation of a circle, its center and radius length;
- Give an informal argument for the formulas for the circumference and area of a circle;
- Solve routine problems based on the volumes of compositions or parts of cylinders, pyramids, cones, or spheres;
- Complete the square to find the center and radius of a circle given by an equation;
- Construct inscribed and circumscribed circles of a triangle;

- Describe events involving unions, intersections, or complements of other events using set notation;
- Use a two-way relative frequency table as a sample space to decide if events are independent by approximating conditional probabilities;
- Explain the independence of events in everyday situations.

Advanced

A student performing at the **Advanced Level** demonstrates a distinguished command of Ohio's Learning Standards for Geometry. A student at this level has a sophisticated ability to use geometric transformations to prove congruence of triangles and theorems, to derive and use geometric relationships in similar triangles and trigonometric ratios in right triangles, to derive and use geometric measurements and relationships involving circles, and to understand and use concepts involving conditional probability and rules of probability.

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:

- Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent;
- Specify, using abstract values, a sequence , of transformations that will carry a given figure onto another;
- Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions;
- Construct a logical formal proof of a theorem about lines and angles, triangles, or parallelograms;
- Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in non-routine real world problems;
- Use a variety of geometric methods to model and solve non-routine design problems limited by many constraints or restrictions;
- Describe the relationship among the measures of central angles, inscribed angles, and circumscribed angles;
- Solve non-routine real world problems involving finding arc lengths and areas of sectors;
- Give an informal argument for the formulas for the volume of a cylinder, pyramid, and cone;
- Apply the understanding of scale factor to area and volume in solving a variety of non-routine problems;
- Explain the concepts of conditional probability in everyday situations;
- Apply the addition rule for probability for events that are not mutually exclusive and interpret the answer in terms of the model.