Washington Mathematics

Geometry

Standards for Mathematical Practice

1 **Make sense of problems and persevere in solving them.** 1

2 **Reason abstractly and quantitatively.** 2

3 **Construct viable arguments and critique the reasoning of others.** 3

4 **Model with mathematics.** 4

5 **Use appropriate tools strategically.** 5

6 **Attend to precision.** 6

7 **Look for and make use of structure.** 7

8 **Look for and express regularity in repeated reasoning.** 8

Geometry — **Geometry**

Congruence

A **Experiment with transformations in the plane.**

1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. G.CO.A.1

2 Flexibly, efficiently, and accurately represent transformations in the plane, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). G.CO.A.2

3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. G.CO.A.3

4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. G.CO.A.4

5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Flexibly, efficiently, and accurately specify a sequence of transformations that will carry a given figure onto another. G.CO.A.5

Jnderstand congruence in terms of rigid motions.

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6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. G.CO.B.6

7 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. G.CO.B.7

8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. G.CO.B.8

C Solve real-world and mathematical problems involving area, surface area, and volume.

9 Flexibly, efficiently, and accurately prove theorems about lines and angles: vertical, transversals, alternate interior and exterior, perpendicular bisectors, etc. G.CO.C.9

10 Flexibly, efficiently, and accurately prove theorems about triangles: interior angles, base angles, segments joining midpoint of two sides, and medians of a triangle. G.CO.C.10

11 Flexibly, efficiently, and accurately prove theorems about parallelograms: congruence of opposite sides and opposite angles, properties of diagonals. G.CO.C.11

D Make geometric constructions.

12 Make formal geometric constructions with a variety of tools and methods. G.CO.D.12

13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. G.CO.D.13

Similarity, Right Triangles, and Trigonometry

A Understand similarity in terms of similarity transformations.

1a, b Verify experimentally the properties of dilations given by a center and a scale factor by seeing what happens to lines affected by a center of dilation and how scale factor affects line segments. G.SRT.A.1A, B

2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; 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. G.SRT.A.2

3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. G.SRT.A.3

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B Prove theorems involving similarity

4 Flexibly, efficiently, and accurately prove theorems about triangles: proportionality, triangle similarity, and the Pythagorean Theorem. G.SRT.B.4

5 Flexibly, efficiently, and accurately use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. G.SRT.B.5

C Define trigonometric ratios and solve problems involving right triangles.

6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. G.SRT.C.6

7 Explain and use the relationship between the sine and cosine of complementary angles. G.SRT.C.7

8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. G.SRT.C.8

Circles

A Understand and apply theorems about circles.

1 Flexibly, efficiently, and accurately prove that all circles are similar. G.C.A.1

2 Identify and describe relationships among inscribed angles, radii, and chords, including how angles formed inside the circle, the circle's radius, and line segments within the circle are related. Understand special cases including angles formed by diameters and how the circle's edge interacts with its radius. G.C.A.2

3 Construct the inscribed and circumscribed circles of a triangle and flexibly, efficiently, and accurately prove properties of angles for a quadrilateral inscribed in a circle. G.C.A.3

B Find arc lengths and areas of sectors of circles.

5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector. G.C.B.5

Expressing Geometric Properties with Equations

A Translate between the geometric description and the equation for a conic section.

1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem. G.GPE.A.1

B Use coordinates to prove simple geometric theorems algebraically.

4 Use coordinates to prove simple geometric theorems algebraically. G.GPE.B.4

5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). G.GPE.B.5

6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio. G.GPE.B.6

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7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. G.GPE.B.7

Geometric Measurement and Dimension

A Explain volume formulas and use them to solve problems.

1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. G.GMD.A.1

3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. G.GMD.A.3

B Visualize relationships between two-dimensional and three-dimensional objects.

4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. G.GMD.B.4

Modeling with Geometry

A Apply geometric concepts in modeling situations.

1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). G.MG.A.1

2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). G.MG.A.2

3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). G.MG.A.3

Statistics and Probability

Statistics and Probability

Interpreting Categorical and Quantitative Data

A Summarize, represent, and interpret data on a single count or measurement variable.

1 Represent data with plots on the real number line (dot plots, histograms, and box plots). S.ID.A.1

2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. S.ID.A.2

3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). S.ID.A.3

B Summarize, represent, and interpret data on two categorical and quantitative variables.

5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. S.ID.B.5

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6a, b, c Represent data on two quantitative variables on a scatter plot, and describe how the variables are related to solve problems in context by fitting functions to the data and explaining trends and relationships within the data. S.ID.B.6A, B, C

C Interpret linear models.

7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S.ID.C.7

8 Compute (using technology) and interpret the correlation coefficient of a linear fit. S.ID.C.8

9 Distinguish between correlation and causation. S.ID.C.9

Conditional Probability and the Rules of Probability

A Understand independence and conditional probability and use them to interpret data.

1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). S.CP.A.1

2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. S.CP.A.2

3 Understand the conditional probability of AA given BB as $PP(AA \text{ aaaaaa } BB)$, $PP(BB)$ and interpret independence of AA and BB as saying that the conditional probability of AA given BB is the same as the probability of AA, and the conditional probability of BB given AA is the same as the probability of BB. S.CP.A.3

4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. S.CP.A.4

5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. S.CP.A.5

B Use the rules of probability to compute probabilities of compound events.

6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. S.CP.B.6

7 Apply the Addition Rule, $PP(AA \text{ oooo } BB) = PP(AA) + PP(BB) - PP(AA \text{ aaaaaa } BB)$, and interpret the answer in terms of the model. S.CP.B.7

Data Science

Formulate statistical investigative questions.

1 Formulate multivariable statistical investigative questions and determine how data can be collected and provide an answer, consider causality and prediction when posing the question. HS.DS.1

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ollect and consider data.

2 Understand the issues of bias and confounding variables when collecting data and their impact on interpretation. Understand practices for collecting and handling data, including sensitive information and concerns for privacy and how that may affect data collection. HS.DS.2

Analyze the data.

3 Create and analyze data sets and data displays, including but not limited to scatter plots, regressions, histograms and boxplots using technology to sort or filter data, summarize, and describe relationships between quantitative variables. HS.DS.3

Interpret results.

4 Acknowledge the presence of missing data values and understand how missing values may add bias to analysis and interpretation. Examine and discuss competing explanations for data trends observed such as confounding variables. Respond to competing arguments or interpretations of the data of different community groups, paying careful attention to what conclusions the data supports, taking into account correlation versus causation. HS.DS.4