Iowa Mathematics

Geometry

Geometry G.G

G-CO. Congruence G.G-CO

1. Experiment with transformations in the plane. G.G-CO.A
   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.G-CO.A.1
   2. Represent transformations in the plane using 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. For example, translation versus horizontal stretch). G.G-CO.A.2
   3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. G.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.G-CO.A.4
   5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure. Specify a sequence of transformations that will carry a given figure onto another. For example, using graph paper, tracing paper, or geometry software. G.G-CO.A.5
2. Understand congruence in terms of rigid motions. G.G-CO.B
   1. 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.G-CO.B.6
   2. 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.G-CO.B.7
   3. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. G.G-CO.B.8

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3 Prove geometric theorems. G.G-CO.C

1 Prove theorems about lines and angles. Theorems include vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. G.G-CO.C.9

2 Prove theorems about triangles. Theorems include measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point. G.G-CO.C.10

3 Prove theorems about parallelograms. Theorems include opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals. G.G-CO.C.11

4 Make geometric constructions. G.G-CO.D

1 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line. G.G-CO.D.12

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

G-SRT. Similarity, Right Triangles, and Trigonometry G.G-SRT

1 Understand similarity in terms of similarity transformations. G.G-SRT.A

1 Verify experimentally the properties of dilations given by a center and a scale factor: G.G-SRT.A.1

a A dilation takes a line not passing through the center of the dilation to a parallel line and leaves a line passing through the center unchanged. G.G-SRT.A.1.A

b The dilation of a line segment is longer or shorter in the ratio given by the scale factor. G.G-SRT.A.1.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.G-SRT.A.2

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

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2 Prove and apply theorems involving similarity. G.G-SRT.B

1 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity. G.G-SRT.B.4

2 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. G.G-SRT.B.5

3 Define trigonometric ratios and solve problems involving right triangles. G.G-SRT.C

1 Define trigonometric ratios using similar triangle ratios and the ratios of corresponding side lengths. G.G-SRT.C.6

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

3 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems, including special right triangles. ★ G.G-SRT.C.8

G-C. Circles G.G-C

1 Understand and apply theorems about circles. G.G-C.A

1 Prove that all circles are similar. G.G-C.A.1

2 Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle. G.G-C.A.2

3 Construct the inscribed and circumscribed circles of a triangle with technology, and investigate properties of a quadrilateral inscribed in a circle. G.G-C.A.

2 Find arc lengths and areas of sectors of circles. G.G-C.B

1 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.G-C.B.5

G-GPE. Expressing Geometric Properties with Equations G.G-GPE

1 Translate between the geometric description and the equation for a conic section. G.G-GPE.A

1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation. G.G-GPE.A.1

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

1 Use coordinate geometry to prove simple geometric theorems. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle. G.G-GPE.B.4

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

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

4 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles. For example, use the distance formula to calculate the distance between the two points. ★ G.G-GPE.B.7

G-GMD. Geometric Measurement and Dimension G.G-GMD

1 Explain volume formulas and use them to solve problems. G.G-GMD.A

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.G-GMD.A.1

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

2 Visualize relationships between two-dimensional and three-dimensional objects. G.G-GMD.B

1 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.G-GMD.B.4

G-MG. Modeling with Geometry G.G-MG

1 Apply geometric concepts with modeling situations. G.G-MG.A

1 Use geometric shapes, their measures, and their properties to describe and explain objects. For example, modeling a tree trunk as a cylinder. ★ G.G-MG.A.1

2 Apply concepts of density based on area and volume in modeling situations. For example, persons per square mile, BTUs per cubic foot. ★ G.G-MG.A.2

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

Statistics and Pr

S-CP. Conditional Probability and the Rules of Probability★ G.S-CP

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1. Use independence and conditional probability to interpret data.★ G.S-CP.A
    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”). ★ G.S-CP.A.1
    2. Understand that two events AA and BB are independent if the probability of AA and BB occurring together is the product of their probabilities and use this characterization to determine if they are independent. ★ G.S-CP.A.2
    3. Understand the conditional probability of AA given BB as $PP(AA\ aaaaaa\ BB)$ $PP(BB)$, 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.★ G.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. For example, collect data from a random sample of students in your school on their favorite subject among mathematics, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results. ★ G.S-CP.A.4
    5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer. ★ G.S-CP.A.5
2. Use the rules of probability to compute probabilities of compound events in a uniform probability model. ★ G.S-CP.B
    1. Find the conditional probability of AA given BB as the fraction of $BB'ss$ outcomes that also belong to AA and interpret the answer in terms of the model. ★ G.S-CP.B.6
    2. Apply the Addition Rule, $PP(AA\ oooo\ BB) = PP(AA) + PP(BB) - PP(AA\ aaaaaa\ BB)$, and interpret the answer in terms of the model. ★ G.S-CP.B.7

S-MD. Using Probability to Make Decisions ★ G.S-MD

1. Use probability to evaluate outcomes of decisions. ★ G.S-MD.B
    1. Analyze decisions and strategies using probability concepts. For example, product testing, medical testing, pulling a hockey goalie at the end of a game. ★ G.S-MD.B.7