URBANDALE COMMUNITY SCHOOL DISTRICT
CURRICULUM FRAMEWORK OUTLINE

SUBJECT: Mathematics
COURSE TITLE: Geometry **2 Credits/2 Semesters**
PREREQUISITES: Algebra I or Algebra IA & IB

COURSE DESCRIPTION:
Geometry is designed to provide insight into the properties of geometry and mathematical proofs, which will provide a good foundation for students who may want to take advanced courses. Most of the work is with two-dimensional figures with the idea that students can transfer these properties to the three dimensional world.

STANDARDS AND COURSE BENCHMARKS WITH INDICATORS:
In order that our students may achieve the maximum benefit from their talents and abilities, the students of Urbandale Community School District's Geometry course should be able to…

Standard VIII: Understand geometry.

Benchmark: Experiment with transformations in the plane. (Iowa Core: HSG.CO.A)
Indicators:
- Define angle, circle, perpendicular lines, parallel lines, ray, and segment.
- Represent transformations in the plane.
- Describe transformations as functions.
- Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
- Describe the rotations and reflections that carry a rectangle onto itself.
- Describe the rotations and reflections that carry a parallelogram onto itself.
- Describe the rotations and reflections that carry a trapezoid onto itself.
- Describe the rotations and reflections that carry a regular polygon onto itself.
- Develop definitions of rotations, reflections, and transformations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
- Draw transformed figure when given geometric figure and a rotation.
- Specify a sequence of transformations that will carry a given figure onto another.

Benchmark: Understand congruence in terms of rigid motions. (Iowa Core: HSG.CO.B)
Indicators:
- Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure.
- Prove figures are congruent using transformations.
- 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.
- Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

Benchmark: Prove geometric theorems. (Iowa Core: HSG.CO.C)
Indicators:
- Prove the theorem: Vertical angles are congruent.
- Prove the theorem: When a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent.
- Prove the theorem: Points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.
- Prove the theorem: Measures of interior angles of a triangle sum to 180°.
- Prove the theorem: Base angles of isosceles triangles are congruent.
- Prove the theorem: The segment joining midpoints of two sides of a triangle is parallel to the third side and half the length.

Prove the theorem: The medians of a triangle meet at a point.
Prove the theorem: Opposite sides of a parallelogram are congruent.
Prove the theorem: Opposite angles of a parallelogram are congruent.
Prove the theorem: The diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.

Benchmark: Make geometric constructions. (Iowa Core: HSG.CO.D)

Indicators:
Construct congruent segments.
Construct congruent angles.
Construct a segment bisector.
Construct an angle bisector.
Construct a perpendicular bisector of a line segment.
Construct a line parallel to a given line through a point not on the line.
Construct an equilateral triangle inscribed in a circle.
Construct a square inscribed in a circle.
Construct a regular hexagon inscribed in a circle.

Benchmark: Understand similarity in terms of similarity transformations. (Iowa Core: HSG.SFT.A)

Indicators:
Verify properties of dilations: 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.
Verify properties of dilations: The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
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.
Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Benchmark: Prove theorems involving similarity. (Iowa Core: HSG.SRT.B)

Indicators:
Prove theorems about triangles: A line parallel to one side of a triangle divides the other two proportionally, and conversely.
Prove the Pythagorean Theorem using triangle similarity.
Use congruence and similarity criteria for triangles to solve problems.
Use congruence and similarity criteria for triangles to prove relationships in geometric figures.

Benchmark: Define trigonometric ratios and solve problems involving right triangles. (Iowa Core: HSG.SRT.C)

Indicators:
Demonstrate an understanding 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.
Explain and use the relationship between the sine and cosine of complementary angles.
Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Benchmark: Understand and apply theorems about circles. (Iowa Core: HSG.C.A)

Indicators:
Identify and describe the relationship between central, inscribed, & circumscribed angles.
Identify and describe: Inscribed angles on a diameter are right angles.

Identify and describe: The radius of a circle is perpendicular to the tangent where the radius intersects the circle.
Construct the inscribed and circumscribed circles of a triangle.
Prove properties of angles for a quadrilateral inscribed in a circle.
Construct a tangent line from a point outside a given circle to the circle.

Benchmark: **Find arc lengths and areas of sectors of circles. (Iowa Core: HSG.C.B)**

Indicators:
Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius.
Define the radian measure of the angle as the constant of proportionality.
Derive the formula for the area of a sector.

Benchmark: **Translate between the geometric description and the equation for a conic section. (Iowa Core: HSG.GPE.A)**

Indicators:
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.
Derive the equation of a parabola given a focus and directrix.

Benchmark: **Use coordinates to prove simple geometric theorems algebraically. (Iowa Core: HSG.GPE.B)**

Indicators:
Use coordinates to prove simple geometric theorems algebraically.
Prove the slope criteria for parallel and perpendicular lines.
Use the slope criteria for parallel and perpendicular lines to solve geometric problems.
Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
Use coordinates to compute perimeters of polygons.
Use coordinates to compute areas of triangles and rectangles.

Benchmark: **Explain volume formulas and use them to solve problems. (Iowa Core: HSG.GMD.A)**

Indicators:
Give an informal argument for the formula for the circumference of a circle.
Give an informal argument for the formula for the area of a circle.
Give an informal argument for the formula for the volume of a cylinder, pyramid, and cone.
Use volume formulas for cylinders to solve problems.
Use volume formulas for pyramids to solve problems.
Use volume formulas for cones to solve problems.
Use volume formulas for spheres to solve problems.

Benchmark: **Visualize the relation between two-dimensional and three-dimensional objects. (Iowa Core: HSG.GMD.B)**

Indicators:
Plot points in three-dimension.
Identify the shapes of two-dimensional cross-sections of three-dimensional objects.
Identify three-dimensional objects generated by rotations of two-dimensional objects.

Benchmark: **Apply geometric concepts in modeling situations. (Iowa Core: HSG.MG.A)**

Indicators:
Use geometric shapes, their measures, and their properties to describe objects.
Apply concepts of density based on area and volume in modeling situations.
Apply geometric methods to solve design problems.
Use diagrams consisting of vertices and edges (vertex-edge graphs) to model and solve problems related to networks.

Understand, analyze, evaluate, and apply vertex-edge graphs to model and solve problems related to paths, circuits, networks, and relationships among a finite number of elements, in real-world and abstract settings.
Model and solve problems using at least two of the following fundamental graph topics and models: Euler paths and circuits, Hamilton paths and circuits, the traveling salesman problem (TSP), minimum spanning trees, critical paths, vertex coloring.
Compare and contrast vertex-edge graph topics and models in terms of properties, algorithms, optimization, and types of problems that can be solved.

Standard VII: Understand statistics & probability.

Benchmark: Understand independence and conditional probability and use them to interpret data. (Iowa Core: HSS.CP.A)

Indicators:
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").
Explain 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.
Explain the conditional probability of A given B as P(A and B)/P(B).
Interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.
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.
Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

Benchmark: Use rules of probability to compute probabilities of compound events in a uniform probability model. (Iowa Core: HSS.CP.B)

Indicators:
Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A.
Interpret the answer in terms of the model.
Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B)
Interpret the answer in terms of the model.
Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.
Use permutations and combinations to compute probabilities of compound events and solve problems.

Benchmark: Use probability to evaluate outcomes of decisions. (Iowa Core: HSS.MC.B)

Indicators:
Use probabilities to make fair decisions.
Analyze decisions and strategies using probability.