MANHATTAN HUNTER SCIENCE HIGH SCHOOL
GEOMETRY CURRICULUM

COORDINATE Geometry

- Plotting points on the coordinate plane.
- Using the Distance Formula: Investigate, and apply the Pythagorean Theorem as it relates to the distance formula. (G.GPE.7, 8.G.B.7, 8.G.B.8)
- Find the length of a line segment, given its endpoints. (G.GPE.7, 8.G.8) (discover the distance formula)
- Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, plane, collinear, coplanar, distance along a line, and distance around a circular arc. (G.CO.1)
- Find the midpoint of a line segment on a coordinate plane.
- Definition: Review definition of Congruence. Congruent line segments, angles. (8.G.1)
- Define Polygons and give examples and demonstrate why a circle is not a polygon.
- Define perimeter and use the distance formula to calculate the perimeter of polygons. (GPE.7)
- Angles: vertical, adjacent, supplementary, complementary (7.G.5)
- Angle addition, subtraction postulates. (4.MD.7)
- Angle bisector

Triangle Properties:

- Discuss the properties of isosceles, equilateral, scalene, obtuse, right, and acute triangles. (DNE)
- Investigate, and apply the properties of triangles in the coordinate plane, using the distance formula.
- Explain the converse of a statement and show its relation to the definition of isosceles triangles.
- Demonstrate that the sum of two sides of a triangle must be greater than the third side using inequalities. (DNE)
- Demonstrate that the sum of the angles of a triangle must = 180°.
- Demonstrate that if two angles of a triangle are different sizes, then the side opposite the larger angle is greater than the side opposite the smaller angle. Demonstrate that its converse is also true.
- External Angle theorem.
- Vertical angle theorem.
- Algebraic applications of special segments in triangles
    - Altitude
    - Angle bisector
    - Median
    - Perpendicular bisector

EUCLIDEAN

- Demonstrate two non-parallel lines and define interior and exterior.
- Cut the lines by a transversal and define "alternate"
- Identify
    a. Alternate interior angles
    b. Alternate exterior angles
    c. Corresponding angles
    d. Same-side interior angles
    e. Same-side exterior angles
- Demonstrate, when the two lines are *parallel*, the *equality* of
    a. Alternate interior angles

   b. Alternate exterior angles
   c. Corresponding angles
- Demonstrate, when the two lines are *parallel*, the *supplementary* quality of
   a. Same-side interior angles
   b. Same-side exterior angles
- Polygons: Lab showing how polygons are composed of separate triangles
- Investigate, justify, and apply theorems about the sum of the measures of the interior and exterior angles of polygons
- Investigate, justify, and apply theorems about each interior and exterior angle measure of *regular* polygons.

GCO – 9
GCO - 10

Constructions with triangles:

- Demonstrate how a compass can be used to measure line segments.
- Creating a triangle from a given triangle using a compass and straight edge.
- Given a base and a side, using a compass, construct an isosceles triangle.
- Create an equilateral triangle given 1 leg
- Create an angle from a given angle.

GCO – 12
GCO -13

Logic

- Conjunction
- Disjunction
- Conditional
- Biconditional
- Converse, inverse, contrapositive
   - Determine which statements are logically equivalent
- Basic logic proofs

Triangle Congruence

- Introduce two column proof using statement and reason
   - Introduce important theorems and postulates to be used in proofs
- Introduce SSS triangle congruence theorem.
- Introduce SAS triangle congruence theorem
- Introduce ASA triangle congruence theorem
- Introduce AAS triangle congruence theorem
- Introduce HL triangle congruence theorem
- CPCTC proofs
- Isosceles triangle proofs
- Proving and proofs involving parallel lines
- Overlapping triangles proofs

- Indirect proofs

GCO – 7
GCO - 8

Constructions

- Definitions: Bisect, equidistant, perpendicular bisector.
- Demonstrate how we create a perpendicular bisector of a line segment. Join the endpoints and show triangle congruence again by SAS.
- Demonstrate how we bisect an angle. Use a protractor to show that the two resulting angles are congruent. Show how by connecting the endpoints, the two triangles are congruent by SSS.
- Given a line and a point, construct a line through the point parallel to the given line by creating a corresponding angle.

TRANSFORMATIONAL Geometry

- Explore reflections, translations, rotations, dilations and glide reflections.
- Definition: Orientation, Isometry, Pre-image, image.
- Compositional transformations.

GCO-2: **Experiment with transformations in the plane**
GCO – 3
GCO-4
GCO – 5
GCO - 6

Midsegment theorem

- Define endpoint, midpoint, diameter.
- Find the center of a circle given the endpoints of the diameter.
- Introduce midpoint formula.
- Given a triangle, find the midpoint of two sides and join them creating a mid-segment. Measure the length of the mid-segment and the base. What do you notice?
- Measure the acute angles formed by a leg and the mid-segment and the base and the mid-segment. What do you notice?

Lines and Their Relations

Perpendicular/ Parallel Lines

- Review slopes of parallel vs perpendicular lines
- Given the equation of a line on a coordinate plane, find the equation of another line that
  a) goes through a given point on the coordinate plane and
  b) is also parallel to the first line.
- Review slopes of perpendicular lines.
- Given the equation of a line on a coordinate plane, find the equation of another line that
  a) goes through a given point on the coordinate plane and

b) is also perpendicular to the first line.

- Determine whether two lines are parallel, perpendicular, or neither, given their equations of the lines.

GCO-1

Circles

- Using the distance formula, derive the equation of a circle when the center is at the point of origin.
- Write the equation of a circle when the center is NOT at the point of origin using $(x-h)^2+(y-k)^2=r^2$
- Write the equation of a circle
  a) given its center and radius
  b) given the endpoints of a diameter (students must use the midpoint formula to find the center)
- Find the center and radius of a circle, given the equation of the circle in center-radius form
- Graph circles given an equation in the form $(x-h)^2+(y-k)^2=r^2$

Locus

- 5 basic loci
- Writing the equations of the locus of points
- Compound locus

Quadrilaterals

- Definition: Quadrilateral, parallelogram.
- Construction: Construct a parallelogram by constructing two corresponding angles (see earlier constructions.
- By having students measure each angle and each line segment, state the properties of a **parallelogram**.
- Investigate, justify, and apply theorems about parallelograms involving their angles, sides, and diagonals
- Investigate, justify, and apply theorems about special parallelograms (**rectangles, rhombuses, squares**) involving their angles, sides, and diagonals
- Investigate, justify, and apply theorems about **trapezoids** (including isosceles trapezoids) involving their angles, sides, medians, and diagonals
- Investigate, justify, and apply theorems about **kites** involving their angles, sides, and diagonals
- Review all properties of each quadrilateral:
  a) Parallelogram
  b) Rectangle
  c) Rhombus
  d) Kite
  e) Trapezoid
  f) Isosceles trapezoid

- Continue to develop two column proof using angle properties of a parallelogram given a figure drawn on a Cartesian plane.

GCO - 11

Circles Part 1

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Definitions:

1. Radius
2. diameter
3. chord
4. arc
5. semi-circle
6. inscribed angle
7. central angle
8. tangent line
9. external angle formed by two tangent lines, secant line
10. intercepted arc
11. internal angle
12. Inscribed vs circumscribed.

- Investigate and apply theorems related to the measure of arcs and *central angles* of a circle formed by
    a) two chords,
    b) a secant line and a chord
    c) two secant lines.
- Investigate and apply theorems related to the measure of arcs *inscribed angles* of a circle formed by
    a) two chords,
    b) a secant line and a chord,
    c) two secant lines
    d) a tangent line and a chord.
- Investigate and apply theorems related to the measure of *external angles* drawn from a point outside a circle created by two tangent lines, two secant lines, or a tangent and a secant line.
- Investigate, justify, and apply theorems regarding chords of a circle:
- Equal chords intercepting equal arcs *and its converse*.
- Arcs cut by two parallel chords or secant lines *and its converse*
- Lines drawn through the center perpendicular to a chord *and its converse*
- Distance of line segments drawn from the center of a circle to congruent chords *and its converse*.
- Investigate, justify, and apply theorems about two tangent lines drawn to a circle from a point outside the circle and their relationship to each other.
- Investigate, justify, and apply theorems about a tangent line and a radius drawn to the point of tangency *and its converse*.
- Investigate the properties of two tangent lines drawn to two non-intersecting or tangent circles
- Investigate, justify, and apply theorems related to *internal* angles created by two chords, a secant line and a chord or two secant lines when the vertex is inside the circle but neither at the center nor on the circle
- Continue to develop two column proof using angle properties of circles.

Similarity

Euclidean

- Determine ***similarity*** of triangles, using the following theorems: AA, SAS, and SSS (GSRT-3)
- Investigate relationships and explore theorems related to similar triangles. GSRT-2
- Explore similarity in right triangles by discovering and applying the three geometric mean theorems. Missing from CC
- Investigate, justify, and apply theorems about proportional relationships among the segments of the sides of similar triangles, given one or more lines parallel to one side of a triangle and intersecting the other two sides of the triangle (side splitter theorem). GSRT-5
  Investigate and discover the triangle-angle bisector theorem. Missing from CC

- Continue to develop two column proof involving Similar triangles GSRT-4
  Explore the relationships between the legs and hypotenuse of Missing from CC
  a. 30-60-90 triangles
  b. 45-45-90 triangles

Solid Geometry

Definitions: plane, coplanar

- Know and apply the theorem that if a line is perpendicular to each of two intersecting lines at their point of intersection, then the line is perpendicular to the plane determined by them
- Know and apply that through a given point there passes one and only one plane perpendicular to a given line
- Know and apply that through a given point there passes one and only one line perpendicular to a given plane
- Know and apply that two lines perpendicular to the same plane are coplanar
- Know and apply that two planes are perpendicular to each other if and only if one plane contains a line perpendicular to the second plane
- Know and apply that if a line is perpendicular to a plane, then any line perpendicular to the given line at its point of intersection with the given plane is in the given plane
- Know and apply that if a line is perpendicular to a plane, then every plane containing the line is perpendicular to the given plane
- Know and apply that if a plane intersects two parallel planes, then the intersection is two parallel lines
- Know and apply that if two planes are perpendicular to the same line, they are parallel

Volume/Surface Area

Definitions: Edge, face, vertices, base.

- Know and apply that the lateral edges of a prism are congruent and parallel
- Know and apply that two prisms have equal volumes if their bases have equal areas and their altitudes are equal
- Know and apply the theorem that the volume of a prism is the product of the area of the base and the altitude
- Apply the properties of a regular pyramid, including:

a. lateral edges are congruent
b. lateral faces are congruent isosceles triangles
c. volume of a pyramid equals one-third the product of the area of the base and the altitude

- Apply the properties of a cylinder, including:
  a. bases are congruent
  b. volume equals the product of the area of the base and the altitude
  c. lateral area of a right circular cylinder equals the product of an altitude and the circumference of the base
- Apply the properties of a right circular cone, including:
  a. lateral area equals one-half the product of the slant height and the circumference of its base
  b. volume is one-third the product of the area of its base and its altitude
- Apply the properties of a sphere, including:
  a. the intersection of a plane and a sphere is a circle
  b. a great circle is the largest circle that can be drawn on a sphere
  c. two planes equidistant from the center of the sphere and intersecting the sphere do so in congruent circles
  d. surface area is $4\pi r^2$
  e. volume is $\frac{4}{3}\pi r^3$

Altitudes and medians of triangles

- Explore the concept of the incenter, orthocenter and circumcenter of a triangle.