

Middle School Mathematics Task Force Geometry Subcommittee Report

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Current Course Overview: This course is designed to give students a basic foundation in geometry and how geometric thinking develops in K-8 children. Participants are given many opportunities to explore geometric figures and develop an understanding of their properties and relationships. Emphasis will be placed on making observations and justifying conclusions. The mathematical objectives for participants include a deeper understanding of measurement, geometric shape, line and angle relationships, and three dimensional representations and properties.

Competencies and Specific Content:

The vanHiele Levels of Geometric Understanding and how they impact student learning and instruction

Standard and non-standard linear measurement (including perimeter and circumference)

Standard and non-standard measurement of area, including plane figures and introduction to the surface area of 3-D figures and nets

Standard and non-standard measurement of volume

Classification and measurement of angles

Properties of parallel and perpendicular lines

Classification and characteristics of triangles and quadrilaterals

Properties of triangles and quadrilaterals, including angle relationships, congruence and similarity

Properties of right triangles, and exploration of the Pythagorean Theorem

Classification and properties of polygons

Circle properties and relationships

Introduction to the idea of informal justification or “proof”

Rationale for adaptations to accommodate the needs of Middle School Specialists:

It is the feeling of the committee that all of the topics listed above should be included in the middle school course. The stated approach (exploration and discovery) is extremely important for the middle school specialist, and this course may provide their first opportunity. In addition, some of the topics should be extended and enriched. For this reason introductory topics will need to be compressed or combined.

A middle school specialist should have a comprehensive understanding of the concepts and skills addressed in the K-8 mathematics curriculum, and should be familiar with the additional concepts included in a high school geometry course (which is now offered at many middle schools). This would include understanding the development of geometric formulas, decomposing and recombining geometric figures, utilization of more formal geometric reasoning, and construction of geometric figures (both by hand and electronically). In a middle school setting there is an even

greater need for a teacher to recognize a student's level of geometric understanding and adapt instruction to fit the individual need.

Recommended Course Resources to support Middle School Specialists:

Access to Geometer's Sketchpad or other dynamic geometric software
Discovering Geometry (Key Curriculum Press)
Developing Thinking in Geometry, Paul Chapman Publishing, 2005
If available, a casebook with middle school cases related to geometry

Recommended Course Adaptations: As stated above, the original content should be included with certain adaptations as listed below.

Increased emphasis on coordinate geometry
Include instruction in the use of dynamic geometry software (such as The Geometer's Sketchpad), and make it regularly available to participants.
More emphasis on volume and surface area of 3-D figures.
Location and comparison of various triangle centers
Circle segments
Tessellations (including justification based on angle size)
Symmetry and Transformations

Summary Comments:

The introductory lessons on non-standard linear measurements (including royal measurements) could be shortened somewhat for this class, but should not be omitted. Angle wedges should at least be covered (if not created by the participants). Lessons involving sorting, classification, and properties of geometric figures should be extended, with emphasis on justification or "proof" of conclusions. Exploration with 3-D figures should include prisms, pyramids, cylinders, cones, spheres, and polyhedra.