Wallingford Public Schools - HIGH SCHOOL COURSE OUTLINE

Course Title: Geometry	**Course Number:** G1224, A 1223, H1222
Department: Mathematics	**Grade(s):** 9-12
Level(s): General, Academic, and Honors *Objectives to be mastered at different levels may vary. Expectations for each level are clearly defined within each learning strand, but are not intended to be limiting.*	**Credit:** 1

Course Description:
In this geometry course students define, classify, and measure their world through visualizations and models. They will apply theorems and postulates to calculate perimeters, lengths, angle measures, areas, and volumes of geometric figures. They will be required to justify their work both orally and in written form. Students will review linear functions learned in Algebra 1 and then apply them to geometric concepts. In the honors level, students will also develop formal written proofs and indirect proofs as well as review linear functions, circles, and quadratic functions to coordinate geometry. (Prerequisite: Algebra 1)

Required Instructional Materials:	**Completion/Revision Date:**
Honors textbook: *Geometry,* Ray C. Jurgenson, Richard G. Brown, John W. Jurgenson*,* Houghton Miffin, 1990. Academic textbook: *Geometry: An Integrated Approach,* Ronald E. Larson, Laurie Boswell, Lee Stiff*,* Heath, McDougall Littell, 1998. General textbook: *Geometry Concepts and Skills*, Ronald E. Larson, Laurie Boswell, Lee Stiff, McDougall Littell, Inc 2003. *Geometer's Sketchpad* software by Key Press	Revisions Approved by Board of Education on July 17, 2006

Mission Statement of the Curriculum Management Team
The mission of the Wallingford K-12 mathematics program is to develop mathematical literacy in all students. Students will understand the importance of mathematics and become flexible and resourceful problem solvers. They will use a range of numerical, algebraic, geometrical and statistical concepts and skills to formulate and solve authentic problems, communicating their reasoning in oral and written form.

Enduring Understandings for the Course
• A problem solver understands what has been done, knows why the process was appropriate, and can support it with reasons and evidence.
• There can be different strategies to solve a problem, but some are more effective and efficient than others are.
• The context of a problem determines the reasonableness of a solution.
• Geometry and spatial sense offer ways to interpret and reflect on our physical environment.
• Geometric figures can be represented numerically, graphically, symbolically, and verbally.

- Analyzing geometric relationships develops reasoning and justification skills.
- Some real world situations can be represented geometrically and graphically.
- Unique relationships exist between lines and angles.
- Different tools are needed to measure different geometric shapes.
- The sum of the interior angles of a triangle is a constant.
- The sum of the interior angles of a triangle directly relates to the sum of the interior angles of all other convex polygons.
- There is a relationship between the measure of the angles of a triangle and the measure of the sides of a triangle.
- The Pythagorean Theorem establishes an essential relationship between the sides of a right triangle.
- There is a relationship between the number of sides of a polygon and the sum of its interior angles.
- There are similarities and differences between all quadrilaterals.
- Each type of quadrilateral has properties that make it unique.
- Proportional relationships express how quantities change in relationship to each other.
- Geometric figures can change size and/or position while maintaining proportional attributes.
- Ratios can be used to compare similar figures.
- There are relationships between angles, arcs, and segments of circles.
- Every plane figure has an area and perimeter.
- Perimeter and area are measured in different ways.
- There is a constant relationship between the circumference of a circle and its diameter
- Every three dimensional shape has a surface area and volume.
- Generalizations can be made to represent the relationship between surface area and volume.

Learning Strand

1.0 Problem Solving

NOTE: This learning strand should be taught through the integration of the other learning strands. This learning strand is not meant to be taught in isolation as a separate unit.

ENDURING UNDERSTANDING(S)
- A problem solver understands what has been done, knows why the process was appropriate, and can support it with reasons and evidence.
- There can be different strategies to solve a problem, but some are more effective and efficient than others are.
- The context of a problem determines the reasonableness of a solution.

ESSENTIAL QUESTIONS
- How do I know where to begin when solving a problem?
- How does explaining my process help me to understand a problem's solution better?
- How do I decide what strategy will work best in a given problem situation?
- What do I do when I get stuck?
- How do I know when a result is reasonable?
- What is the relationship between solving problems and computation?

LEARNING OBJECTIVES   The student will :
1.1 Distinguish between given information, unknown information, and assumptions that may be necessary.
1.2 Identify different strategies to solve a problem (table, diagram, number pattern).
1.3 Devise a plan to solve the problem.
1.4 Apply an appropriate strategy(ies) to solve a problem.
1.5 Use a variety of computational strategies (mental computation, paper-and-pencil, and calculator) to solve multi-step word and practical problems.
1.6 Justify the strategy and solution with mathematical reasoning and evidence.
1.7 Analyze strategies used to solve problems.
1.8 Judge the reasonableness of a solution for a problem.
1.9 Communicate the solution and the strategies used to solve the problem in oral and/or written form.
1.10 Pose problems from given situations.
1.11 Distinguish between deductive and inductive reasoning.
1.12 Use deductive and inductive reasoning to support conclusions.

INSTRUCTIONAL SUPPORT MATERIALS
- Websites for problem solving
  - Math Forum
  - NCTM Standards and Illuminations
- CSDE Goals 2000 resources (W drive)
- CAPT Problems (released and sample practice problems)
  - House in a Hurry
  - Spinner Explorations
  - Planning a Bookcase

SUGGESTED INSTRUCTIONAL STRATEGIES
- Small group discussion about strategies and solutions
- Written explanation of strategy and solution for a problem
- Peer editing of strategies and solutions
- Revise written solutions of problems
- Oral presentation of solution strategies
- Journal writing
- Modeling
- Think aloud
- Student inquiry through guided investigations
- Graphic organizers
- TNT strategy (directions on W drive)
- Pass a Problem (directions on W drive)
- Cooperative learning
- Logic problems
- See other learning strands for integration

	SUGGESTED ASSESSMENTS
	• Open-ended questions included on tests and quizzes • Performance tasks • Teacher observations • Written explanation of strategy and solution for a problem • District rubric for assessing problem solving • Oral presentation of solution strategies • See other learning strands for integration

LEARNING STRAND

2.0 Lines and Angles

ENDURING UNDERSTANDING(S)
- Geometry and spatial sense offer ways to interpret and reflect on our physical environment.
- Analyzing geometric relationships develops reasoning and justification skills.
- Some real world situations can be represented geometrically and graphically.
- Geometric figures can be represented numerically, graphically, symbolically, and verbally.
- Different tools are needed to measure different geometric figures.
- Unique relationships exist between lines and angles.
- Geometric figures can be displayed on a coordinate system.

ESSENTIAL QUESTIONS
- How do geometric models describe spatial relationships?
- How are geometric figures and objects classified?
- How do I use geometric relationships to analyze or solve problems?
- How do I decide what tool will work best in any given problem situation?
- How do the properties of lines and angles contribute to geometric understanding?
- What role do lines and angles play in interpreting the world around us?

LEARNING OBJECTIVES
In General level the student will :
2.1 Apply vocabulary related to lines, segments, angles, rays and planes.
2.2 Apply the postulates related to lines, segments, angles, rays and planes.
2.3 Measure segments and angles using the appropriate tools.
2.4 Explain the relationship between different types of angle pairs.
2.5 Solve for an unknown variable given a geometric diagram containing algebraic expressions.
2.6 Use proper notation when referring to lines, planes, and angles.
2.7 Apply properties of parallelism and perpendicularity to problem situations.
2.8 Determine the measures of angles given a diagram using properties of vertical, complementary, supplementary, corresponding, and adjacent angles.
2.9 Determine the distance and slope between two points.
2.10 Find the lengths and coordinates of the midpoint of a segment.

In addition to above, the Academic level student will:
2.11 Verify segment and angle congruence.
2.12 Verify lines are parallel.

INSTRUCTIONAL SUPPORT MATERIALS
- Scientific calculator
- Ruler
- Protractor
- Compass
- *Geometer's Sketchpad* software
- *Discovering Geometry,* Key Curriculum Press
- *Teaching Reading in Mathematics,* Mary Lee Barton and Clare Heidema
- Individual dry erase boards
- Patty paper
- CAPT Problems (released and sample practice problems)
    - Midpoints and Percents
    - Computer Lab

SUGGESTED INSTRUCTIONAL STRATEGIES
- Teacher facilitated class discussions
- Cooperative Learning
- Small group discussion about strategies and solutions
- Written explanation of strategy and solution for a problem
- Modeling
- Student inquiry through guided investigations
    - ° *Discovering Geometry-* Paper Folding: The Basics
- Graphic organizers (*Reading in Math*, pg 101-108)

In addition to the above, the Honors level student will:
 	
2.13 Prove segment and angle congruence using direct and indirect methods.
 	
2.14 Prove lines are parallel using direct and indirect methods.
	• Vocabulary development strategies(*Teaching Reading in Math*)
	   o Concept definition mapping
	   o Frayer Model
	   o List-Group-Label
	   o Semantics Feature Analysis
	   o Semantic Mapping
	   o Verbal and Visual Word Association
	   o Word Sort
	• Revision of previous work
	• Computer assisted instruction – *Geometers Sketchpad*
	
	SUGGESTED ASSESSMENTS
	• Homework/Classwork
	• Notebook
	• Quizzes and tests
	• Self-evaluation
	• Partner quizzes
	• Teacher observation of group activity
	• Problem solving assessed with rubric
	• Projects - Frequent Flyer Miles Project
	• Reflective journals
	• Teacher observations
	• Writing assignments

LEARNING STRAND

3.0 Triangles

ENDURING UNDERSTANDING(S)
- Geometry and spatial sense offer ways to interpret and reflect on our physical environment.
- Analyzing geometric relationships develops reasoning and justification skills.
- The sum of the interior angles of a triangle is a constant.
- There is a relationship between the measure of the angles of a triangle and the measure of the sides of a triangle.
- The Pythagorean Theorem establishes an essential relationship between the sides of a right triangle.

ESSENTIAL QUESTIONS
- How do the properties of triangles contribute to geometric understanding?
- Given that a geometric object has certain properties, what other properties can be inferred?
- What is the relationship between angles and sides of an angle?
- How can the Pythagorean Theorem be used to solve problems?

LEARNING OBJECTIVES
In General level the student will:
3.1 Identify the parts of a triangle.
3.2 Classify triangles by their angles and sides.
3.3 Find the measures of the interior and exterior angles of a triangle.
3.4 Verify the relationships between the sides of a right triangle using the Pythagorean Theorem.
3.5 Solve geometric and real world problems using the Pythagorean Theorem.
3.6 Classify a triangle using the Pythagorean Theorem Converse.
3.7 Identify the corresponding parts of congruent triangles.
3.8 Arrange sides and angles in order from least to greatest measures using the triangle inequality theorems.
3.10 Identify congruent triangles using SAS, SSS, ASA, AAS or HL.
3.11 Calculate the measures of the missing sides or angles in isosceles triangles.
3.12 Verify that two triangles are congruent.

In addition to the above, the Academic level student will:
3.13 Apply the definitions of median, altitude, midsegment, perpendicular bisector and angle bisector to geometric situations.
3.14 Determine the lengths of two sides of a 30-60-90 right triangle given the length of one side.
3.15 Determine the lengths of two sides of a 45-45-90 right triangle given the length of one side.

INSTRUCTIONAL SUPPORT MATERIALS
- Scientific calculator
- Protractor
- Ruler
- Dry erase boards
- Patty Paper
- Geoboards
- *Geometer's Sketchpad* software
- *Discovering Geometry,* Key Curriculum Press
- *Teaching Reading in Mathematics,* Mary Lee Barton and Clare Heidema
- CAPT Problems (released and sample practice problems)
    - The Snail Shell Puzzle
    - Stair Railing
    - Shortest Route

SUGGESTED INSTRUCTIONAL STRATEGIES
- Small group discussion about strategies and solutions
- Written explanation of strategy and solution for a problem
- Modeling
- Student inquiry through guided investigations
    - Congruent Triangle Investigation
- Graphic organizers (*Teaching Reading in Math*, pg 101-108)
- Vocabulary development strategies (*Teaching Reading in Math)*
- Games
- Cooperative learning
- Teacher facilitated class discussions

3.16 Solve for unknown variables in right triangles using geometric mean.

In addition to the above, the Honors level student will:
3.17 Use a 2-column deductive format to prove congruent triangles.
3.18 Use a 2-column deductive format to prove triangle inequalities.
3.19 Use tangent, sine, cosine and their inverses to solve for lengths and angles in right triangles.

- Computer assisted instruction- *Geometers Sketchpad*
- Revision of previous work

SUGGESTED ASSESSMENTS
- Homework/Class work
- Notebook
- Quizzes and tests
- Self-evaluation
- Partner quizzes
- Teacher observation of group activity
- Problem solving assessed with rubric
- Projects
- Writing assignments/reflective journals
- Teacher observations

LEARNING STRAND	
4.0 Polygons	

ENDURING UNDERSTANDING(S)	**ESSENTIAL QUESTIONS**
• Geometry and spatial sense offer ways to interpret and reflect on our physical environment. • Analyzing geometric relationships develops reasoning and justification skills. • There is a relationship between the number of sides of a polygon and the sum of the measures of the interior angles • There are similarities and differences between all quadrilaterals. • Each type of quadrilateral has properties that make it unique.	• How are geometric shapes classified? • What patterns exist among polygons? • What makes a shape a polygon? • How do geometric models describe spatial relationships? • How are geometric shapes and objects classified? • How are quadrilaterals unique?
LEARNING OBJECTIVES ***In General and Academic level the student will:*** 4.1 Classify polygons based on their properties and attributes. 4.2 Calculate the measure of each interior and exterior angle of a regular polygon. 4.3 Determine the sum of the interior angles of a polygon. 4.4 Use the exterior angle theorem of polygons to find the measure of angles. 4.5 Compare and contrast the properties of parallelograms and trapezoids. 4.6 Use the relationships between the angles and sides of parallelograms and trapezoids to find missing angles and sides. 4.7 Compare and contrast a square, rectangle, rhombus, trapezoid, isosceles trapezoid, right trapezoid. 4.8 Verify that a quadrilateral is a parallelogram. ***In addition to the above, the Honors level student will:*** 4.9 Use a 2-column deductive format to prove quadrilaterals are parallelograms, rhombi, rectangles, and squares.	**INSTRUCTIONAL SUPPORT MATERIALS** • Scientific calculator • Protractor • Ruler • Dry erase boards • *Teaching Reading in Mathematics,* Mary Lee Barton and Clare Heidema • *Geometer's Sketchpad* software • *Discovering Geometry,* Key Curriculum Press • CAPT released items Classifying Quadrilaterals **SUGGESTED INSTRUCTIONAL STRATEGIES** • Teacher facilitated class discussions • Classroom discussion • Small group discussion about strategies and solutions • Guided practice • Written explanation of strategy and solution for a problem • Modeling • Cooperative learning • Games for reinforcement and review • Student inquiry through guided investigations ○ Properties of a parallelogram investigation ○ Properties of special parallelograms investigation ○ Finding the angles of a polygon investigation • Graphic organizers (*Teaching Reading in Math*, pg 101-108) • Vocabulary development strategies(*Teaching*

	Reading in Math) • Revision of previous work • Computer assisted instruction – *Geometers Sketchpad* • Labs **SUGGESTED ASSESSMENTS** • Homework/Classwork • Notebook • Quizzes and tests • Self-evaluation • Partner quizzes • Teacher observation of group activity • Problem solving assessed with rubric • Projects • Reflective journals • Teacher observations • Writing assignments

LEARNING STRAND

5.0 Similar Figures

ENDURING UNDERSTANDING(S)	ESSENTIAL QUESTIONS
• Geometry and spatial sense offer ways to interpret and reflect on our physical environment. • Analyzing geometric relationships develops reasoning and justification skills. • Proportional relationships express how quantities change in relationship to each other. • Geometric figures can change size and/or position while maintaining proportional attributes. • Ratios can be used to compare similar figures.	• When and why do I use proportional comparisons? • How are similar figures described using ratios and proportions? • How is proportional reasoning of geometric figures used to solve problems?

LEARNING OBJECTIVES	INSTRUCTIONAL SUPPORT MATERIALS
In General level the student will: 5.1 Identify the properties of similar polygons. 5.2 Investigate the relationship between proportion and scale factor. 5.3 Determine the scale factor of two similar polygons. 5.4 Apply ratio, proportions and scale factors to solve real world problems involving similarity. *In addition to the above, the Academic level student will:* 5.5 Verify that two triangles are similar. *In addition to the above, the Honors level student will:* 5.6 Use a 2-column deductive format to prove that two triangles are similar.	• Scientific calculator • Ruler • *Geometer's Sketchpad* software • *Discovering Geometry,* Key Curriculum Press • *Teaching Reading in Mathematics,* Mary Lee Barton and Clare Heidema • CAPT released items The Camping Trip The Parcel Drop Hit and Run Maple Syrup Statue of Liberty On Long Island Sound **SUGGESTED INSTRUCTIONAL STRATEGIES** • Teacher facilitated class discussions • Classroom discussion • Small group discussion about strategies and solutions • Guided practice • Graphic organizers (*Reading in Math*, pg 101-108) • Vocabulary development strategies (*Reading in Math)* • Written explanation of strategy and solution for a problem • Modeling • Cooperative learning • Revision of previous work • Computer assisted instruction - *Geometers*

	Sketchpad • Student inquiry through guided investigations **<u>SUGGESTED ASSESSMENTS</u>** • Homework/Classwork • Notebook • Quizzes and tests • Self-evaluation • Partner quizzes • Teacher observations of group activity • Problem solving assessed with rubric • Projects – Enlargement Project • Reflective journals • Writing assignments

LEARNING STRAND

6.0 Circles

ENDURING UNDERSTANDING(S)
- Geometry and spatial sense offer ways to interpret and reflect on our physical environment.
- Analyzing geometric relationships develops reasoning and justification skills.
- There are relationships between angles, arcs, and segments of circles.

ESSENTIAL QUESTIONS
- What experiences will lead me to discover the relationships in circles?
- What characteristics make a circle unique as a geometric figure?
- How can properties and relationships from other geometric figures be applied to circles?

LEARNING OBJECTIVES
In General level the student will:
6.1 Identify segments, lines, angles, and arcs of circles.
6.2 Apply the relationships between arcs, angles, and segments of circles
6.3 Solve real world problems using the properties of circles.

In addition to the above, the Academic and Honors level student will:
6.4 Solve for the length of a segment using the corresponding theorems.
6.5 Find the equation of a circle when given its graph.
6.6 Construct the graph of a circle when given its equation.
6.7 Apply theorems of secants and tangents to solve for unknown segment or angle.

INSTRUCTIONAL SUPPORT MATERIALS
- Scientific calculator
- Ruler
- Compass
- Protractor
- Dry erase boards
- *Geometer's Sketchpad* software
- *Discovering Geometry,* Key Curriculum Press

SUGGESTED INSTRUCTIONAL STRATEGIES
- Teacher directed discussion
- Classroom discussion
- Small group discussion about strategies and solutions
- Guided practice
- Written explanation of strategy and solution for a problem
- Modeling
- Cooperative learning
- Games for reinforcement and review
- Revision of previous work
- Research real data to use in problems
- Computer assisted instruction – *Geometers Sketchpad*
- Student inquiry through guided investigations
- Labs

SUGGESTED ASSESSMENTS
- Teacher observations
- Tests
- Quizzes
- Projects
- Homework/Classwork
- Notebooks
- Writing assignments

LEARNING STRAND

7.0 Perimeter and Area of Plane Figures

ENDURING UNDERSTANDING(S)
- Geometry and spatial sense offer ways to interpret and reflect on our physical environment.
- Analyzing geometric relationships develops reasoning and justification skills.
- Every plane figure has an area and perimeter.
- Perimeter and area are measured in different ways.
- There is a constant relationship between the circumference of a circle and its diameter

ESSENTIAL QUESTIONS
- How does what I measure influence how I measure?
- Where does pi come from?
- In what ways are the perimeter and area of a figure related?
- How do the dimensions of a geometric figure affect its area?

LEARNING OBJECTIVES
In General level the student will:
7.1 Determine the perimeter of plane figures.
7.2 Establish the relationship between the formulas for the area of rectangles, squares, triangles, parallelograms, trapezoids, and circles.
7.3 Analyze how the perimeter and the area of a plane figure are related.
7.4 Investigate the relationship between the diameter and circumference of a circle.
7.5 Determine the areas of composite figures.
7.6 Solve problems from real life settings that involve perimeter and area of common geometric figures.

In addition to the above, the Academic and Honors level student will:
7.7 Use area and perimeter formulas to derive missing segments.
7.8 Calculate the lengths of arcs and the area of sectors.
7.9 Convert units of measure in a two dimensional setting.
7.10 Derive and use formulas for the area of rhombi.

INSTRUCTIONAL SUPPORT MATERIALS
- Scientific calculator
- Ruler
- Compass
- *Geometer's Sketchpad* software
- *Discovering Geometry,* Key Curriculum Press
- String
- Circular objects
- Dry erase boards
- CAPT released items
  - Expanding Table
  - Stained Glass
  - Camping
  - Patchwork Quilts
  - Golf Course
  - Pager Range
  - Hugo's Pizza
  - Pizza Order
  - The Cassette Tape
  - Book Covers
  - Geo Design of Tracks
  - Building a Cabin
  - Bicycle Wheels
  - Running Track
  - Sports Bag
  - Senior Center
  - Plans for a New House
  - Continuing Adventures of Marvelous Marlone

SUGGESTED INSTRUCTIONAL STRATEGIES
- Teacher directed discussion
- Classroom discussion
- Small group discussion about strategies and solutions

	• Guided practice
	• Graphic organizers (*Teaching Reading in Math*, pg 101-108)
	• Vocabulary development strategies (*Teaching Reading in Math)*
	• Written explanation of strategy and solution for a problem
	° Shakespeare Problem (W drive)
	° Wipe It Clean problem (W drive)
	° Sprinkler Problem (W drive)
	° Bigger and Better Photo (W drive)
	• Modeling
	• Cooperative learning
	• Games for reinforcement and review
	• Revision of previous work
	• Research real data to use in problems
	• Computer assisted instruction
	• Student inquiry through guided investigations
	° Pi investigation
	• Labs
	SUGGESTED ASSESSMENTS
	• Homework/Classwork
	• Notebook
	• Quizzes and tests
	• Self-evaluation
	• Partner quizzes
	• Teacher observation of group activity
	• Problem solving assessed with rubric
	• Projects - Popzi Challenge
	• Reflective journals
	• Teacher observations
	• Writing assignments

LEARNING STRAND

8.0 Surface Area and Volume of Three Dimensional Figures

ENDURING UNDERSTANDING(S)
- Geometry and spatial sense offer ways to interpret and reflect on our physical environment.
- Analyzing geometric relationships develops reasoning and justification skills.
- Every three dimensional shape has a surface area and volume.
- Generalizations can be made to represent the relationship between surface area and volume.

ESSENTIAL QUESTIONS
- How does what I measure influence how I measure?
- How do the dimensions of a geometric figure affect its surface area and volume?
- What connections exist between the volume of different solids?

LEARNING OBJECTIVES
In General level the student will:
8.1 Determine the base area, lateral area and total surface area of prisms, and cylinders.
8.2 Use models to find and derive formulas for surface area and volume of prisms and cylinders.
8.3 Find the surface area of a sphere.
8.4 Determine the volume of prisms, cylinders and spheres.
8.5 Solve real world problems that involve surface area and volume.

In addition to the above, the Academic and Honors level student will:
8.6 Determine the base area, lateral area, surface area, and volume of cones and pyramids.
8.7 Calculate the surface area and volume of composite figures.
8.8 Analyze how the surface area and dimensions of a three-dimensional figure affect its volume.
8.9 Convert units of measure in a three dimensional setting.

INSTRUCTIONAL SUPPORT MATERIALS
- Scientific calculator
- Ruler
- Three-dimensional solids
- CAPT released items
  - Oil Truck
  - Silly Melon
  - Jamaican Coin
  - Backpack Purchase
  - Measuring Paper
  - The Birdfeeder
  - The New Soccer Field
  - Buying Strapping Tape
  - Ice Chest Capacities
  - Cereal Box Dilemma

SUGGESTED INSTRUCTIONAL STRATEGIES
- Class discussions
- Small group discussion about strategies and solutions
- Guided practice
- Written explanation of strategy and solution for a problem
  - Camp Juice (W drive)
- Modeling
- Cooperative learning
- Games for reinforcement and review
- Revision of previous work
- Research real data to use in problems
- Student inquiry through guided investigations
  ° Polyhedron gum drop investigation

SUGGESTED ASSESSMENTS
- Homework/Classwork
- Notebook
- Quizzes and tests

	• Self-evaluation • Partner quizzes • Teacher observation of group activity • Problem solving assessed with rubric • Projects • Writing assignments/ reflective journals