Exhibit O

BALTIMORE COUNTY PUBLIC SCHOOLS

DATE: August 9, 2011

TO: **BOARD OF EDUCATION**

FROM: Dr. Joe A. Hairston, Superintendent

SUBJECT: **CONSIDERATION OF THE GEOMETRY CURRICULUM**

ORIGINATOR: Dr. Renee A. Foose, Deputy Superintendent

RESOURCE PERSON(S): Roger Plunkett, Assistant Superintendent, Curriculum and Instruction
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Patricia Baltzley, Director, Mathematics PreK-12
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RECOMMENDATION

That the Board of Education approves the Geometry curriculum.

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Attachment I – Executive Summary and Curriculum Pilot Evaluation
Attachment II – AIM Objectives
Attachment III – Phase III - BCPS Course Request

BALTIMORE COUNTY PUBLIC SCHOOLS

Executive Summary and Curriculum Pilot Evaluation

Pilot Name: Geometry Curriculum

Executive Summary

In 1999, two separate curriculum guides were developed to support teachers teaching in the geometry program in Baltimore County: *Geometry and Foundations of Geometry* and *Gifted and Talented 9 Geometry and Honors Geometry.* These two curriculum guides were aligned to Core Learning Goal 2: Geometry, Measurement, and Reasoning, but were supported by two different textbooks. Although an addendum was developed in 2001 for the *Gifted and Talented 9 Geometry and Honors Geometry* curriculum guides, these two curriculum guides have not been revised since 1999.

The purpose of revising the *Geometry* curriculum was to produce one curriculum guide, differentiated for Standard, Honors, and GT9 Geometry, that provides the background and framework for geometry instruction appropriate for 21st Century learners, reflects the principles and philosophy of STEM, and is aligned to the Common Core State Standards. The geometry program features an inquiry approach based on the van Hiele levels of geometric thought: visualization, analysis, informal deduction, deduction, and rigor. The program focuses on the development of spatial sense; representation, analysis, and measurement of two- and three-dimensional figures; and the abilities to make and verify conjectures and construct valid mathematical arguments using deductive and inductive reasoning skills. The program emphasizes the application of mathematics in real-world contexts, the use of language to communicate mathematical ideals effectively, and the importance of geometry in society and careers. The *Common Core Standards for School Mathematics, Focus in High School Mathematics: Reasoning and Sense Making in Geometry, Principles and Standards for School Mathematics, Professional Teaching Standards,* and *Assessment Standards* developed by the National Council of Teachers of Mathematics outline the core teaching, learning, and assessment standards for the Baltimore County Geometry program.

Three textbooks were piloted during 2009-2010, and the draft curriculum was developed and piloted with the one textbook selected from that pilot to support instruction in all geometry courses. The revised curriculum was piloted during the 2010-2011 academic year with 15 teachers in 13 high schools across the system. Pilot teachers met throughout the year either through face-to-face or Webinar opportunities for training on curriculum materials and to examine and analyze student performance data and to provide anecdotal data relative to content, delivery of instruction, organization, assessment, and the alignment with standards. Professional development was also provided to pilot teachers by the Office of Mathematics.

Based on feedback, final curriculum revisions were made during the spring of 2011. All geometry teachers were offered the opportunity to attend one of two five-day workshops for training on the revised curriculum in either June 2011 or August 2011. Additional professional development will be provided for all teachers throughout the school year. The revised curriculum will be implemented systemwide beginning in 2011-2012. Office of Mathematics secondary staff will monitor daily instruction and continue to collect anecdotal feedback.

BALTIMORE COUNTY PUBLIC SCHOOLS

Research Questions:

1. What are/were the expectations for implementation of the pilot curriculum?
2. How does/did the pilot curriculum impact the approach to content instruction?
3. What is/was the impact of the pilot curriculum on student achievement?

Research Question 1: What are/were the expectations for implementation of the pilot curriculum?

Outcome	Criteria	Measures Used
Pilot teachers will implement the draft written curriculum in daily mathematics instruction.	Pilot teachers will self-report on their use of written curriculum. When observed in their classrooms, pilot teachers will include use of instructional strategies from the written curriculum.	Surveys of teachers: Curriculum Evaluation, Unit Feedback Classroom observations
Effective professional development on the written curriculum and on new instructional strategies will be provided for pilot teachers.	Pilot teachers will indicate that the professional development assisted them in implementing the curriculum and new instructional strategies.	Surveys of teachers: Professional Development
Curriculum materials will provide pilot teachers with support necessary to implement the written curriculum.	Pilot teachers will indicate that the curriculum materials assisted them in implementing the written curriculum.	Surveys of teachers: Curriculum Evaluation
Curriculum materials and professional development will be revised as needed.	Pilot teachers will report all issues/concerns throughout the pilot process.	Surveys of teachers: Curriculum Evaluation, Unit Feedback, Professional Development

<u>Findings:</u>

- The pilot curriculum was provided to sixteen pilot teachers to implement in their schools for the 2010-2011 school year. One teacher dropped out of the pilot at the beginning of the school year. Fifteen pilot teachers continued with the pilot for the remainder of 2010-2011.
- Eight of the 15 pilot teachers were observed presenting lessons from the draft curriculum guide. Observations from these classroom visits provided information that pilot teachers were using instructional strategies from the draft written curriculum. During classroom observations, students appeared to be engaged at a higher level in the geometry instruction. They were observed to be more willing to analyze, discuss, and work through problems. Vocabulary use by students was observed to be stronger as well. All of these student observations supported that teachers were utilizing the written draft curriculum.
- Data collected from electronic surveys after the Pilot PD sessions show that the professional development was beneficial for the teachers as they piloted the curriculum guide (11 of 12

who attended responded to a survey after the January 2011 professional development; 11 of 11 who attended responded to a survey after the March 2011 professional development). The one issue that was rated "disagree or lower" was item 5 for January and March with one responder marking “Somewhat Disagree” in response to the question, “Information shared during this session helped me gain a better understanding of how students learn mathematics.” Responses to Items 7-10 were short answer responses and were reviewed and summarized to assist with revisions to the guide and design of the week long summer professional development.

- Eleven of the 15 pilot teachers returned the curriculum evaluation near the end of the pilot. Data collected from this electronic survey show that the majority of the pilot teachers agreed or strongly agreed that the written curriculum supported the implementation of the geometry program as they piloted the curriculum guide.
- Curriculum revisions were made utilizing the feedback provided by the pilot teachers on the Unit Feedback Forms. Data collected from the curriculum evaluation survey shows that pace needs to be addressed as revisions are made to the guide and during the first year of implementation. Comments from the pilot teachers were helpful in identifying revisions for the guide and in the design of the week-long professional development summer sessions.
    - Notable quotes: What differences has it made in your role as a teacher?
        - “I see now how much we as teachers can have an effect on the curriculum, and then are able to see it implemented across the county. It means a lot for a teacher to be able to put in their input into the guide, especially because we are currently working in the field, and know firsthand what is going on inside the classroom.”

Research Question 2: How does/did the pilot curriculum impact the approach to content instruction?

Outcome	Criteria	Measures Used
Teachers’ feelings/attitudes and performance/behaviors related to implementing the written curriculum will change.	Pilot teachers will increase in their stage of concern/level of use.	*Stages of Concern Questionnaire* (SOCQ) and *Levels of Use Survey* (LOU)
The pilot curriculum is beneficial to student engagement, teaching, and learning.	Pilot teachers indicate that the draft curriculum actively engaged students and provided opportunities for deeper understanding of content.	Surveys of teachers: Curriculum Evaluation Action Research Project

Findings:

- The SOCQ was used to determine the pilot teachers’ levels of concern during the piloting of the Geometry Curriculum Guide. Data gathered from the SOCQ was used to address pilot teachers concerns throughout the pilot phase with the goal of helping individuals transition from lower stages to higher stages. This data was also helpful in designing professional development for the pilot teachers and for the week-long training. *Peak Score Interpretation* for individual and group data was used. It should be noted that the higher the score the more

intense the concerns at that stage and the lower the score the less intense the concerns at that stage. Higher and lower are not absolute, however, but relative to the other stages scores for the individual or group. Most of the pilot teachers completed the SOCQ: 9 out of 15 completed the fall 2010 SOCQ; 13 out of 15 completed the spring 2011; 8 out of 15 completed both; 2 out of 15 did not complete either survey. An analysis of individual and group data (fall 2010 and spring 2011) revealed that most of the pilot teachers indicated an intense concern related to *Collaboration*-coordination and cooperation with others regarding use of the innovation. A review of those completing both surveys reveals changes in intensity levels for the stages and some changes in their peak stage: 3 out of 8 same peak Level 5; 1 out of 8 peak shifted from Level 1 to Level 5; 1 out of 8 shifted from Level 5 to Level 1; 1 out of 8 shifted from Level 0 to Level 2; 1 out of 8 shifted from Level 1 to Level 0; and 1 out of 8 shifted from Level 5 to Level 2.

Stages of Concern Data

Fall 2010

	0	1	2	3	4	5	6
Teacher A	49	69	59	34	30	88	81
Teacher B	10	30	48	14	43	72	47
Teacher C	46	30	45	43	27	95	60
Teacher D	72	66	70	60	27	68	52
Teacher E	93	66	61	60	27	48	60
Teacher F	53	45	59	52	38	93	47
Teacher G	66	75	72	34	54	52	60
Teacher H	37	75	78	39	21	84	60
Teacher I	46	72	80	69	66	59	69
Teacher J							
Teacher K							
Teacher L							
Teacher M							
Group Mean	52	59	64	45	37	73	60
Number of individuals	2	1	1	0	0	5	0

Spring 2011

	0	1	2	3	4	5	6
Teacher A	49	71	72	18	18	91	42
Teacher B	66	79	57	47	43	48	17
Teacher C	46	23	25	47	33	80	38
Teacher D	29	19	40	23	8	22	5
Teacher E	23	48	38	11	48	52	57
Teacher F	37	63	5	15	59	98	11
Teacher G	96	88	83	80	42	76	60
Teacher H	10	72	89	52	86	68	84
Teacher I							
Teacher J	66	72	72	60	82	98	93
Teacher K	29	75	78	65	31	72	69
Teacher L	46	27	17	15	19	3	14
Teacher M	29	16	25	11	24	95	30
Group Mean	44	54	50	37	41	67	43
Number of individuals	2	1	3	0	0	6	0

- LOU Survey items were incorporated into the online surveys administered for the professional development sessions and the curriculum evaluation. Many of the pilot teachers are at the Routine and Refinement Levels of use and transitioning into Level 5-integration.
- All the pilot teachers completing the curriculum evaluation reported that the materials actively engaged the students to promote their understanding of the curriculum.
    - Notable quotes: What differences has it made in your presentation of material?
        - "Breaks the mold we have been using in Math for years."
        - "My presentation is far more hands on."
        - "Rely more on hands-on and discovery-based learning."

        - "Giving the students more opportunity to investigate and learn the material on their own."
        - "The old geometry curriculum was application based, and so felt more like 'algebra II with diagrams.' The new geometry curriculum feels more authentic and should provide students who claim to hate mathematics an opportunity to be successful in material that they had not previously recognized as mathematics."
        - "My presentation is much more student centered."
    - Notable quotes: What differences has it made in your role as a teacher?
        - "I am doing more coaching than lecturing."
        - "It has made me more of a facilitator and realize [that] I don't have to be the only one sharing ideas and doing the discovering of why things work the way they do."
        - "Helped me to guide students toward a deeper understanding of geometric concepts."
- Pilot teachers at 5 of the 13 pilot schools participated in a small action research project to study the effectiveness of the geometry curriculum designed around the van Hiele-model and in which the content is developed through a transformational approach. It was expected that such a curriculum will increase the level of geometric thinking in students and improve student achievement in the area of geometry. The data and results support the hypothesis that a van Hiele model along with a transformational approach to develop geometric thinking and geometric understanding in students is effective. The results from the van Hiele assessment show gains in at least 50% of the students' van Hiele levels.

Research Question 3: What is/was the impact of the pilot curriculum on student achievement?

Outcome	Criteria	Measures Used
Student achievement will improve as a result of the implementation of the written curriculum.	Student achievement will improve from previous year. Student achievement will improve when compared to national/international norms.	Benchmark Assessments Student artifacts Two items from Programme for International Student Assessment (PISA)

Findings:

- Benchmark data was collected and analyzed using assessments designed specifically for the pilot curriculum. No concerns related to topic mastery were identified by the pilot teachers. Final exam data were collected and reviewed using administration of the current appropriate course level final exam. Analysis showed no negative changes in student performance compared to previous administrations.
- Students in pilot classrooms were administered two items from the PISA. Item analysis showed that students in the pilot classrooms scored better than the United States average on both questions. The results from two schools are shown on the next page.

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PISA Item Analysis
Question 1: Triangles

School E	
Answer Choice	**Number of Responses**
A	8
B	10
C	9
*D	42

School F	
Answer Choice	**Number of Responses**
A	4
B	4
C	14
*D	30

Percent Correct:	60.9%

Percent Correct:	57.7%

United States Average:	46%

Question 2: Farms

School E	
Question	**Percentage of Correct Responses**
2a	72.5%
2b	98.6%

School F	
Question	**Percentage of Correct Responses**
2a	82.7%
2b	92.3%

United States	
2a	51%
2b	67%

- Source: http://nces.ed.gov/surveys/pisa/pdf/PISA_Math_Concepts_Items.pdf

Addendum: The Office of Mathematics worked collaboratively with Dr. Todd Moyer, a Towson University associate professor of mathematics, throughout the development and piloting of the Geometry curriculum. The following is an excerpt from a note written by Dr. Moyer: "As a Towson University professor and geometry education researcher, I have been involved with the curriculum effort by Dr. John Staley and Ms. Nina Riggs for the past year. The new curriculum is aligned with the van Hiele Model of Geometric Thought, which has been shown through research to be an effective means of geometry instruction. I have reviewed the curriculum guides for the units as they have been created. The writers have been developing the guide in accordance to the van Hiele Model, including activities to build the foundation of understanding for each student. I am thoroughly impressed by the new curriculum guide and am genuinely excited for the implementation of the guide in the classrooms. It should be a wonderful experience for both students and teachers!

Articulated Instruction Module

Objectives List (2011 - 2012)

Subject Area : Mathematics
Course : GEOMETRY (2030000)

Last Revised : 07/13/2011
Report Date : 07/13/2011

Objectives / Knowledge and Skill Indicators

Unit: A. Foundations for Geometry

O-1 Given geometric terms, students will define each term precisely.

Congruence 1: Experiment with transformations in the plane (G.CO.1-CO.5) (Source : Common Core Standards for Mathematics)

KSI-A Identify, name, and draw points, lines, segments, rays, and planes.

KSI-B Apply basic facts about points, lines, and planes.

KSI-C Name and classify angles.

KSI-D Identify adjacent, vertical, complementary, and supplementary angles.

KSI-E Find measures of pairs of angles.

Unit: A. Foundations for Geometry

O-2 Students will make formal geometric constructions with a variety of tools and methods.

Congruence 1: Experiment with transformations in the plane (G.CO.1-CO.5) (Source : Common Core Standards for Mathematics)

Congruence 4: Make geometric constructions (G.CO.12-CO.13) (Source : Common Core Standards for Mathematics)

KSI-A Use length and midpoint of a segment.

KSI-B Construct midpoints and congruent segments.

KSI-C Measure and construct angles and angle bisectors.

Unit: B. Extending Transformational Geometry

O-3 Students will represent transformations in the plane using, e.g., transparencies and geometry software, describe transformations as functions that take points in the plane as inputs and give other points as outputs, and compare transformations that preserve distance and angle to those that do not.

Congruence 1: Experiment with transformations in the plane (G.CO.1-CO.5) (Source : Common Core Standards for Mathematics)

Similarity, Right Triangles, and Trigonometry 1: Understand similarity in terms of similarity transformations (G.SRT.1-SRT.3) (Source : Common Core Standards for Mathematics)

KSI-A Identify and draw reflections.

KSI-B Identify and draw translations.

KSI-C Identify and draw rotations.

KSI-D Apply theorems about isometries.

KSI-E Identify and draw compositions of transformation, such as glide reflections.

Unit: B. Extending Transformational Geometry

O-4 Given a geometric figure and a rotation, reflection, or translation, students will draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software and specify a sequence of transformations that will carry a given figure onto another.

Congruence 1: Experiment with transformations in the plane (G.CO.1-CO.5) (Source : Common Core Standards for Mathematics)

KSI-A Identify and describe symmetry in geometric figures.

KSI-B Use transformations to draw tessellations.

KSI-C Identify regular and semiregular tessellations and figures that will tessellate.

Unit: C. Geometric Reasoning

O-5 Given a conjecture or argument, students will use inductive or deductive reasoning to verify mathematical properties.

No standard available.

Subject Area : Mathematics
Course : GEOMETRY (2030000)

Last Revised : 07/13/2011
Report Date : 07/13/2011

	Objectives / Knowledge and Skill Indicators
	KSI-A Use inductive reasoning to identify patterns and make conjectures.
	KSI-B Find counterexamples to disprove conjectures.
	KSI-C Identify, write, and analyze the truth value of conditional statements.
	KSI-D Write the inverse, converse, and contrapositive of a conditional statement.
	KSI-E Apply the Law of Detachment and the Law of Syllogism in logical reasoning.
	Unit: C. Geometric Reasoning
O-6	Given a conjecture or argument, students will use inductive or deductive reasoning to verify mathematical properties.
	No standard available.
	KSI-A Write and analyze biconditional statements.
	KSI-B Review properties of equality and use them to write algebraic proofs.
	KSI-C Identify properties of equality and congruence.
	KSI-D Write two-column proofs. Prove geometric theorems by using deductive reasoning.
	KSI-E Write flowchart and paragraph proofs. Prove geometric theorems by using deductive reasoning.
	Unit: D. Parallel and Perpendicular Lines
O-7	Students will prove theorems about lines and angles.
	Congruence 3: Prove geometric theorems (G.CO.9-CO.11) (Source : Common Core Standards for Mathematics)
	Congruence 4: Make geometric constructions (G.CO.12-CO.13) (Source : Common Core Standards for Mathematics)
	KSI-A Identify parallel, perpendicular, and skew lines.
	KSI-B Identify the angles formed by two lines and a transversal.
	KSI-C Use the angles formed by a transversal to prove two lines are parallel.
	KSI-D Prove and use theorems about the angles formed by parallel lines and a transversal.
	KSI-E Prove and apply theorems about perpendicular lines.
	Unit: D. Parallel and Perpendicular Lines
O-8	Students will prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.
	Expressing Geometric Properties with Equations 2: Use coordinates to prove simple geometric theorems algebraically (G.GPE.4-GPE.7) (Source : Common Core Standards for Mathematics)
	KSI-A Find the slope of a line.
	KSI-B Use slopes to identify parallel and perpendicular lines.
	KSI-C Graph lines and write their equations in slope-intercept and point-slope form.
	KSI-D Classify lines as parallel, intersecting, or coinciding.
	Unit: E. Triangle Congruence
O-9	Students will 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.
	Congruence 2: Understand congruence in terms of rigid motions (G.CO.6-CO.8) (Source : Common Core Standards for Mathematics)
	Congruence 3: Prove geometric theorems (G.CO.9-CO.11) (Source : Common Core Standards for Mathematics)
	Congruence 4: Make geometric constructions (G.CO.12-CO.13) (Source : Common Core Standards for Mathematics)

Subject Area : Mathematics
Course : GEOMETRY (2030000)

Last Revised : 07/13/2011
Report Date : 07/13/2011

Objectives / Knowledge and Skill Indicators

KSI-A Use properties of congruent triangles.

KSI-B Prove triangles congruent by using the definition of congruence.

KSI-C Prove triangles congruent and construct triangles using SSS and SAS.

KSI-D Prove triangles congruent and construct triangles using ASA, AAS, and HL.

Unit: E. Triangle Congruence

O-10 Students will prove theorems about triangles.

Congruence 2: Understand congruence in terms of rigid motions (G.CO.6-CO.8) (Source : Common Core Standards for Mathematics)

Congruence 3: Prove geometric theorems (G.CO.9-CO.11) (Source : Common Core Standards for Mathematics)

Congruence 4: Make geometric constructions (G.CO.12-CO.13) (Source : Common Core Standards for Mathematics)

KSI-A Classify triangles by their angle measures and side lengths, and use triangle classification to find angle measures and side lengths.

KSI-B Find the measures of interior and exterior angles of triangles and apply theorems regarding interior and exterior angles.

KSI-C Use CPCTC to prove parts of triangles are congruent.

KSI-D Apply properties of isosceles and equilateral triangles.

KSI-E Prove theorems about isosceles and equilateral triangles.

Unit: F. Properties and Attributes of Triangles

O-11 Students will prove theorems about triangles-bisectors, medians, and altitudes.

Congruence 3: Prove geometric theorems (G.CO.9-CO.11) (Source : Common Core Standards for Mathematics)

KSI-A Prove and apply properties of perpendicular bisectors of a triangle.

KSI-B Prove and apply properties of angle bisectors of a triangle.

KSI-C Apply properties of medians of a triangle.

KSI-D Apply properties of altitudes of a triangle.

KSI-E Prove and use properties of triangle midsegments.

Unit: F. Properties and Attributes of Triangles

O-12 Students will use the Pythagorean Theorem to solve right triangles in applied problems.

Similarity, Right Triangles, and Trigonometry 3: Define trigonometric ratios and solve problems involving right triangles (G.SRT.6-SRT.8) (Source : Common Core Standards for Mathematics)

KSI-A Use the Pythagorean Theorem and its converse to solve problems.

KSI-B Use Pythagorean inequalities to classify triangles.

KSI-C Justify and apply properties of 45°-45°-90° triangles.

KSI-D Justify and apply properties of 30°-60°¬90° triangles.

Unit: G. Polygons and Quadrilaterals

O-13 Students will prove theorems about parallelograms.

Congruence 3: Prove geometric theorems (G.CO.9-CO.11) (Source : Common Core Standards for Mathematics)

Congruence 4: Make geometric constructions (G.CO.12-CO.13) (Source : Common Core Standards for Mathematics)

KSI-A Classify polygons based on their sides and angles.

Subject Area : Mathematics
Course : GEOMETRY (2030000)

Last Revised : 07/13/2011
Report Date : 07/13/2011

	Objectives / Knowledge and Skill Indicators
	KSI-B Find and use the measures of interior and exterior angles of polygons.
	Unit: G. Polygons and Quadrilaterals
O-14	Students will construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
	Congruence 4: Make geometric constructions (G.CO.12-CO.13) (Source : Common Core Standards for Mathematics)
	KSI-A Construct an equilateral triangle inscribed in a circle.
	KSI-B Construct a square inscribed in a circle.
	KSI-C Construct a regular hexagon inscribed in a circle.
	Unit: G. Polygons and Quadrilaterals
O-15	Students will prove theorems about parallelograms and other quadrilaterals.
	Congruence 3: Prove geometric theorems (G.CO.9-CO.11) (Source : Common Core Standards for Mathematics)
	KSI-A Prove and apply properties of parallelograms.
	KSI-B Prove that a given quadrilateral is a parallelogram.
	KSI-C Prove and apply properties of rectangles, rhombuses, and squares.
	KSI-D Prove that a given quadrilateral is a rectangle, rhombus, or square.
	KSI-E Use properties of kites and trapezoids to solve problems.
	Unit: H. Similarity
O-16	Given two figures, students will use the definition of similarity in terms of similarity transformations to decide if they are similar and will 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.
	Similarity, Right Triangles, and Trigonometry 1: Understand similarity in terms of similarity transformations (G.SRT.1-SRT.3) (Source : Common Core Standards for Mathematics)
	Similarity, Right Triangles, and Trigonometry 2: Prove theorems involving similarity (G.SRT.4-SRT.5) (Source : Common Core Standards for Mathematics)
	KSI-A Write and simplify ratios. Use proportions to solve problems.
	KSI-B Identify similar polygons.
	KSI-C Apply properties of similar polygons to solve problems.
	KSI-D Use ratios to make indirect measurements.
	KSI-E Use scale drawings to solve problems.
	Unit: H. Similarity
O-17	Students will use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
	Similarity, Right Triangles, and Trigonometry 3: Define trigonometric ratios and solve problems involving right triangles (G.SRT.6-SRT.8) (Source : Common Core Standards for Mathematics)
	Similarity, Right Triangles, and Trigonometry 4: Apply trigonometry to general triangles (G.SRT. 9-SRT.11) (Source : Common Core Standards for Mathematics)
	KSI-A Prove certain triangles are similar by using AA, SSS, and SAS.
	KSI-B Use triangle similarity to solve problems.
	KSI-C Use properties of similar triangles to find segment lengths.
	KSI-D Apply proportionality and triangle angle bisector theorems.
	Unit: H. Similarity
O-18	Students will verify experimentally the properties of dilations given by a center and a scale factor.

Subject Area : Mathematics
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Objectives / Knowledge and Skill Indicators

Similarity, Right Triangles, and Trigonometry 1: Understand similarity in terms of similarity transformations (G.SRT.1-SRT.3) (Source : Common Core Standards for Mathematics)

Similarity, Right Triangles, and Trigonometry 2: Prove theorems involving similarity (G.SRT.4-SRT.5) (Source : Common Core Standards for Mathematics)

Expressing Geometric Properties with Equations 2: Use coordinates to prove simple geometric theorems algebraically (G.GPE.4-GPE.7) (Source : Common Core Standards for Mathematics)

KSI-A Identify and draw dilations.

KSI-B Apply similarity properties in the coordinate plane.

KSI-C Use coordinate proof to prove figures similar.

Unit: I. Right Triangles and Trigonometry

O-19 Students will determine 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.

Similarity, Right Triangles, and Trigonometry 3: Define trigonometric ratios and solve problems involving right triangles (G.SRT.6-SRT.8) (Source : Common Core Standards for Mathematics)

KSI-A Use geometric mean to find segment lengths in right triangles.

KSI-B Apply similarity relationships in right triangles to solve problems.

KSI-C Find the sine, cosine, and tangent of an acute angle.

Unit: I. Right Triangles and Trigonometry

O-20 Students will use trigonometric ratios to solve right triangles in applied problems.

Similarity, Right Triangles, and Trigonometry 3: Define trigonometric ratios and solve problems involving right triangles (G.SRT.6-SRT.8) (Source : Common Core Standards for Mathematics)

KSI-A Use trigonometric ratios to find side lengths in right triangles and to solve real-world problems.

KSI-B Use trigonometric ratios to find angle measures in right triangles and to solve real-world problems.

KSI-C Solve problems involving angles of elevation and angles of depression.

Unit: K. Spatial Reasoning

O-21 Students will develop an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.

Geometric Measurement and Dimension 1: Explain volume formulas and use them to solve problems (G.GMD.1-GMD.3) (Source : Common Core Standards for Mathematics)

KSI-A Develop and apply the formulas for the perimeters and areas of triangles and special quadrilaterals.

KSI-B Develop and apply the formulas for the area and circumference of a circle.

KSI-C Develop and apply the formula for the area of a regular polygon.

KSI-D Use the Area Addition Postulate to find the areas of composite figures and to estimate the areas of irregular shapes.

KSI-E Describe the effect on perimeter and area when one or more dimensions of a figure are changed.

Unit: K. Spatial Reasoning

O-22 Students will identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Geometric Measurement and Dimension 2: Visualize relationships between two-dimensional and three-dimensional objects (G.GMD.4) (Source : Common Core Standards for Mathematics)

KSI-A Classify three-dimensional figures according to their properties. Use nets and cross sections to analyze three-dimensional figures.

Subject Area : Mathematics
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Objectives / Knowledge and Skill Indicators

KSI-B Draw representations of three-dimensional figures.
KSI-C Recognize a three-dimensional figure from a given representation.
KSI-D Apply Euler's formula to find the number of vertices, edges, and faces of a polyhedron.
KSI-E Develop and apply the Distance and Midpoint Formulas in three dimensions.

Unit: K. Spatial Reasoning

O-23 Students will develop an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.

Geometric Measurement and Dimension 1: Explain volume formulas and use them to solve problems (G.GMD.1-GMD.3) (Source : Common Core Standards for Mathematics)

KSI-A Learn and apply the formula for the surface area of a prism.
KSI-B Learn and apply the formula for the surface area of a cylinder.
KSI-C Learn and apply the formula for the surface area of a pyramid.
KSI-D Learn and apply the formula for the surface area of a cone.
KSI-E Learn and apply the formula for the surface area of a sphere.

Unit: K. Spatial Reasoning

O-24 Students will develop an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.

Geometric Measurement and Dimension 1: Explain volume formulas and use them to solve problems (G.GMD.1-GMD.3) (Source : Common Core Standards for Mathematics)

KSI-A Learn and apply the formula for the volume of a prism.
KSI-B Learn and apply the formula for the volume of a cylinder.
KSI-C Learn and apply the formula for the volume of a pyramid.
KSI-D Learn and apply the formula for the volume of a cone.
KSI-E Learn and apply the formula for the volume of a sphere.

Unit: L. Circles

O-25 Students will identify and describe relationships among inscribed angles, radii, and chords.

Congruence 1: Experiment with transformations in the plane (G.CO.1-CO.5) (Source : Common Core Standards for Mathematics)

KSI-A Identify tangents, secants, and chords. Use properties of tangents to solve problems.
KSI-B Apply properties of arcs and chords.
KSI-C Find the measure of an inscribed angle and use the properties of inscribed angles to solve problems.
KSI-D Find the measures of angles formed by lines that intersect circles and use them to solve problems.
KSI-E Find the lengths of segments formed by lines that intersect circles and use them to solve problems.

Unit: M. Applications of Probability

O-26 Students will 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").

Statistics 1: Understand independence and conditional probability and use them to interpret data (S.CP.1-CP.5)
(Source : Common Core Standards for Mathematics)

KSI-A Describe a sample space

Subject Area : Mathematics
Course : GEOMETRY (2030000)

Last Revised : 07/13/2011
Report Date : 07/13/2011

	Objectives / Knowledge and Skill Indicators
	KSI-B Use and interpret set notation
	Unit: M. Applications of Probability
O-27	Students will determine 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.
	Statistics 1: Understand independence and conditional probability and use them to interpret data (S.CP.1-CP.5) (Source : Common Core Standards for Mathematics)
	KSI-A Determine conditional probability of an event.
	KSI-B Determine the probability of an event given the probability of a complementary event.
	KSI-C Determine if two events are dependent or independent.
	Unit: M. Applications of Probability
O-28	Students will determine the conditional probability of A given B as P(A and B)/P(B), and 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.
	Statistics 1: Understand independence and conditional probability and use them to interpret data (S.CP.1-CP.5) (Source : Common Core Standards for Mathematics)
	KSI-A Determine the conditional probability of an event.
	KSI-B Determine when conditional probability leads to independence.
	Unit: M. Applications of Probability
O-29	Students will construct and interpret two-way frequency tables of data when two categories are associated with each object being classified and will use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.
	No standard available.
	KSI-A Write two-way tables for data.
	KSI-B Determine if events are independent.
	KSI-C Determine conditional probabilities.
	Unit: M. Applications of Probability
O-30	Students will recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.
	Statistics 1: Understand independence and conditional probability and use them to interpret data (S.CP.1-CP.5) (Source : Common Core Standards for Mathematics)
	KSI-A Determine conditional probabilities for a variety of situations.
	KSI-B Determine if events are independent for a variety of situations.
	KSI-C Interpret conditional probability and independence in the context of a variey of situations.
	Unit: M. Applications of Probability
O-31	Students will find the conditional probability of A given B as the fraction of B’s outcomes that also belong to A and interpret the answer in terms of the model.
	Statistics 2: Use the rules of probability to compute probabilities of compound events in a uniform probability model (S.CP.6-CP.7) (Source : Common Core Standards for Mathematics)
	KSI-A Find the probability of event A given that event B has occurred.
	KSI-B Interpret conditional probabaility in context.

Articulated Instruction Module

Objectives List (2011 - 2012)

Subject Area : Mathematics
Course : GEOMETRY (2030000)

Last Revised : 07/13/2011
Report Date : 07/13/2011

Objectives / Knowledge and Skill Indicators

Unit: M. Applications of Probability

O-32 Students will apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B) and interpret the answer in terms of the model.

Statistics 2: Use the rules of probability to compute probabilities of compound events in a uniform probability model (S.CP.6-CP.7)
(Source : Common Core Standards for Mathematics)

KSI-A Determine P(A).

KSI-B Determine P(B).

KSI-C Determine P(A and B).

KSI-D Determine P(A or B).

KSI-E Interpret P(A or B) in context.

PHASE III - BCPS COURSE REQUEST
CHANGE/TERMINATE APPROVAL FORM*

Attachment III

Executive Director >>> ***Assistant Superintendent of C&I*** >>> ***Executive Leadership Team*** >>> ***Board of Education*** >>> ***Office of Student Data***

1. **BEGIN HERE** Before completing this form, verify that that the course whose number you are seeking to change is in the Master Course List for Baltimore County Public Schools.
2. **PRINT** a hard copy of this form for future reference and then **SAVE** this form using the following format: "Course Request Change Terminate Approval Form_<<*Curricular Office*>>_<<*Originator's name*>>_ <<*Proposed course name*>>_<<*Date submitted*>>" (**ex: Course Change Terminate Approval Form_World Languages_Peggy Johnson_Chinese4_July 2014.**)
3. For course content changes requiring a new course number, DO NOT continue with this form. Instead, complete the "Phase I-BCPS Course Concept Review and Approval Form." For course content changes with the original course number, complete sections 1, 2, and 3. For course termination, complete sections 1, 2, and 4 only. For course number changes, complete sections 1, 2, and 6. For all other changes (including renaming a course, changing a course's credits, and identifying restrictions on course offerings), complete sections 1, 2, and 5. Once the required sections are complete (including the approval signature lines), forward to Frank Curnoles, manager of the Office of Student Data.
4. Need **HELP** completing this form? Call the Office of Student Data (OSD) at #7846.

Section I: Course Information

Course Number	Course Name	Master Course File *(Ex: 2013-2014, v1)*
2009005 *2009007* *2030000* *2030004* *2030105*	GEOMETRY GT GEOMETRY GT/IB MAG GEOMETRY GEOMETRY HON GEOMETRY MAG	*2011-2012, v4*

Section II: Date to be instituted

2011-2012

Sponsoring Office:

STEM-Math

Section III: Request to Change Course Content with the Original Course Number

Complete this section only if you desire to change the objectives and/or KSIs for a course number that currently appears in the Master Course File.

Rationale (Be specific): In 1999, two separate curriculum guides were developed to support teachers teaching in the Geometry program in Baltimore County: *Geometry and Foundations of Geometry* and *Gifted and Talented 9 Geometry and Honors Geometry*. These two curriculum guides were aligned to Core Learning Goal 2: Geometry, Measurement, and Reasoning, but were supported by two different textbooks. Although an addendum was developed in 2001 for the *Gifted and Talented 9 Geometry and Honors Geometry* curriculum guides, these two curriculum guides have not been revised since 1999.

The purpose of revising the *Geometry* curriculum is to produce one curriculum guide, differentiated for Standard, Honors, and GT9 Geometry, that reflects the principles and philosophy of STEM, provides the background and framework for geometry instruction appropriate for 21st Century learners, and is aligned to the Common Core State Standards. The *Geometry* program features an investigative approach based on the van Hiele levels of geometric thought: visualization, analysis, informal deduction, deduction, and rigor. The program focuses on the development of spatial sense; representation, analysis, and measurement of two- and three-dimensional figures; and the abilities to make and verify conjectures and construct valid mathematical arguments using deductive and inductive reasoning skills. The program emphasizes the application of mathematics in real-world contexts, the use of language to communicate mathematical ideals effectively, and the importance of geometry in society and careers. The *Common Core Standards for School Mathematics, Focus in High School Mathematics: Reasoning and Sense Making in Geometry, Principles and Standards for School Mathematics, Professional Teaching Standards*, and *Assessment Standards* developed by the National Council of Teachers of Mathematics outline the core teaching, learning, and assessment standards for the Baltimore County Geometry program.

Section IV: Request to TERMINATE Course

Complete this section only if you desire to remove a course number from the Master Course File; from STARS, and from AIM. For all other changes, proceed to Section V.

Rationale (Be specific):

Section V: Request to Change School Type, Number of Credits, Course Name, or Course Availability

Rationale (Be specific):

- **SCHOOL TYPE change desired**

No change

- **NUMBER OF CREDITS change desired**

No change

- **COURSE NAME change desired**

Type desired 30-character course name here

- **COURSE AVAILABILITY change desired**

Systemwide: *All schools within the "School Type" identified above may offer course.*	*YES*
Specific School(s): *Only school(s) within the "School Type" identified above and listed below may offer course.*	*NO*
•	
•	

Section VI: Request to Change Course Number

Rationale (Be specific):

Original Course Number	New Course Number	Course Name
Type original course number here	*Type new course number here*	*Type 30-character course name here*

For Approval Use Only:
Executive Director >>> ***Assistant Superintendent of C&I*** >>> ***Executive Leadership Team*** >>> ***Board of Education*** >>> ***Office of Student Data***

Executive Director *After obtaining required signatures, forward this form to Frank Curnoles, manager of the Office of Student Data.*

Executive Director's Approval:	*Date:*	
Assistant Superintendent of C&I's Approval:	*Date:*	
Superintendent's Approval (In accordance with the Executive Leadership Team's review):	*Date:*	
Board of Education's Approval: (if necessary)	*Date:*	

For Office of Student Data Use Only:

Course details revised in SILK MAIN district course.	*Type date here*	*OSD staff name*
Parent course deactivated in STARS course maintenance for desired school year, if applicable)	*Type date here*	*OSD staff name*
Course deactivated in Data Warehouse for desired school year.	*Type date here*	*OSD staff name*
Course removed from AIM for desired school year.	*Type date here*	*AIM staff name*