Comprehensive Course Syllabus

Geometry I/II

Course Description:

Geometry I/II is a one-semester course in Euclidean Geometry for students who have not had a geometry course previously. The content is taken from material typically found in a full-year honors-level college preparatory geometry course. It is intended to provide a survey of topics in plane and solid geometry, including problem solving, critical thinking, and various forms of proof. Significant emphasis is placed on making connections among topics in geometry, other topics in mathematics, such as algebra and probability, and the real world. Verbal and written communications are stressed.Students will also experience the dynamic nature of geometry through projects that make use of computer technology.

INSTRUCTOR(S):

- Name(s): Dr. Janice Krouse
- Office Number(s): A157
- Office Hours:
  A, C and D Days: 7:15-7:45, 10:15-11:30, 2:30-3:30, 4:15-5:15 (except on chess match Thursdays)
  B Days: 7:15-7:45, 10:15-11:30, 1:30-3:00; 4:15-5:15
- Telephone number(s): 630-907-5964
- Email address(es): krouse@imsa.edu

Meeting Days, Time and Room(s)

A, B, C, and D Days, 10:00 – 10:55 am (mod 3), A150

Text(s) / Materials:

No printed text required. Geometry curriculum is a product of current members of IMSA faculty. Materials are given out in part each day. Students are expected to maintain a notebook containing class notes, homework assignments, quizzes, and other handouts. Students are also expected to have a graphing calculator (TI-89 Titanium, TI-84 preferred) daily.
Geometer's Sketchpad will be used in class.

Essential Content:

- *Meta-mathematical concepts*
  - Visualization
  - Definitions and undefined terms
  - Postulates
  - Conditional statements: hypothesis and conclusion
  - Constructing proofs

- *Geometric concepts*
  - Point – Line – Plane
  - Angles – complementary, supplementary, vertical, bisectors
  - Triangles – isosceles, equilateral, right
  - Circles – chords, tangents, secants, angles
  - Transformations – reflection, rotation, translation
  - Congruence
  - Similarity
  - Parallelism – perpendicularity
  - Quadrilaterals – trapezoid, kite, parallelogram, isosceles trapezoid, rhombus, rectangle, square, cyclic
  - Area – perimeter – volume
  - 3D figures – volume – surface area
  - Right triangle trigonometry – Pythagoras
  - Polygons

IMSA Math Standards addressed:

A. Students studying mathematics at IMSA demonstrate a disposition and propensity to use mathematics, a variety of problem solving strategies, and creative thought to solve problems by:

A.1 investigating and gaining insight into mathematical concepts by selecting and using a variety of traditional and creative problem solving strategies and methodologies. [SSL-I.B,III.B,III.C,IV.A; IL-AoL-1; NCTM-6.1]

A.2 posing, solving, and extending both multi-step routine and multi-step unconventional problems. [SSL-I.B,III.B,III.C,IV.A,IV.C; IL-AoL-1, 9.C; NCTM-6.2]

A.3 interpreting, generalizing , and verifying the understanding gained in the problem solving process and extending it to new settings. [SSL-I.B,II.B,III.B,III.C,IV.A,IV.C; IL-AoL-1; NCTM-6.3]

A.4 using a variety of resources and problem solving approaches. [SSL-III.B,IV.A; IL-AoL-1; NCTM-6.3]

A.5 demonstrating confidence, persistence, and reflective analysis of the effectiveness of an approach when attempting to solve a problem. [SSL-I.D,II.A,II.B,III.B,IV.A,IV.C; NCTM-6.2,6.4]

B. Students studying mathematics at IMSA reason logically in mathematical situations and understand the nature, role, and necessity of proof and counterexample in mathematical reasoning by:

B.1 demonstrating understanding of an axiomatic system. [SSL-I.A,III.C,IV.A]

B.2 reasoning inductively and deductively. [SSL-I.B,III.C,IV.A; IL-9.C; NCTM-7.2,74.]

B.3 making and testing conjectures, creating proofs, and identifying counterexamples. [SSL-III.C,IV.B; IL-9.C; NCTM-7.4]

B.4 enhancing inductive and deductive reasoning through the use of intuition, imagination, and other forms of reasoning. [SSL-III.C,IV.A; NCTM-7.4]

B.5 analyzing and critiquing proofs created by themselves and others. [SSL-I.D,II.B,III.C,IV.A,IV.B,V.A; NCTM-7.3]

B.6 understanding the role of logic in the development of mathematics and understanding the necessity of carefully proving assertions. [SSL-II.A,II.B,III.C,IV.D; NCTM-7.1]

C. Students studying mathematics at IMSA communicate clearly and accurately about mathematical relationships and results by:

C.1 understanding mathematical information given in written, oral, symbolic, numeric, or graphic form and interpreting the relationship it represents. [SSL-IV.B]

C.2 accurately recording and effectively communicating using proper notation, vocabulary, and usage in a variety of modalities (written, oral, graphic, algebraic, etc.). [SSL-I.C,IV.B,V.A]

C.3 presenting mathematical work and results using the power of mathematical language effectively. [SSL-IV.B,V.A; IL-AoL-2,7.C; NCTM-8.2,8.4]

C.4 summarizing results in a form that is accurate, appropriate to the topic and level, and understandable to the intended audience. [SSL-I.C,IV.B,V.A]

D. Students studying mathematics at IMSA demonstrate awareness of the inter-connectedness of mathematical thought in inter- and intra-disciplinary settings by:

D.1 understanding that mathematics is a system of interconnected ideas. [SSL-III.B,III.C,IV.]

D.2 recognizing the commonalties among the components and processes of the sub-disciplines of mathematics. [SSL-I.B,III.B,III.C,IV.C]

E. Students studying mathematics at IMSA understand and employ the power, economy, clarity, and elegance of mathematical representations by:

E.1 recognizing that mathematical representations carry specific meanings and using mathematical notation correctly to enhance clarity and avoid ambiguity. [SSL-II.B,IV.B]

I. Students studying mathematics at IMSA understand and apply geometric relationships by:

I.1 analyzing spatial relationships from both static and dynamic perspectives. [SSL-III.B; IL-9.A; NCTM-3.4]

I.2 identifying, classifying, and using characteristics of two- and three-dimensional objects. [SSL-IV.A,IV.C; IL-9.B; NCTM-3.1]

I.3 selecting and using appropriate geometric relationships, properties, formulas, tools, and units when working in a geometric context. [SSL-II.A,III.B,IV.A,IV.C; IL-7.A,9.A; NCTM-3.3,4.1,4.2]

I.4 modeling situations geometrically in two and three dimensions to formulate, describe, and solve problems. [SSL-I.B,III.B,IV.A,IV.C; IL-9.A,9.C; NCTM-3.2]

I.5 performing and describing geometric transformations. [SSL-I.A,IV.B; IL-9.A; NCTM-3.3]

I.6 solving problems involving coordinate (analytic) geometry. [SSL-I.A; IL-9.A,9.C; NCTM-3.2]

I.7 recognizing that geometry is an effective context for the study of deductive systems. (NCTM-3.1elaboration]

K. Students studying mathematics at IMSA understand and apply discrete mathematical models by:

K.4 demonstrating an understanding of basic counting principles and the situations under which they may be applied. [SSL-I.A,I.D,III.B; IL-10.C; NCTM-5.4]

L. Students studying mathematics at IMSA use technology to gain insight and obtain different perspectives on problems by:

L.1 deciding whether to use technology, selecting an appropriate technology for a given situation, and understanding the limitation of the technology. [SSL-I.D,II.A,III.A]

L.2 using technology to facilitate doing, exploring, and understanding of mathematics. [SSL-II.A,III.A,IV.A]

L.3 judging the reasonableness of information and answers given by technology. [SSL-III.A,IV.A]

SSLs and Outcomes:

FA: Formally assessed, IA: Informally assessed

IA. Students expected to demonstrate automaticity in skills, concepts, and processes that enable complex thought by
- ❖ completing weekly problem sets **FA**
- ❖ completing daily worksheets **IA**
- ❖ engaging in daily collaboration to complete work **IA**
- ❖ engaging in daily classroom discussion **IA**
- ❖ completing quizzes and tests **FA**

IB. Students expected to construct questions, forge connections and deepen meaning
- ❖ completing daily worksheets **IA**
- ❖ completing problem sets **IA**
- ❖ completing dynamic geometry explorations **FA**
- ❖ conversing and collaborating with peers **IA**

- ❖ engaging in daily classroom discussion **IA**
- ❖ solving problems that require a novel compilation of knowledge and skills on quizzes/tests **FA**

ID. Students expected to evaluate the soundness and relevance of information and reasoning
- ❖ completing geometric proofs on daily worksheets and quizzes/tests **FA**
- ❖ completing problem sets **FA**

IIIA. Students use appropriate technologies as extensions of the mind by
- ❖ regular use of graphing calculator, Desmos **IA**
- ❖ use of dynamic geometry software to explore and examine ideas **IA**

IIIB. Students recognize, pursue, and explain substantive connections within and among areas of knowledge
- ❖ solving problems on problem sets designed to make connections between geometry and other mathematics content areas, particularly algebra. **IA**
- ❖ using dynamic geometry explorations designed to make connections between geometry and other mathematics content areas. **IA**

IIIC. Students recreate the "beautiful conceptions" that give coherence to structures of thought by.
- ❖ completing geometric proofs on daily worksheets and quizzes/tests. **FA**
- ❖ engaging in daily collaboration to complete work **IA**
- ❖ engaging in daily classroom discussion **IA**
- ❖ experiencing the development of geometry as an axiomatic system . **IA**

IVA. Students construct and support judgments based on evidence by.
- ❖ completing geometric proofs on daily worksheets and quizzes/tests. **FA**
- ❖ engaging in daily collaboration to complete work **IA**
- ❖ engaging in daily classroom discussion **IA**

IVB. Students will be challenged to write and speak with economy, power, and elegance by.
- ❖ completing geometric proofs on daily worksheets and quizzes/tests. **FA**
- ❖ sharing individual or group work with the class. **IA**

IVD. Students will be challenged to develop an aesthetic awareness and capability by.
- ❖ completing geometric proofs on daily worksheets and quizzes/tests. **FA**
- ❖ exploring dynamic geometry examples. **IA**
- ❖ engaging in daily collaboration to complete work **IA**
- ❖ engaging in daily classroom discussion **IA**
- ❖ experiencing the development of geometry as an axiomatic system . **IA**

VB. In order for students to make reasoned decisions which reflect ethical standards, and act in accordance with those decisions, students.
- ❖ learn to collaborate in class to learn and solve problems or generate proofs, but produce their own work for assessments **IA**
- ❖ collaborate outside of class on assignments in an appropriate manner, modeling their in-class behavior. **IA**

Instructional Design and Approach:

Geometry through the use of the axiomatic system will provide an environment for logical, creative investigation of quantitative and relational situations. This includes: patterns of logical reasoning and inference, and geometric and algebraic manipulation. Students will appreciate the power, economy, elegance, and beauty of mathematical thought. Presenting the proofs of theorems provides experiences

and opportunities that enable students to interpret and to communicate mathematical concepts in both oral and written form. A primary outcome of the course is to teach students to reason logically in mathematical situations and understand the nature, role, and necessity of proof and counterexample in mathematical reasoning. In doing so they communicate clearly and accurately about mathematical relationships and results. The use of dynamic geometry software will allow students to gain insight and obtain different perspectives on problems.

The instructional design of this mathematics core course provides opportunities for students to work collaboratively on a regular basis both in and out of class. Collaboration encourages oral communication, multiple perspectives in problem solving, and self-regulation. Carefully crafted and sequenced questions, problems, and applications comprise our problem-centered curriculum, which enables learning through guided discovery. This process requires pattern recognition, mathematical reasoning and visualization, critical thinking, appropriate use of technology and use of multiple representations in building connections within and between mathematical concepts. Regular teacher feedback and ongoing assessment shapes the learning experience for each individual student. The teacher's informal assessment of each student and the class as a whole tailors instruction to immediate need, generates enthusiasm, and insures intended connections. In addition, students are expected to communicate their understandings in writing with clarity, coherence, and mathematical accuracy.

Alongside daily lessons, students are regularly working problem sets, which contain a mixture of review, practice, and novel problems from various mathematical topics. Students are expected to collaborate in working toward a solution, but final writing should be their own. Ultimately, students are responsible for the material contained within the problem sets. As a result of this carefully structured learning experience, students' abilities to engage in mathematical inquiry, pose questions, and communicate mathematical concepts evolve, inviting creativity in problem solving and further collaboration.

Student Expectations:
All students are expected to

- be actively involved in small-group activities, class discussions and explorations
- study and work independently in a fast-paced curriculum
- be willing to work collaboratively with others both in and out of class
- engage actively in problem solving, present problems and proofs to the class for critique and discussion, and help others understand the course content.
- treat others with politeness and respect
- spend adequate time practicing, preparing prior to class, and studying for review
- complete all assigned tasks and work in a timely manner
- keep a sense of adventure, a sense of humor, and be willing to try new stuff.

Assessment Practices, Procedures, and Processes:
Students will be evaluated in a variety of different ways. Means of formal assessment may include individual and group quizzes, examinations, weekly problem sets, and written papers. Informal assessment takes place in an ongoing manner through classroom presentations, classroom observations, and individual contacts. Since assessments are also intended to be learning experiences, not all assessments will be evaluative.

- ***Daily worksheets***. The course worksheets ARE the textbook for this class! They must be completed daily (so that everyone can contribute to the class discussion on the material) AND checked (with help from classmates) for correctness. You would not want to be given a textbook filled with errors to study from, so why would you want to create one of your own that has errors in it. These worksheets also form the basis for class discussions and exploration.
- ***Problem Sets.*** Generally, Problems Sets will be handed out on a **C-day** (usually Thursday) and collected the following **C-day**, at the ***beginning*** of class. If you will be absent or tardy on a day that a Problem Set is due, give your Problems Set to another student in the class to turn in. I expected you to turn in every Problem Set, no matter how late it may be. If a Problems Set is turned in late without prior approval of the instructor, then the following penalties apply.

after class but before 4:15 pm on the day the problem set is due	10% off
after class but before the class on the day after the problem set is due.	25% off
after class but before 4:15 pm on the day after the problem set is due.	50% off
after 4:15 pm on the day after the problem set is due.	75% off

- ***Quizzes.*** These are given every 4 to 8 worksheets, typically take between 25-40 minutes, will, on occasion, be done in groups or pairs, and will be yours to keep in your binder.
- ***Unit Tests.*** These are given at the end of each unit (except the last one) and will be announced well ahead of time. **If a Unit Test is not passed, a student will have up to two more opportunities to retake it in order to pass,** but only after additional practice problems are completed. Unit tests are kept by your instructor after they have been graded and the results discussed in class. You may come into the Math Office to look them over.
- ***Semester Exam.*** For this comprehensive exam, students are allowed to bring a 4" by 6" card with any notes, formulas, or sketches that the student chooses written on it.

Weights of components of the quarter grade:

course worksheets in binder and class participation		15%
Problem Sets, projects, and collected homework assignments		25%
Unit Tests and quizzes	:	60%

Weights of components of the semester grade:

Cumulative Semester Work	80%
comprehensive Semester Final Exam	20%

Grading scale:

A - 90% or above
B - 80% or above but less than 90%
C - 70% or above but less than 80%
D - less than 70%

Sequence of Topics and Activities

I. Unit One
- A. Points, Lines, Segments, Rays
- B. Points, Lines, Planes
- C. Angles
- D. Triangle Introduction
- E. Pythagorean Theorem
- F. Circles Introduction
- G. Midpoints, Bisectors, Congruence
- H Concatenation and More
- I. Angles in Action

II. Unit Two
- A. Conditional Statements
- B. Converse, Inverse, Contrapositive
- C. Logical Flow Diagrams
- D. Flow Proof Practice (6 worksheets)

III. Unit Three
- A. Congruent Triangles
- B. SSS Postulate
- C. SAS Theorem
- D. ASA Theorem
- E. Mixed triangle congruence involving SSS, SAS, ASA
- F. CPCTC – Corresponding Parts of Congruent Triangles are Congruent
- G. Auxiliary Lines & Overlapping Triangles
- H. Isosceles Triangle
- I. AAS, LA, HA congruence Theorems
- J. HL – Hypotenuse Leg Congruence Theorem

IV. Unit Four
- A. Converse of the Pythagorean Theorem
- B. Equidistant Theorems
- C. Chords and Tangents
- D. Parallel Lines
- E. Congruent Angles and Parallel Lines
- F. Parallel Postulate and Theorems
- G. Circles: Arcs and Angles
- H. Circles: Chord and Tangent Angles
- I. Circles: Tangent and Secants Angles

V. Unit Five
- A. Quadrilaterals: General, Cyclic, and Kites
- B. Quadrilaterals: Trapezoids
- C. Quadrilaterals: Parallelograms
- D. Rectangles, Rhombi, Squares
- E. Quadrilateral Family Tree
- F. Quadrilateral Identification
- G. Polygons

VI. Unit Six
- A. Ratios and Proportions
- B. Proportions and Segments
- C. Similar Polygons
- D. Proving Triangles Similar
- E. Altitude to the Hypotenuse
- F. Steiner Power of a Point

VII. Unit Seven
- A. Right Triangle Trigonometry
- B. Applications of Right Triangle Trigonometry