BEGIN TERM ONE
INTEGRATED GEOMETRY
BEGINNING IN SEPTEMBER 2008

PI	#	Aim and Performance Objectives – Term 1 – Integrated Geometry
GG24 LOGIC	1	Lesson #1 AIM: How do we use logic to find the negation of a statement? Students will be able to: 1. describe what is meant by logic 2. represent an English statement in symbols 3. form the negation of a statement in both words and symbols 4. determine the truth value of a statement and its negation 5. construct a truth table for negations Writing Exercises: 1. Explain how a double negation is like flipping a light switch twice. 2. Given the statement: "All squares are rectangles." Determine the truth value of this statement and its negation.
GG25	2	Lesson #2 AIM: How do we determine the truth values of conjunctions and disjunctions? Students will be able to: 1. combine two simple statements to write a conjunction and a disjunction 2. translate sentences using the words "and" and "or" into symbolic form 3. construct a truth table for conjunctions 4. construct a truth table for disjunctions 5. justify whether a sentence is true, false or open by substituting given sentences into given open sentences in symbolic notation involving a conjunction or disjunction 6. explore the similarities among the term conjunction, finding the solution set to a system of equations, inequalities, and the probability of "A and B" 7. relate the term disjunction to finding the probability of "A or B" and to graphing inequalities on a number line 8. apply the conjunction and disjunction to solve numeric and geometric problems Writing Exercise: Investigate how parallel circuits and series circuits are constructed. Explain how these can be used to illustrate disjunctions and conjunctions.

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GG25 GG26	3	Lesson #3 AIM: How are the truth value of a conditional statement and its converse related? Students will be able to: 1. describe the following terms: conditional, antecedent, hypothesis, consequent, conclusion 2. identify the hypothesis and the conclusion in various conditional statements 3. translate sentences using the words “if ... then ...” into symbolic form 4. construct a truth table for conditionals 5. write the converse of a conditional statement in words and in symbolic form 6. conjecture the truth value of the converse of a given conditional statement whose truth value has been determined Writing Exercises: 1. Some statements are hidden conditional statements. Give an example of such a statement and then write the statement and its converse in if-then form. 2. Sometimes a statement and its converse have the same truth value, and sometimes they don’t. Give an example of a conditional statement and its converse that are always true.
GG26	4	Lesson #4 AIM: How do we determine when the inverse and contrapositive of a conditional statement are true? Students will be able to: 1. write the inverse and contrapositive of a conditional statement in words and in symbolic form 2. discover the truth value of the inverse and contrapositive of a given conditional statement whose truth value has been determined 3. compare and contrast how the converse, inverse, and contrapositive of a given conditional statement are formed 4. apply the inverse, converse, and contrapositive to solving numeric, algebraic, and geometric problems Writing Exercise: Your friend was absent from school today. He missed the lesson on inverse and contrapositive. Write him a note that fills him in on what he missed. Be sure to include examples of each type of statement.

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GG25 GG27	5	Lesson #5 AIM: How do we use biconditional statements? Students will be able to: 1. use the contrapositive to select a sentence that is logically equivalent to a given sentence, given several conditional sentences 2. write a biconditional statement and define symbolically that "p if and only if q" means that "if p then q" and 'if q, then p" 3. translate sentences using the words "if and only if" and the symbol $\leftrightarrow$ for "if and only if" 4. construct a truth table using the biconditional 5. explain what is meant by two sentences being logically equivalent to each other 6. explain when statements are logically equivalent Writing Exercise: Lorraine said to Sharon "If I run then I will win the race." Sharon said to her, "You mean, 'I don't run or I will win the race.' Don't you? That is the same thing, isn't it?" Are they the same thing? How could they verify if these two statements are the same truth value?

Optional Logic Proofs Unit – 7

For those schools wishing to prepare students for formal Geometry proofs via this unit on formal Logic Proofs. These lessons should be taught after lesson #5 and would add seven additional lessons to the syllabus, increasing the overall syllabus to 112 lessons and the Term I syllabus to 66 lessons.

Otherwise, skip over the lessons #A - #G and proceed directly to Lesson #6.

		Lesson #A (Optional Lesson) AIM: How do we determine if a compound sentence is a tautology? Students will be able to: 1. explain what is meant by a tautology 2. determine if a compound statement is a tautology 3. explain what is meant by logically equivalent statements
		Lesson #B (Optional Lesson) AIM: How do we apply the Law of Contrapositive and Law of Detachment? Students will be able to: 1. investigate and conjecture that reasoning from the converse or reasoning from the inverse is invalid 2. investigate, conjecture and apply the Law of Contrapositive 3. investigate, conjecture and apply the Law of Detachment (Modus Ponens) 4. apply the Law of Contrapositive and the Law of Detachment to draw conclusions and write simple proofs 5. explain the conditions under which the Law of Contrapositive and the Law of detachment may be applied

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		Lesson #C (Optional Lesson) AIM: How do we apply the Law of Contrapositive Inference? Students will be able to: 1. state and apply the Law of Contrapositive Inference (Modus Tollens) 2. investigate and conjecture that the Law of Contrapositive Inference combines both the Law of Contrapositive and the Law of Detachment 3. apply the Law of Contrapositive Inference to draw conclusions and write simple proofs 4. compare and contrast the conditions necessary to apply Modus Tollens and Modus Ponens
		Lesson #D (Optional Lesson) AIM: How can we apply the laws of logic to test the validity of an argument? Students will be able to: 1. explain what is meant by a proof of logic 2. write simple proofs using the laws of logic 3. explain under what circumstances the laws of logic apply 4. determine, using the laws of logic, whether conclusions are valid or invalid
		Lesson #E (Optional Lesson) AIM: What are the Chain Rule and the Law of Disjunctive Inference? Students will be able to: 1. state and apply the Chain Rule 2. state and apply the Law of Disjunctive Inference 3. draw conclusions using the Chain Rule and the Law of Disjunctive Inference 4. write proofs involving the Chain Rule and the Law of Disjunctive Inference 5. justify the application of each specific law of logic used in a proof 6. explain under what conditions the Chain Rule and the Law of Disjunctive Inference is used
		Lesson #F (Optional Lesson) AIM: How can we negate conjunctions and disjunctions? Students will be able to: 1. state and apply DeMorgan's Laws 2. form the negation of conjunctions and disjunctions 3. explain the conditions necessary to apply DeMorgan's Laws 4. write proofs involving DeMorgan's Laws 5. justify the application of each specific law of logic used in a proof 6. compare and contrast the conditions necessary to apply Modus Ponens, Modus Tollens, and DeMorgan's Laws

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		Lesson #G (Optional Lesson) AIM: How can we apply the laws of logic to proofs? Students will be able to: 1. translate sentences into variables with connectives 2. apply the laws of logic to more complex proofs involving application of multiple laws of logic 3. justify the application of each specific law of logic used in a proof
Congruent Triangles Unit	6	Lesson #6 AIM: Why is geometry a postulational system? Students will be able to: 1. investigate and describe the differences between using deductive and inductive reasoning to draw conclusions 2. justify the need for undefined terms in geometry: points, lines, planes 3. explain the difference between a theorem and a postulate Writing Exercise: 1. Explain why geometry is considered a postulational system 2. Give a real world example in which a conclusion is reached using deductive reasoning that is not always true.
	7	Lesson #7 AIM: What are the basic geometry terms involving lines, line segments and rays? Students will be able to: 1. describe the differences among a line, a ray, and a line segment 2. name lines, rays, and line segments using appropriate notation 3. define what is meant by congruent line segments 4. investigate the geometric meaning of collinear points 5. explain what is meant for point C to be between points A and B, and solve numeric applications involving the term “between” 6. define the midpoint and the bisector of a line segment 7. justify conclusions using the symbols for congruence and equality in diagrams in which a midpoint, a bisector or two line segments bisecting each other are given 8. solve numeric and algebraic applications involving midpoints and bisected line segments Writing Exercise: 1. Why can’t a line be bisected? 2. A problem states that $\overline{AB}$ bisects $\overline{CD}$ at E. Mario concludes that there are two pairs of congruent line segments, while Kristy says he should only have one pair. Determine which student is incorrect and explain the error in that student’s thinking. 3. If AB = 13 and BC = 5, must AC= 18? Explain your reasoning.

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	8	Lesson #8 AIM: What are the basic geometry terms involving angles? Students will be able to: 1. explain that an angle is a figure formed by rays having a common endpoint called a vertex 2. name angles by using its vertex, a three letter name, a variable or a number 3. classify angles as right, straight, acute, obtuse or reflex 4. define congruent, adjacent, complementary, and supplementary angles 5. define an angle bisector 6. apply the definition of angle bisector to make appropriate conclusions using the symbol for congruence and equality in a diagram where an angle bisector is given 7. define perpendicular lines and identify the right angles in diagrams with perpendicular lines Writing Exercise: Describe a situation in which an angle must be referred to using its three letter name rather than solely by its vertex. Why this is necessary?
GG21	9	Lesson #9 AIM: How do we use the definitions of altitude, median, and angle bisector of a triangle to solve problems? Students will be able to: 1. define altitude, median, and angle bisector of a triangle (teaching suggestion: state these definitions in conditional form) 2. identify altitudes, medians, and angle bisectors of triangles in diagrams 3. identify congruent angles, congruent line segments, and right angles in diagrams in which altitudes, medians, and angle bisectors are given 4. compare and contrast the properties of altitudes, medians, and angle bisectors of a triangle 5. solve numeric and algebraic problems involving altitudes, medians, and angle bisectors of triangles 6. investigate and apply the concurrence of medians, altitudes, and angle bisectors to numeric and algebraic problems Writing exercise: 1. What are the circumstances for an altitude to lie outside a triangle? 2. Is it possible for one line segment to be a median, an angle bisector, and an altitude at the same time? Describe the situation in which you feel this can occur or give a logical argument why it cannot.

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GG20 Begin Construc- tions	10	Lesson #10 AIM: How do we use a compass and straight edge to copy angles and line segments? Students will be able to: 1. define a circle, radius, and congruent circles 2. discover and state the postulate: "In the same or congruent circles all radii are congruent." 3. construct a line segment congruent to a given line segment 4. construct a triangle with sides having the lengths of given line segments 5. construct an equilateral triangle and justify this construction 6. construct an angle congruent to a given angle and justify this construction 7. apply the above to other constructions, to copying triangles, or completing a quadrilateral by constructing parallel sides or congruent angels, given the measures of 2 adjacent sides and the included angle, etc. Writing exercise: Carol was absent from today's lesson in which you learned how to use a compass and a straight edge to copy an angle. Write a recipe, a list of steps, for copying an angle.
GG17 GG18	11	Lesson #11 AIM: How do we use a compass and straight edge to bisect an angle or a line segment? Students will be able to: 1. construct a bisector of a given angle 2. justify the construction for bisecting a given angle 3. construct a perpendicular bisector of a given line segment using a straight edge and compass 4. justify the construction for the perpendicular bisector of an angle 5. apply the above to constructing an angle bisector or a median of a triangle Writing Exercise: 1. Explain why joining the vertex of an angle to the point found in the angle bisector construction guarantees that the angle is bisected. 2. In constructing the perpendicular bisector of a line segment, why must the two arcs have the same radius?

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GG28 GG29	12	Lesson #12 AIM: How do we prove triangles congruent? Students will be able to 1. define congruent polygons 2. identify corresponding sides and angles that are congruent when two triangles are congruent 3. explore**, using compass and straight edge construction techniques**, and conjecture the postulates SAS, ASA, SSS for proving triangles congruent (i.e. If two triangles agree in three sides, then these triangles are congruent.) 4. draw diagrams to illustrate the corresponding sides and angles that need to be congruent for each postulate to be applied 5. justify which of these postulates would be used to prove triangles congruent in given diagrams marked with congruent parts 6. apply methods of proving triangles congruent to formal proofs Writing Exercise: 1. Exactly what do we mean when we say that two triangles are congruent? 2. Write about a real life example of the concept of congruence.
	13	Lesson #13 AIM: How do we use the addition, subtraction, partition, and reflexive properties in formal proofs? Students will be able to: 1. state, in words, the addition, subtraction, partition, and reflexive properties 2. apply the addition, subtraction, partition, and reflexive properties to algebraic applications and to constructions involving angles and line segments 3. justify why the addition, subtraction, partition, and reflexive properties are postulates 4. prove line segments and angles congruent in formal proofs by applying the addition, subtraction, partition, and reflexive postulates 5. deciding whether to use the addition or subtraction postulate with the reflexive postulate 6. apply the above named postulates in formal proofs to prove that two triangles are congruent Writing Exercise: How do we know when to use the addition postulate vs. the subtraction postulate?

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	14	Lesson #14 AIM: How do we use the multiplication, division, substitution, and transitive properties in formal proofs? Students will be able to: 1. state, in words, the multiplication, division, substitution, and transitive properties 2. apply the multiplication, division, substitution, and transitive properties, and the definitions of midpoint of a line segment and bisector in algebraic applications 3. explain why the multiplication, division, substitution, and transitive properties are postulates 4. prove lines segments and angles congruent in formal proofs by applying the multiplication, division, substitution, and transitive properties 5. apply the above named postulates in formal proofs to prove that two triangles are congruent Writing Exercise: 1. Describe the circumstances in geometry in which you would use the multiplication and division postulates. 2. Describe a relationship in the real world that obeys the transitive property.
	15	Lesson #15 AIM: How do we apply postulates to prove triangles congruent? Students will be able to: 1. mark diagrams appropriately based on given information and determine which postulate (SSS, SAS or ASA should be used to prove triangles congruent 2. use a flow chart diagram to indicate a plan for a formal proof 3. apply postulates and theorems from previous lessons to proving triangles congruent 4. indicate, next to the reasons in the proofs, which previous steps are used to reach particular conclusions Writing Exercise: Discuss whether or not the relationship "is a brother of" can be used to illustrate the transitive property. Support your answer with the logic you used to arrive at that answer.
	16	Lesson #16 AIM: How do we prove angles congruent? Students will be able to: 1. define linear pair and state the relationship between angles that form a linear pair 2. State the theorem: "If two angles form a linear pair, then these angles are supplementary" 3. discover and prove algebraically: a. If two angles are complementary to the same angle, or congruent angles, then these angles are congruent. b. If two angles are supplementary to the same angle, or congruent angles, then these angles are congruent. 4. explain why the statements in (3) are theorems 5. apply the above theorems in algebraic problems and formal proofs Writing Exercise: 1. Find a dictionary definition of the word 'complement.' Compare and contrast this definition to the mathematical meaning of complementary angles. 2. Describe the relationship between the supplement and the complement of angle.

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	17	Lesson #17 Aim: How do we prove other angle pairs congruent? Students will be able to: 1. explain what it means for angles to be vertical angles 2. state and prove algebraically: a. If two angles are right angles, then they are congruent. b. If two angles are vertical angles, then they are congruent. 3. explain why the statements in (2) are theorems 4. apply these theorems in numeric and algebraic problems 5. apply these theorems to geometric proofs Writing Exercise: 1. Explain how to determine which pairs of angles are vertical when two lines intersect. 2. Write a paragraph proof that demonstrates the validity of the theorem: "Vertical angles are congruent."
GG28	18	Lesson #18 AIM: How do we write congruent triangle proofs involving perpendicular lines and altitudes? Students will be able to: 1. state that, "If two lines are perpendicular, then they meet to form right angles." 2. analyze diagrams in which a perpendicular bisector is given to identify right angles and congruent line segments 3. apply the definitions of perpendicular lines, altitudes, and perpendicular bisectors to algebraic problems 4. prove triangles congruent when perpendicular lines, a perpendicular bisector or an altitude is given 5. create a flow chart diagram to indicate a plan for a formal proof 6. apply postulates and theorems from previous lessons to proving triangles congruent 7. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercise: 1. Explain the similarities and differences between an altitude and a perpendicular bisector. 2. Under what circumstances might an altitude be considered a perpendicular bisector as well?

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GG28	19	Lesson #19 AIM: How do we prove triangles congruent? Students will be able to: 1. list methods they have learned for proving angles congruent 2. list methods they have learned for proving line segments congruent 3. mark diagrams appropriately based on the given and determine which postulate (SSS, SAS or ASA) should be used 4. create a flow chart diagram to indicate a plan for a formal proof 5. apply postulates and theorems from previous lessons to proving triangles congruent 6. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercise: 1. Describe a concept map (or a flow chart) and tell why it is helpful for creating a plan for proving triangles congruent. 2. Identify a real-world application that uses congruent triangles. What would happen in this situation if the triangles were NOT congruent?
GG29	20	Lesson #20 AIM: How do we use congruent triangles to prove line segments or angles congruent? Students will be able to: 1. state the theorem: "If two triangles are congruent, then their corresponding parts are congruent." 2. explain how to determine which sides or angles are corresponding 3. analyze diagrams to determine how to select the appropriate pair of triangles to be proved congruent 4. apply the definition of congruent triangles to algebraic problems and formal proofs 5. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercise: 1. Congruent triangles occur when there is a correspondence between the pairs of sides and the pairs of angles. What is meant by "correspondence?" 2. What conditions must be met in order to guarantee that a pair of triangles are congruent?

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GG31	21	Lesson #21 AIM: How do we apply the properties of an isosceles triangle? Students will be able to: 1. define an isosceles triangle and its parts (legs, base, vertex angle, base angles) 2. explore the relationships among the sides and angles of isosceles triangles and equilateral triangles 3. discover and state in conditional form: "If two sides of a triangle are congruent, then the angles opposite these sides are congruent." 4. apply this theorem to algebraic problems and formal proofs 5. reason that equilateral triangles are equiangular, and state the theorem 6. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing exercise: Explain why the altitude drawn to the base of an isosceles triangle can also be called the median or angle bisector. Identify another type of triangle in which the altitude is also the median and the angle bisector. What evidence can you give to support your answer?
GG28	22	Lesson #22 AIM: How do we prove overlapping triangles congruent? Students will be able to: 1. state methods of proving triangles congruent learned so far 2. formulate a plan/flowchart for a proof involving overlapping triangles by a. deciding which pair of triangles to prove congruent b. outlining the triangles in different colors c. identifying overlapping parts d. deciding whether to use the addition or subtraction postulate with the reflexive postulate e. using previous techniques to decide which method of congruence is appropriate 3. write formal proofs involving overlapping triangles Writing Exercise: How do you think that overlapping parts make a congruence proof more difficult or more complicated?

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GG28	23	Lesson #23 AIM: How do we write proofs that require two pairs of congruent triangles? Students will be able to: 1. investigate and explain the conditions under which more than one pair of triangles must be proved congruent 2. make a plan/flowchart for a proof involving two pairs of congruent triangles by a. identifying the two pairs of triangles to be proved congruent b. determining which pair of triangles to prove congruent first c. using corresponding parts of congruent triangles together with other information to prove a second pair of triangles congruent d. using corresponding parts of congruent triangles are congruent 3. write a proof involving two pairs of congruent triangles Writing Exercise: Why is it important to work backwards when planning to write a formal proof?
GG28	24	Lesson #24 AIM: How do we write proofs involving two pairs of congruent triangles? (Day 2) Students will be able to: 1. write a proof involving two pairs of congruent triangles 2. indicate, next to the reasons in the proofs, which previous steps are used to reach particular conclusions Writing Exercise: How do you know when is it necessary to use two pairs of triangles? How does proving the first pair of triangles congruent help to prove the second pair of triangles congruent?
	25	Lesson #25 AIM: How do we prove lines perpendicular? Students will be able to: 1. state and apply the theorem: “ If two lines meet and form right angles, then they are perpendicular” to algebraic problems and geometric proofs 2. solve algebraic problems involving angles that form linear pairs and determine whether the lines will be perpendicular based on the measures of the angles that are found 3. investigate, conjecture, and justify algebraically: “If two lines meet forming congruent adjacent angles, then the lines are perpendicular.” 4. use the above theorem to prove lines are perpendicular 5. investigate and conjecture: “If two points are each equidistant from the endpoints of a line segment, the points determine the perpendicular bisector of the line segment” 6. prove this theorem and apply it to numerical problems and formal proofs Writing exercise: When a carpenter is building a house, he tries to position the walls of the house correctly, so that they are “right” or “true.” How is this statement related to the concept of perpendicular lines?

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GG35 Parallel Lines & Regular Polygons	26	Lesson #26 AIM: What are properties of parallel lines? Students will be able to: 1. state the definitions of parallel lines and transversal 2. define and identify pairs of alternate interior angles, corresponding angles, and interior angles on the same side of the transversal 3. investigate and discover the relationship between corresponding angles formed by parallel lines 4. conjecture and justify: "If two parallel lines are cut by a transversal then the corresponding angles formed are congruent." 5. state Euclid's Fifth Postulate, the parallel postulate as: "Through a point not on a given line, there exists one and only one line parallel to the given line." 6. apply Euclid's Fifth Postulate in numerical and algebraic problems 7. apply the postulate: "If two parallel lines are cut by a transversal then the corresponding angles formed are congruent." to formal proofs Writing Exercise: Euclid's Fifth Postulate is also called the Parallel Postulate. Explain why it is also known as an "existence postulate." Compare it to the Addition or Substitution Postulates.
GG35	27	Lesson #27 AIM: What are additional properties of parallel lines? Students will be able to: 1. write conjectures about the relationship between alternate interior angles and same side interior angles of parallel lines 2. discover that if two lines are parallel then a line perpendicular to one of them is perpendicular to the other 3. apply and justify the properties of parallel lines in numerical and algebraic problems 4. apply the properties of parallel lines to formal proofs 5. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercise: Explain what is wrong with the statement: "Alternate interior angles are congruent."

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GG35	28	Lesson #28 AIM: How can we show lines are parallel algebraically? Students will be able to: 1. recall that a statement and its contrapositive are equivalent 2. form the contrapositive of the postulate “If two parallel lines are cut by a transversal then the corresponding angles are congruent.” 3. postulate and apply in numerical and algebraic problems: “If two lines are cut by a transversal forming congruent corresponding angles, then these lines are parallel.” 4. investigate and prove informally a. If two lines are cut by a transversal forming congruent alternate interior angles then these lines are parallel. b. If two lines are cut by a transversal forming a pair of supplementary same side interior angles then these lines are parallel. c. If two lines are perpendicular to the same line then the two original lines are parallel to each other. 5. analyze diagrams and given information to determine whether a pair of lines are parallel 6. justify the properties of parallel lines in numerical and algebraic problems 7. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercises: Emily said that if a line is perpendicular to one of two parallel lines then it is going to be perpendicular to the other of the parallel lines. Write a few sentences explaining whether or not you agree with her statement.
GG35	29	Lesson #29 AIM: How can we prove that lines are parallel? Students will be able to: 1. state in words, the ways to show that lines are parallel 2. apply the direct methods of proof to prove lines parallel Writing Exercise: Describe two situations in your own life in which you encounter parallel lines. How could you guarantee the lines are parallel?
GG19	30	Lesson #30 AIM: How do we use a compass and straight edge to construct lines parallel or perpendicular to a given line? Students will be able to: 1. construct a line parallel to a given line through a point not on the given line and justify the construction 2. construct a line perpendicular to a given line through a point not on the given line and justify the construction 3. construct a line perpendicular to a given line through a point on the given line and justify the construction 4. apply the above to the constructions to create figures such as: altitudes, right triangles, rectangles, parallelograms, etc. Writing Exercise: In your construction of a line parallel to a given line through a point not on the given line, explain why the line constructed must be parallel to the given line.

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GG36	31	Lesson #31 AIM: How can we find the measures of the interior angles of a triangle? Students will be able to: 1. explore, discover, and state the sum of the interior angles of a triangle is 180 degrees 2. prove algebraically and state corollaries of the sum of the interior angles of a triangle theorem 3. solve numerical and algebraic problems involving the interior angles of a triangle 4. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercise: We learned today that in plane geometry the sum of the angles of a triangle is 180 degrees. Consider drawing a triangle on a sphere; will the sum of the angles still equal 180 degrees? Explain your thoughts. (Hint: Consider the lines of latitude and longitude)
GG36	32	Lesson #32 AIM: What relationships exist among the measures of the interior and exterior angles of a triangle? Students will be able to: 1. state the sum of the angles theorem and its corollaries 2. define exterior angle of a triangle 3. investigate the relationship between the interior and exterior angles at any vertex of a triangle 4. explore, discover and conjecture the sum of the exterior angles of a triangle 5. solve numerical and algebraic problems involving the interior and exterior angles of a triangle Writing Exercises: 1. How is it possible for the interior and exterior angle at any vertex of a triangle to be equal in measure? Justify your answer. 2. Modern Euclidean Geometry is based on the ideas that Euclid wrote down in his book called the **Elements**. In it he describes a line as ‘breathless length.’ What do you think this means? How does this idea of a line allow for the formation of an exterior angle of a triangle?
GG36	33	Lesson #33 AIM: How do we find the measures of interior and exterior angles of n-sided convex polygons? Students will be able to: 1. define, compare, and contrast convex and concave polygons 2. name polygons that have 4, 5, 6, 7, 8, 9, 10, and 12 sides 3. investigate, discover, and conjecture the sum of the interior angles of polygons and state the relationship as $180°(n – 2)$ or $(n – 2)$ straight angles 4. investigate the sum of the exterior angles of n-sided polygon 5. apply and justify the interior angle sum relationship and exterior angle sum to solving numerical and algebraic problems involving finding the number of sides, sum of the interior angles, and sum of the exterior angles of n-sided polygons Writing Exercise: Your friend was absent from school today. Write her a note explaining how to use triangles to develop the interior angle sum relationship for a polygon.

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GG37	34	Lesson #34 AIM: How do we find the measure of each interior angle, the measure of each exterior angle, and the area of a regular polygon? Students will be able to: 1. define regular polygon and its apothem 2. state the sum of the interior angles of polygons 3. state the sum of the exterior angles of polygons 4. state the relationship between an interior and exterior angle of a regular n-sided polygons 5. discover and prove that the area of a regular polygon is one-half the product of the perimeter and the length of the apothem 6. solve numerical and algebraic problems involving finding the number of sides, the sum of the interior or exterior angles, and the measure of each interior and exterior angle of regular n-sided polygons 7. apply these relationships to real-world problems Writing Exercise: When seen from the air, the Pentagon building in Washington, DC is in the shape of a regular pentagon. If someone has a corner office on the third floor of this building, at what angle do the walls of her office meet?
GG28 Sample tasks are proofs of construct-ions	35	Lesson #35 AIM: How can we prove triangles congruent if they agree in two angles and a side opposite one of these angles (AAS)? Students will be able to: 1. investigate and discover :"If two triangles agree in two angles and a side opposite one of these angles then the triangles are congruent." 2. recall and state the ways of proving triangles congruent learned to date 3. apply the AAS theorem to numerical and algebraic problems 4. analyze diagrams and given information to justify a method to prove triangles congruent 5. apply the AAS theorem and previous learned ways of proving triangles congruent to formal proofs 6. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercise: Explain why SSA and AAA are not sufficient to guarantee that a pair of triangles will be congruent.

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GG31	36	Lesson #36 AIM: How can we apply the converse of the base angles theorem? Students will be able to: 1. explain how to form the converse of a statement 2. form the converse of the Base Angles theorem 3. apply AAS to informally prove the converse of the Base Angles Theorem 4. investigate and discover: "If a triangle is equiangular then it is equilateral." 5. apply the converse of the Base Angles Theorem, "If two angles of the same triangle are congruent then the sides opposite these angles are congruent." to numerical and algebraic problems 6. apply the converse of the Base Angles Theorem to formal proofs 7. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercise: Webster's dictionary defines the word "base" as "the lowest or bottom part." An isosceles triangle has a side known as the base. Explain how Webster's definition does not apply to the base of an isosceles triangle.
GG28	37	Lesson #37 AIM: How do we prove right triangles congruent (HL or Hy-Leg)? Students will be able to: 1. define a right triangle and its parts 2. investigate and conjecture the theorem: "If two right triangles agree in their hypotenuse and one leg then these triangles are congruent." 3. informally prove the above theorem 4. apply the Hypotenuse-Leg Theorem to formal proofs Writing Exercises: 1. In all the ways we previously learned to prove triangles congruent we always needed three pairs of corresponding parts to be congruent. Explain how the hypotenuse-leg theorem also involves three pairs of congruent corresponding parts. 2. Explain why SSA only applies to right triangles.

PI	#	Aim and Performance Objectives – Term 1 – Integrated Geometry
GG32	38	Lesson #38 AIM: What are angle inequality relationships in a triangle? Students will be able to: 1. explore and discover the relationship between an exterior angle of a triangle and the remote interior angles 2. conjecture that the exterior angle of a triangle is equal to the sum of the two remote interior angles 3. conjecture that the exterior angle of a triangle is greater than either remote interior angle 4. apply the theorems to numerical, algebraic, and real-world problems 5. investigate and state: "If two angles of a triangle are not congruent then the sides opposite them are not congruent and the longer side is opposite the larger angle." and the converse 6. analyze diagrams and given information to order the sides or angles of triangles Writing Exercise: Your friend asks if the word 'remote' means the same thing in the expressions "remote interior angle" as it does in "remote control." How would you answer your friend?
GG33 GG34	39	Lesson #39 AIM: What are side inequality relationships in a triangle? Students will be able to: 1. investigate and conjecture that in a triangle the sum of the lengths of two sides is always greater than the length of the third side 2. state and apply that in a triangle the longest side is opposite the largest angle and its converse 3. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercise: Explain why the sum of the lengths of two sides of a triangle cannot be less than or equal to the length of the third side.

PI	#	Aim and Performance Objectives – Term 1 – Integrated Geometry
GG38 Quadrila- terals	40	Lesson #40 AIM: What are properties of a parallelogram? Students will be able to: 1. state the definition of parallelogram 2. construct a parallelogram based on its definition 3. investigate the parallelogram and write conjectures about its angles, sides, diagonals, and lines of symmetry 4. prove the theorems a. If a quadrilateral is a parallelogram then its opposite sides are congruent. b. If a quadrilateral is a parallelogram then its opposite angles are congruent. c. If a quadrilateral is a parallelogram then its consecutive angles are supplementary. d. If a quadrilateral is a parallelogram then its diagonal bisects each other. 5. apply the properties of a parallelogram to numerical and algebraic problems 6. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercise: 1. We know that if we are given the lengths of three sides of a triangle, we can only draw one triangle with those lengths. This is what the SSS congruence postulate says. Explore the possibility of drawing only one parallelogram if the lengths of its four sides are given. 2. A triangle is considered a rigid shape, meaning that it holds its shape. It is therefore used in building and bridge construction for that reason. Comment, in writing, if this is true for the parallelogram.

PI	#	Aim and Performance Objectives – Term 1 – Integrated Geometry
GG39	41	Lesson #41 AIM: What are the properties of a rectangle and square? Students will be able to: 1. state the definitions of a rectangle and square 2. using construction techniques, construct a rectangle and a square based on their definition 3. investigate and informally prove conjectures about the angles, sides, diagonals and symmetries of rectangles and squares 4. apply the properties of a rectangle and square in numerical and algebraic problems 5. apply to formal proofs: a. If a quadrilateral is a rectangle, then it is a parallelogram. b. If a quadrilateral is a rectangle, then it is equiangular. c. If a quadrilateral is a rectangle, then its diagonals are congruent. 6. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercises: 1. The volunteers at a Habitat for Humanity construction site used two 20-foot pieces of rope as the diagonals of a rectangle. Describe possible dimensions of the rectangle that they can form. 2. Rosalie said a square and rectangle are both parallelograms. Discuss what you think she could have meant by that statement.

PI	#	Aim and Performance Objectives – Term 1 – Integrated Geometry
GG39	42	Lesson #42 AIM: What are the properties of a rhombus? Students will be able to: 1. state the definitions rhombus 2. re-define a square in terms of a rhombus 3. construct a rhombus based on its definition 4. investigate and informally prove conjectures about the angles, sides, diagonals and symmetries of rhombuses 5. apply the properties of a rectangle and square in numerical and algebraic problems 6. apply to formal proofs: a. If a quadrilateral is a rhombus, then it is a parallelogram. b. If a quadrilateral is a rhombus, then it is equilateral. c. If a quadrilateral is a rhombus, then its diagonals are perpendicular to each other. d. If a quadrilateral is a rhombus then its diagonals bisect the opposite angles. e. If a quadrilateral is a rhombus, then its diagonals form four congruent triangles. 7. use a Venn Diagram or graphic organizer to organize the family of parallelograms based on their properties 8. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercises: Toni said: “If a square is a rhombus and a square is a rectangle, then by transitivity a rhombus is a rectangle.” Write her a note to tell her what is wrong with her logic.
GG41	43	Lesson #43 AIM: How do we prove that a quadrilateral is a parallelogram? Students will be able to: 1. apply the definition of a parallelogram to write a formal proof that a quadrilateral is a parallelogram 2. analyze given information and state whether it is sufficient to prove that a quadrilateral is a parallelogram 3. prove that a quadrilateral is a parallelogram by proving that: a. both pairs of opposite sides are congruent b. one pair of opposite sides is congruent and parallel c. the diagonals bisect each other d. both pairs of opposite angles are congruent e. both pairs of opposite sides are parallel 4. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercise: Give an example of a property of a parallelogram that is not enough to prove that a quadrilateral is a parallelogram.

PI	#	Aim and Performance Objectives – Term 1 – Integrated Geometry
GG41	44	Lesson #44 AIM: How do we write formal proofs involving rectangles, rhombuses, and squares? Students will be able to: 1. apply the properties of a rectangle, rhombus or square to prove two triangles congruent or two corresponding parts of congruent triangles are congruent 2. analyze given information and justify whether it is sufficient to prove that a quadrilateral is a rectangle, rhombus or square 3. prove that a quadrilateral is a rectangle 4. prove that a quadrilateral is a rhombus 5. prove that a quadrilateral is a square Writing Exercises: In which quadrilaterals are the diagonals also lines of symmetry? Give evidence to support your answer.
GG40	45	Lesson #45 AIM: What are the properties of a trapezoid? Students will be able to: 1. state the definition of trapezoid and isosceles trapezoid 2. investigate and write conjectures about the angles, sides, medians, and diagonals of trapezoids 3. analyze the triangles formed by the diagonals of isosceles trapezoids to determine which are congruent and which are isosceles 4. state, prove, and apply in numerical and algebraic problems: a. If a quadrilateral is an isosceles trapezoid, then its diagonals are congruent. b. If a quadrilateral is an isosceles trapezoid, then its base angles are congruent. c. If a quadrilateral is an isosceles trapezoid, then its median is parallel to the bases and is equal in length to one-half their sum. 5. write formal proofs using properties of trapezoids 6. given a written statement, create an appropriately labeled diagram and formulate the symbolic representation for the hypothesis and the conclusion using the letters of the diagram Writing Exercise: If we know HOPE is an isosceles trapezoid and diagonal OE is drawn, explain whether or not it is possible for diagonal OE to bisect the angles that it connects.
GG40 GG41	46	Lesson #46 AIM: How can we apply the properties of quadrilaterals in formal proofs? Students will be able to: 1. state the properties of a parallelogram, rectangle, rhombus, square, trapezoid, and isosceles trapezoid 2. use a Venn Diagram or graphic organizer to organize the family of quadrilaterals based on their properties 3. justify that a given quadrilateral is a rectangle, rhombus, rectangle, square, trapezoid or isosceles trapezoid 4. apply the properties of quadrilaterals in formal proofs Writing Exercise: Discuss: “Every square is a rectangle but not every rectangle is a square.”

PI	#	Aim and Performance Objectives – Term 1 – Integrated Geometry
GG48	47	Lesson #47 Aim: What is the Pythagorean Theorem? Students will be able to: 1. define a right triangle and identify its legs and hypotenuse 2. investigate and discover the relationship between the legs and the hypotenuse of a right triangle 3. state the Pythagorean Theorem as: "In a right triangle, the square of the hypotenuse is equal to the sum of the squares of its legs." 4. apply the Pythagorean Theorem to find the length of a missing side of a right triangle given the lengths of the other two sides 5. identify when to apply the Pythagorean Theorem in real world problems Writing Exercise: The Pythagorean Theorem was proven by ancient peoples in many different ways. Using the Internet, select one of the ways and submit a written summary of the procedure. Include appropriate diagrams.
GG48	48	Lesson #48 AIM: What are some applications of the Pythagorean Theorem? Students will be able to: 1. state and write the Pythagorean Theorem 2. explain when the Pythagorean Theorem can be used 3. solve verbal problems using the Pythagorean Theorem 4. express the length of the missing side of a right triangle in simplest radical form and to the nearest tenth Writing Exercise: Carpenters use a pencil, ruler, and the 3-4-5 Pythagorean Triple to square up a wall. How do they do this?

PI	#	Aim and Performance Objectives – Term 1 – Integrated Geometry
Coordinate Geometry	49	Lesson #49 AIM: How do we write the equation of a line in slope-intercept form? Students will be able to: 1. explain that the graph of y= mx + b is a line with slope m and y-intercept b 2. calculate the slope of a line given the coordinates of two points on the line 3. define angle of inclination 4. define slope as the tangent of the angle of inclination 5. determine the y-intercept of a line given: a. its equation b. its slope and coordinates of a point on the line 6. write an equation of a line in slope-intercept form given: a. its slope and y-intercept b. its slope and the coordinates of a point on the line c. the coordinates of two points on the line 7. explore, discover, and make conjectures regarding the slopes of vertical and horizontal lines 8. write the equations of lines parallel or perpendicular to an axis and passing through a given point Writing Exercise: Describe the procedure for writing the equation of a line passing through two given points.
	50	Lesson #50 AIM: How do we write the equation of a line in point-slope form? Students will be able to: 1. investigate and discover that the graph of $y - y_1 = m(x - x_1)$ is a line that passes through the point (x_1, y_1) with slope m 2. write the equation of a line in point-slope form given: a. its slope and the coordinates of a point on the line b. the coordinates of two points on the line 3. explain the similarities and differences between the equation of a line written in slope-intercept form and point-slope form Writing Exercise: Describe two ways to write the equation of a line passing through a given point with a given slope. Guess at a reason why it is important to have two ways to express the equation of one line.

PI	#	Aim and Performance Objectives – Term 1 – Integrated Geometry
GG63	51	Lesson #51 AIM: What is the relationship between the slopes of parallel and perpendicular lines? Students will be able to: 1. investigate and conjecture the relationship between the slopes of parallel lines and the slopes of perpendicular lines 2. analyze the equations of given pairs of lines to determine if the lines are parallel, perpendicular or neither 3. determine the slope of a line parallel or perpendicular to a line whose equation is given 4. prove lines parallel or perpendicular using their slopes Writing Exercise: Describe how you can use your graphing calculator to model and confirm the relationship between the slopes of pairs of parallel lines and pairs of perpendicular lines.
GG65	52	Lesson #52 AIM: How do we write equations of lines parallel or perpendicular to a given line? Students will be able to: 1. state the relationship between the slopes of parallel lines 2. state the relationship between the slopes of perpendicular lines 3. write the equation of a line through a given point and a. parallel to a line whose equation is given b. perpendicular to a line whose equation is given Writing Exercise: Discuss in writing, the algebraic relationship between an equation of a line written in point-slope form and the equation of the same line written in slope-intercept form.
GG67	53	Lesson #53 AIM: How do we find the distance between two points in the plane? Students will be able to: 1. explore, conjecture, and apply the formula for the distance between two points having the same ordinate or abscissa 2. investigate, conjecture, discover, and apply the formula for the distance between any two points in the plane 3. apply the distance formula to numeric problems involving finding the length of a line segment 4. apply the distance formula to show that two line segments have equal lengths Writing Exercise: 1. How is the distance formula related to the Pythagorean Theorem? 2. Helen forgot the distance formula. How can she find the distance between two points using the Pythagorean Theorem?

PI	#	Aim and Performance Objectives – Term 1 – Integrated Geometry
GG66	54	Lesson #54 AIM: How do we find the coordinates of the midpoint of a line segment? Students will be able to: 1. investigate and conjecture the formulas for the abscissa and ordinate of the midpoint of a line segment, given the coordinates of its endpoints 2. apply the midpoint formula to find the coordinates of one end of a line segment given the coordinates of the midpoint and its other endpoint 3. apply the midpoint formula to find the coordinates of the midpoint of a line segment given the coordinates of the endpoints of the line segment 4. apply the midpoint formula to determine the coordinates of the center of a circle given the coordinates of the endpoints of a diameter Writing Exercise: Describe in your own words, why taking the average of the x-values of the endpoints of a line segment will result in the x-value of the midpoint of that line segment.
GG68	55	Lesson #55 AIM: How do we write the equation of the perpendicular bisector of a line segment? Students will be able to: 1. explain what is meant by the perpendicular bisector of a line segment 2. apply coordinate geometry methods to write the equation of perpendicular bisector of a line segment given the coordinates of its endpoints 3. use construction techniques to create the perpendicular bisector of a line segment Writing Exercise: How is writing the equation for the perpendicular bisector of a line segment different or the same as writing the equation of any line?
GG69	56	Lesson #56 AIM: How can we use coordinate geometry to prove specific triangle, parallelogram and rectangle relationships? Students will be able to: 1. apply coordinate geometry methods to show a triangle is isosceles, right, or congruent to a given triangle and justify their conclusion 2. apply coordinate geometry methods to the specific coordinates of the vertices of a quadrilateral to show the quadrilateral is a parallelogram or rectangle and justify their conclusion 3. prove, given the coordinates of the vertices of a parallelogram or rectangle, that the diagonals bisect each other and/or are congruent and justify their conclusion Writing Exercise: In your opinion which of the following choices is easier to do: to show that the opposite sides of a quadrilateral are congruent using the distance formula OR to show that the opposite sides of a quadrilateral are parallel using the slope formula Explain the reason for your choice.

PI	#	Aim and Performance Objectives – Term 1 – Integrated Geometry
GG69	57	Lesson #57 AIM: How can we prove other specific quadrilateral relationships using coordinate geometry? Students will be able to: 1. given the coordinates of the vertices of a quadrilateral, apply coordinate geometry methods to show that quadrilateral is a rhombus, square, trapezoid or isosceles trapezoid and justify their conclusion 2. prove, given the specific coordinates of the vertices of a quadrilateral that the diagonals bisect each other and/or are congruent and/or are perpendicular to each other and justify their conclusion 3. given the coordinates of the vertices of a quadrilateral, prove that a median is parallel to either base and/or is equal in length to one-half the sum of the bases Writing Exercise: Describe in your own words, how the distance, slope, and midpoint formulas help to demonstrate the properties of geometric figures.
GG69	58 59	Lesson #58 & 59 AIM: How do we use coordinate geometry, where the coordinates are in literal form, to prove relationships for given geometric figures? **(May Require two days)** Students will be able to: 1. explore and conjecture how to graph coordinates expressed in literal terms 2. show, by using the distance formula, midpoint formulas, slope, properties of parallel and perpendicular lines, and equations of lines, that a polygon, given the coordinates of its vertices in literal terms, is a specific type of triangle or quadrilateral 3. prove that the diagonals of a quadrilateral, given the coordinates of its vertices in literal terms, bisect each other and/or are congruent and/or are perpendicular to each other 4. give the mathematical justification for the coordinate proof 5. explain, orally and in writing, how to prove a quadrilateral is a specific type of quadrilateral and a triangle is a specific type of triangle Writing Exercise: 1. Explain the similarities and differences in proving relationships with numerical examples in comparison to those with literal examples. 2. How do you know whether or not line segment AB, where A(a ,c) and B(a, d) is a vertical or a horizontal line segment?

BEGIN TERM TWO
INTEGRATED GEOMETRY
SPRING 2009

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
None SIMILAR TRIANGL ES	60	Lesson #1 AIM: What are ratios and proportions? Students will be able to 1. define ratio, proportion, means, extremes, mean proportional, constant of proportionality, alternation, and inversion 2. investigate, justify, and apply the theorem: "In a proportion, the product of the means equals the product of the extremes." 3. determine if a proportion is valid 4. arrange four elements to form a valid proportion 5. create valid proportions from a given proportion (i.e. by exchanging the means or by exchanging the extremes or by forming the reciprocals or by appropriate additions) 6. solve for the missing term of a proportion 7. evaluate the mean proportional between two values Writing Exercise: You are planning to invite 15 guests to a dinner party. The dessert recipe will serve 12 guests. Explain how you would use ratio and proportion to change the recipe so that it will serve all 15 guests.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG44	61	Lesson #2 AIM: How do we prove triangles similar? Students will be able to: 1. create and state a definition for similar triangles and ratio of similtude 2. identify pairs of corresponding sides 3. compare and contrast the properties of triangles that are similar triangles and triangles that are congruent 4. discover and apply the following similarity theorems to formal proofs: a. If two triangles agree in two pairs of angles then these triangles are similar. (2 Δs ~ by aa) b. If the three sides of one triangle are proportional to the three corresponding sides of another triangle, then the triangles are similar. (2 Δs ~ by SSS) 5. solve numerical and algebraic problems involving proportions in similar triangles. Writing Exercise: Hobbyists build scale models of classic cars or trains. (a) How does the mathematical concept of similarity apply to the model car and the real car situation? (b) How is the scale of the model like the "ratio of similitude" of two similar triangles?
GG44 GG45 GG46	62	Lesson #3 AIM: What are other methods for proving triangles similar? Students will be able to: 1. discover and apply the similarity theorems to formal proofs: a. If two sides of one triangle are proportional to two sides of another triangle and their included angles are congruent, then the triangles are similar. (2 Δs ~ by SAS) b. If a line is parallel to one side of a triangle and intersects the other two sides, then it cuts off a triangle similar to the original triangle. 2. state and prove: "If one or more lines are parallel to one side of a triangle and intersect the other two sides, then the lines divide the two sides of the triangle proportionally." Writing Exercise: Brian said, "If all congruent triangles are similar, then all similar triangles are congruent." Is this true? Explain your answer.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG42 GG44 GG45 GG46	63	Lesson #4 AIM: How can we prove proportions involving line segments? Students will be able to: 1. prove and apply the following theorems in formal proofs to show line segments are in proportion: a. If two triangles are similar, then their corresponding angles are congruent and their corresponding sides are in proportion. b. If a line is parallel to one side of a triangle and intersects the other two sides, then the line divides the two sides proportionally. c. If a line segment joins the midpoints of two sides of a triangle, then it is parallel to the third side and has length equal to one-half the length of the third side. 2. identify the triangles needed to be proven similar from a given proportion 3. write a proportion involving the corresponding sides of similar triangles 4. solve numerical and algebraic problems involving proportions in similar triangles 5. write proofs involving line segments that are in proportion 6. write proofs involving line segments that have a mean proportional Writing Exercise: Using a 3-4-5 right triangle and a 5-12-13 right triangle, John sets up the proportion 3:4=5:12. Show that the proportion is incorrect. Explain what John might have been thinking when he wrote the proportion.
GG44 GG45	64	Lesson #5 AIM: How can we prove that products of line segments are equal? Students will be able to: 1. create a proportion from a given product of line segments 2. identify the triangles needed to be proved similar 3. prove, both formally and informally, triangles similar and line segments in proportion 4. apply the theorem: "In a proportion, the product of the means equals the product of the extremes." to prove products of lengths of line segments equal Writing Exercise: In algebra, you learned cross multiplication. How does that relate to today's aim? How might the term "cross multiplication" be confusing to a student who is simply trying to multiply fractions?

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG43 GG21	65	Lesson #6 Aim: What are the properties of the centroid of a triangle? Students will be able to: 1. state the definition of a median of a triangle 2. define centroid and concurrence 3. investigate the 2:1 relationship between the segments on the median formed by the position of the centroid 4. locate the centroid of a triangle using measurement, construction, or manipulative tools, such as paper folding, or dynamic geometry software 5. apply properties of the centroid to in-context situations Writing Exercise: 1. Why is the centroid of a triangle also known as its "center of gravity?" 2. A cevian is a segment drawn from a vertex of a triangle to the opposite side. The median is a cevian. Identify the names of other cevians that can be drawn in a triangle. Describe them fully.
GG47	66	Lesson #7 Aim: What is the Right-Triangle Altitude Theorem? Students will be able to: 1. define projection, mean proportional, geometric mean 2. identify the altitude, hypotenuse, and projection on the hypotenuse given a diagram 3. investigate, discover, and conjecture the right-triangle altitude theorem a. Each leg of a right triangle is the mean proportional between its projection on the hypotenuse and the whole hypotenuse. b. The altitude drawn to the hypotenuse of a right triangle is the mean proportional between the segments of the hypotenuse. 4. express in writing the relationships between the measures of the segments involved in the right-triangle altitude theorem in different contexts Writing Exercise: Using the Internet as a source, investigate how a surveyor can use the 'right-triangle altitude' theorem to determine the height of building or the height of a cliff. Include a written explanation and a drawing illustrating its use.
GG47	67	Lesson #8 Aim: How do we apply the Right-Triangle Altitude Theorem? Students will be able to: 1. state the Right-Triangle Altitude Theorem 2. apply the Right-Triangle Altitude Theorem to in-context numerical and algebraic problems 3. apply the Right-Triangle Altitude Theorem in proofs 4. solve numerical problems related to similar triangles within a right triangle Writing Exercise: The right-triangle altitude theorem used the altitude to the hypotenuse as a "geometric mean." Define 'geometric mean' using your own words.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG71 GG72 GG73 GG74	68	Lesson #9 AIM: How do we write the equation of a circle? Students will be able to: 1. use the distance formula to discover the equation of a circle with center at (h,k) and with a radius of length r: $(x-h)^2 + (y-k)^2 = r^2$ 2. write the equation of a circle given any of the following: a. the coordinates of the center and the length of the radius b. the coordinates of the center and the coordinates of a point on the circle c. the coordinates of the endpoints of a diameter 3. determine the coordinates of the center and the length of the radius of a circle whose equation is given in center-radius form 4. graph circles in the form $(x-h)^2 + (y-k)^2 = r^2$ 5. determine the center and radius of a circle whose graph is given (the coordinates of the center and the length of the radius are integral values) Writing Exercise: Explain the similarities and differences between the graphs of $x^2 + y^2 = r^2$ and $(x-h)^2 + (y-k)^2 = r^2$.
GRAPHING OF PARABOLAS SHOULD BE REVIEWED THROUGH HOMEWORK PRIOR TO THE NEXT LESSON		
GG70	69	Lesson #10 AIM: How do we find a common solution to a quadratic-linear system of equations graphically? Students will be able to 1. graph the quadratic and linear equations on the same set of axes by making a table of values, using a graphing calculator (include parabola and line as well as circle and line), and/or using dynamic software 2. identify the coordinates of all common solutions by using calculator and/or dynamic software intersection function 3. verify that the coordinates of each point of intersection is a common solution by checking that they satisfy both equations 4. determine the number of solutions by inspecting the graph Writing Exercise: Explain why the coordinates of a point of intersection of the graphs of two equations represents a solution to the system.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG51 CIRCLE S	70	Lesson #11 AIM: What are the parts of a circle? Students will be able to 1. define circle, radius, diameter, center, chord, secant, tangent, central angle, arc, semicircle, minor arc, major arc, congruent arcs, and congruent circles 2. discover, state, and apply the postulates: a. In the same or congruent circles all radii are congruent b. The degree measure of a central angle of a circle is equal to the degree measure of its intercepted arc. 3. explain the difference between arc degrees and arc length 4. solve numerical and algebraic problems involving diameters and radii, major and minor arcs, and central angles 5. apply the above definitions and postulates to formal and informal proofs Writing Exercise: 1. Which do you think is a better illustration of a circle: a round pizza or a bicycle tire? Explain the reasons for your choice. 2. Ellen wondered why a circle with a radius of 5 inches and a bigger circle with a radius of 8 inches both had 360 degrees. She asked Gary, "Shouldn't the bigger circle have more degrees?" How should Gary answer her question?
GG21	71	Lesson #12 AIM: What are the properties of the four centers of a triangle? Students will be able to: 1. define: cevian, concurrence, centroid, orthocenter, in-center, circumcenter 2. explain why medians, altitudes, angle bisectors, and perpendicular bisectors are cevians 3. investigate and locate the concurrency of cevians for a given triangle, using compass and straight edge construction techniques 4. investigate relationships involving these four "centers", such as the effects of the type of triangle on the location of these centers, the location of the centroid in relation to the length of each median, the conditions under which these four centers are collinear, etc. 5. discover the unique relationship the centroid and in-center have to the triangle, namely: a. the centroid is the center of gravity b. the in-center is the center of the inscribed circle Writing Exercise: The center of a circle inscribed in a triangle is located by finding the intersection of the angle bisectors of the angles of the triangle. Identify the construction that must be used to locate the center of the circle that is circumscribed about the triangle. Justify your choice of construction.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG51	72	Lesson #13 AIM: How do we prove arcs congruent? Students will be able to 1. state and apply the following: a. The degree measure of a central angle of a circle is equal to the degree measure of its intercepted arc. b. In the same or in congruent circles, if two central angles are congruent, then the arcs they intercept are congruent. c. In the same or in congruent circles, if two arcs are congruent, then their central angles are congruent. d. In the same or in congruent circles, if two chords are congruent, then their arcs are congruent. e. The diameter of a circle divides the circle into two congruent arcs. 2. apply the above theorems to numerical and algebraic problems, and to formal and informal proofs Writing Exercise: Amar created a pie chart of his personal expenses: rent, car payments, food, and entertainment. If the degree measure of the arc for rent was 60 degrees, what part of his pay check is spent on rent? Explain how you know this.
GG49	73	Lesson #14 AIM: How do we prove chords congruent? Students will be able to 1. state that the distance from a point to a line is measured along the perpendicular from the point to the line 2. discover and apply the following: a. In the same or in congruent circles, if two central angles are congruent, then the chords they intercept are congruent. b. In the same or in congruent circles, if two arcs are congruent, then their chords are congruent. c. In the same or in congruent circles, if two chords are equidistant from the center, then they are congruent. 3. investigate the relative lengths of chords using their distance from the center of a circle 4. apply the above theorems to numerical and algebraic problems and to formal and informal proofs Writing Exercise: 1. Al's new garden was in the shape of a circle. He asked the gardener to plant ivy in the interior of the circle and to build a fence on the circumference. He is using the word circumference incorrectly. Explain. 2. Describe the difference between arc length and arc measure.
GG49	74	Lesson #15 AIM: What relationships exist if a diameter is perpendicular to a chord? Students will be able to 1. explore, conjecture the theorem: "If a diameter is perpendicular to a chord, then it bisects the chord and its major and minor arcs." 2. apply the above theorem to numerical and algebraic problems and to formal and informal proofs Writing Exercise: Paul says that, "If a line through the center of a circle bisects a chord then it is also perpendicular to that chord." Harry says that this isn't necessarily true. Who do you agree with, and why?

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG51 GG52	75	Lesson #16 AIM: How do we measure an inscribed angle? Students will be able to 1. define an inscribed angle 2. identify the intercepted arc 3. investigate, conjecture, and apply the theorem: "The measure of an inscribed angle is equal to one-half the measure of its intercepted arc" 4. state, prove formally, and apply the theorems: a. In the same or in congruent circles, if two inscribed angles intercept the same arc or congruent arcs, then the angles are congruent. b. An angle inscribed in a semi-circle is a right angle. c. If a quadrilateral is inscribed in a circle, then its opposite angles are supplementary. d. In a circle, parallel chords intercept congruent arcs between them. 5. apply the above theorems to numerical and algebraic problems and to formal and informal proofs Writing Exercise: 1. Explain why only certain parallelograms can be inscribed into a circle. 2. Explain why it is possible to circumscribe a circle about a quadrilateral only if the opposite angles are supplementary.
GG50 GG53	76	Lesson #17 AIM: What relationships exist when tangents to a circle are drawn? Students will be able to 1. define a tangent to a circle; distinguish it from a secant 2. state the postulate: "At a given point on a circle, there is one and only one tangent to the circle." 3. state and apply the theorems: a. If a line is tangent to a circle, then it is perpendicular to the radius drawn to the point of contact. b. If a line is perpendicular to a radius at its outer endpoint, then it is a tangent to the circle. c. If two tangents are drawn to a circle from the same external point, then these tangents are congruent. 4. investigate the number of common tangents to circles which intersect in two points, one point (tangent to each other), or no points 5. apply the above theorems and properties to numerical and algebraic problems and to formal and informal proofs Writing Exercise: A total eclipse of the sun occurs when the Moon is positioned between the Sun and the Earth. The Moon casts a shadow on the surface of the Earth. Draw a diagram that illustrates this situation and show by drawing tangent lines how this occurs. Explain why the solar eclipse is only visible in certain areas of the Earth surface.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG51	77	Lesson #18 AIM: How do we measure an angle formed by a tangent and a chord? Students will be able to 1. state and apply the theorem: "The measure of an angle formed by a tangent and a chord equals one-half the measure of its intercepted arc." 2. identify the intercepted arc 3. apply the above theorem to numerical and algebraic problems and to formal and informal proofs Writing Exercise An inscribed angle and a tangent-chord angle intercept the same arc. What conclusion can you make about the measure of these two angles? Justify your answer.
GG51	78	Lesson #19 AIM: How do we measure angles formed by two tangents, by a tangent and a secant or by two secants to a circle? Students will be able to 1. state and apply the theorem: "The measure of an angle formed by two tangents, by a tangent and a secant, or by two secants equals one-half the difference of the measure of their intercepted arcs." 2. identify the intercepted arcs for each angle 3. apply the above theorem to numerical and algebraic problems and to formal and informal proofs Writing Exercise: 1. A secant is a line that intersects a circle in two points. Does a secant always contain a chord of a circle? Explain. 2. Investigate the relationship between the angle formed by two tangents and the intercepted minor arc. Support your conclusion with evidence.
GG51	79	Lesson #20 AIM: How do we measure angles formed by two chords intersecting within a circle? Students will be able to: 1. discover, state, and prove the theorem: "The measure of an angle formed by two chords intersecting inside a circle equals one-half the sum of the measures of its intercepted arcs" 2. apply the above theorem to numerical and algebraic problems and to formal and informal proofs Writing Exercise: Diane says, "In a circle, if a diameter and a chord intersect, they are perpendicular to each other." Is she correct? Justify your answer.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG51	80	Lesson #21 AIM: How do we apply angle measurement theorems to circle problems? Students will be able to: 1. apply angle measurement theorems to numerical and algebraic problems 2. identify and state the angle measure theorem(s) to be used 3. apply the above theorem(s) to formal and informal proofs 4. generalize the measure of an angle based on the location of the vertex (i.e. if the vertex is outside the circle its measure is one-half the difference of the arcs) Writing Exercise: Explain why an angle inscribed in a semicircle must be a right angle.
GG51	81	Lesson #22 AIM: How do we apply angle measurement theorems to more complex circle problems? Students will be able to: 1. apply angle measurement theorems to complex numerical and algebraic problems 2. identify and state the angle measurement theorem(s) to be used 3. apply the above theorem(s) to formal and informal proofs Writing Exercise: How do we find the measure of angles that do not have direct formulas? Describe the other techniques that can be used.
GG53	82	Lesson #23 Aim: How do we use similar triangles to find the measure of segments of chords intersecting in a circle? Students will be able to: 1. apply properties of similar triangles to discover the relationship among the segments of intersecting chords 2. conjecture and prove the theorem: "If two chords intersect within a circle, the product of the measures of the segments of one chord equals the product of the measures of the segments of the other chord." 3. apply the theorem to numerical and algebraic problems Writing Exercise: In a circle whose radius is 6, a diameter is drawn perpendicular to a chord whose length is 8. Explain how to find the distance of the chord to the center of the circle. (Remember: Distance is measured along a perpendicular!)

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG53	83	Lesson #24 Aim: How do we use similar triangles to find the measure of line segments formed by a tangent and secant to circle? Students will be able to: 1. apply properties of similar triangles to discover, conjecture, and prove the theorem: "If a tangent and a secant are drawn to a circle from the same external point, then length of the tangent is the mean proportional between the lengths of the secant and its external segment." 2. apply the above theorem to numerical and algebraic problems Writing Exercise: Write a plan to solve this problem: In a circle, diameter AB is extended through B to an external point P. A tangent segment, PC, is drawn from P to a point, C, on the circle's circumference. If BP=4 and PC=6, find the length of diameter AB.
GG53	84	Lesson #25 Aim: How do we use similar triangles to find the measures of secants and their external segments drawn to a circle? Students will be able to: 1. apply properties of similar triangles to discover, conjecture and prove the theorem: "If two secants are drawn to a circle from the same external point then the product of the lengths of one secant and its external segment is equal to the product of the lengths of the other secant and its external segment." 2. apply the above theorem to numerical and algebraic problems Writing Exercise: Compare the proof for the tangent-secant theorem to the proof for the secant-secant theorem.
	85	Lesson #26 Aim: How do we apply segment measurement relationships to problems involving circles? Students will be able to: 1. apply theorems involving segment relationships of a circle by: a. identifying the relevant theorem b. writing an appropriate equation c. using the computed value to find other missing segment measures 2. apply segment measurement theorems in formal proofs Writing Exercise: Two tangents are drawn to a circle from the same external point. Explore the relationship between the measure of the angle formed by these tangents and the measure of its minor intercepted arc.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG22 LOCUS	86	Lesson #27 AIM: How do we determine a probable locus? Students will be able to: 1. state the definition of locus 2. state and illustrate the five fundamental locus theorems 3. state and apply a procedure for discovering a probable locus 4. describe each locus in a complete sentence Writing Exercise: Describe and sketch real-world examples that illustrate each of the locus theorems discussed in class today.
GG22	87	Lesson #28 AIM: How do we solve problems using compound loci? Students will be able to: 1. sketch on the same diagram the locus of points satisfying two given conditions and locate the point(s) of intersection of these loci 2. explain why the point(s) of intersection represent the locus of points satisfying two conditions 3. determine the number of points satisfying both conditions Writing Exercise: 1. How is a compound loci problem like a buried treasure map? 2. Create a buried treasure map and a list of the compound loci conditions for finding your buried treasure.
GG23	88	Lesson #29 AIM: How do we find the equation of the locus of points at a given distance from a given point? Students will be able to: 1. describe the locus of points at a given distance from a given point 2. explain the meaning of the phrase "equation of a locus" 3. write the equation of a circle given the coordinates of its center and the length of its radius 4. identify the coordinates of the center and the length of the radius of a circle from a graph or an equation 5. determine whether any point whose coordinates are given is on the locus of a given circle 6. write the equation of the locus of points at a given distance from a given point Writing Exercise: Explain in terms of your understanding of locus the differences between $x^2 + y^2 = 6^2$ and $(x-1)^2 + (y+2)^2 = 36$. Can there be any points that satisfy both conditions? Justify your answer.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG23	89	Lesson #30 AIM: How do we write linear equations that satisfy given locus conditions? Students will be able to: 1. explain the meaning of the phrase "equation of a locus" 2. show that two lines are parallel or perpendicular 3. write the equation of a line given the slope and the coordinates of a point on the line 4. write the equations of the locus of points at a given distance from a given line 5. write the equation of the locus of points equidistant from two parallel lines 6. write the equations of the locus of points equidistant from two intersecting lines 7. write the equation of the locus of points equidistant from two given points 8. graph the locus of points described by given conditions 9. determine whether a given point is on a locus whose equation is given Writing Exercise: Speculate on how locus theorems could be used to identify the possible location(s) of people lost in the wilderness.
GG23	90	Lesson #31 AIM: How do we find the points in the coordinate plane which satisfy two different conditions? Students will be able to: 1. draw, on the same coordinate axes, the locus of points that satisfy the first of two conditions, the second of two conditions, and the intersection of these loci 2. explain why the points of intersection represent the locus of points satisfying two conditions 3. determine the number of points satisfying both conditions Writing Exercise: Maria solved a compound loci problem. Maria said that after she drew her compound loci diagram she got her answer by counting all the places where the lines and the circles in her diagram intersected. Explain to Maria why this technique could get her the wrong answer.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG54 GG55 GG59 GG61 TRANSFO R- MATIONS	91	Lesson #32 AIM: How are images and pre-images related under line reflections? Students will be able to: 1. describe the procedure for finding the image of a point under a line reflection 2. define and identify lines of symmetry in geometric figures and real-world shapes 3. discover the rules to finding images of points, line segments, triangles, and curves under line reflections over the x-axis, y-axis, and y =x 4. determine the images of points, lines, triangles, and curves under a line reflection over x=a and y=b where a and b are not equal to zero 5. create images under line reflections by applying learned rules and procedures 6. discover, justify, and apply properties that are invariant under a line reflection: angle measure, collinearity, linearity, distance, area, parallelism, points on the line Writing Exercise: The words slide, turn, flip, enlarge, and shrink all describe different transformations. Identify the transformation that is best described by these words and explain how you made your choices.
GG54 GG55	92	Lesson #33 AIM: How are images and pre-images related under point reflections and translations? Students will be able to: 1. describe the procedure for finding the image of a point under a reflection in a point 2. define and identify point symmetry in geometric figures and real-world shapes 3. discover and apply analytical rules to finding images of points, line segments, triangles and curves under a reflection in the origin 4. discover and apply analytical rules to finding images of points, line segments, triangles and curves under a translation 5. discover, justify, and apply properties that are invariant under a point reflection: angle measure, distance, area, parallelism, point of reflection Writing Exercise: The game of billiards has been played since the 1800's. Look up the rules for billiards on the Internet or in a book and describe how an understanding of line reflections can help you to become a better billiards player.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
	93	Lesson #34 AIM: How are images and pre-images related under rotations? Students will be able to: 1. define rotation about a point 2. define and identify rotational symmetry in geometric figures and real-world shapes 3. identify a positive rotation as a rotation in the counter-clockwise direction and a negative rotation as a rotation in the clockwise direction 4. discover and apply analytical rules to finding images of points, line segments, triangles, and curves under positive or negative rotations of 90° or 180° about the origin 5. discover, justify and apply properties that are invariant under rotation: angle measure, collinearity, distance, area, parallelism, center, point of rotation Writing Exercise: Some properties remain invariant after they undergo a transformation. Using your own words describe what this means. Give an example to illustrate this property.
GG59/60	94	Lesson #35 AIM: How are images and pre-images related under dilations? Students will be able to: 1. describe what is meant by a dilation 2. determine and apply analytical rules to finding the images of points, lines, triangles, and curves after a dilation centered at the origin by a factor of k investigate, discover, justify and apply properties that remain invariant under a dilation: angle measure, collinearity, parallelism, center point of dilation 3. determine that the image figure is similar to its pre-image and solve applications involving similarity Writing Exercise: Mike says that dilation is just another word for similarity. What do you think about his statement? Support your answer with evidence.
GG58	95	Lesson #36 AIM: How do we find an image under a composition of transformations? Students will be able to: 1. define composition of transformations 2. find an image under a composition of transformations 3. show that a glide reflection is a composition of a line reflection and a translation in either order 4. find the image of a point, line segment, triangle or curve under a composition of two transformations 5. discover invariant properties for a glide reflection: angle measure, distance, area, parallelism 6. explore and discover whether the order in which a composition of transformations is performed affects the final image Writing Exercise: How are foot-steps in the snow an excellent example of a glide reflection? How would the foot-steps of someone who is drunk not be a good example of a glide reflection?

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG56	96	Lesson #37 AIM: Which transformations are isometries? Students will be able to: 1. define isometry, direct isometry, and indirect isometry 2. determine which transformation preserves orientation 3. explore, discover, and conjecture which transformations are isometries, direct or indirect 4. identify the isometry or composition of transformations that would produce a particular image of a given figure Writing Exercise: *Isobars* are lines of equal atmospheric pressure drawn on a weather map. *Isotopes* are any of two or more forms of a chemical element that have the same chemical properties. a. Describe what an *isometry* is. b. What does the prefix *'iso'* mean in the words isobar, isotope, and isometry? c. Do you think the prefix means the same thing in the word *isosceles*? Explain.
GG57 GG58 GG59 GG60	97	Lesson #38 Aim: How do we apply the properties of transformations to geometric proofs? Students will be able to: 1. justify geometric relationships (perpendicularity, parallelism, congruence) using transformational techniques 2. write informal and formal proofs using transformational techniques Writing Exercise: Tessellations use shapes in a very specific way to make a pattern. a. Using your own words, describe what a tessellation is. b. Identify shapes which tessellate and which do not. Tell us why? c. Identify at least one transformation that is used when creating a tessellation.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG10 SOLID GEO	98	Lesson #39 Aim: What is solid geometry? Students will be able to: 1. identify by name: prism, pyramid, sphere, cylinder, cone 2. distinguish between solids that are polyhedra and ones that are not 3. distinguish right solids from oblique ones 4. define and identify face, edge, vertex, altitude, slant height 5. create models of regular polyhedra 6. identify the five Platonic Solids 7. describe surface area 8. compare surface area to volume 9. compare and contrast units of measure for surface area and volume 10. state and apply the property: lateral edges of a prism are both congruent and parallel Writing Exercise: Each face of a polyhedron is a polygon. Explain why a prism or a pyramid is a polyhedron but a cone or a cylinder is not.
	99	Lesson #40 Aim: How do we determine a plane? Students will be able to: 1. describe a plane 2. identify undefined terms: point line, plane 3. use appropriate notation to name a plane 4. discover and state that a. three points determine a plane b. a line and a point not on the line determine a plane c. two intersecting lines determine a plane 5. define coplanar points (compare this concept to collinear points in two-dimensions) Writing Exercise: A tripod is a three legged stand used by camera men to steady their cameras while shooting film. Give a reason why three legs is the best way to insure that the stand will be steady.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG1 GG2 GG3	100	Lesson #41 Aim: When is a line perpendicular to a plane? Students will be able to: 1. state the conditions for a line to be perpendicular to a plane a. If a line is perpendicular to each of two intersecting lines at their point of intersection, then the line is perpendicular to the plane determined by them. b. Through a given point there passes one and only one plane perpendicular to a given line. c. Through a given point there passes one and only one line perpendicular to a given plane. 2. identify the 'foot' as the point of intersection of a line with a plane 3. discover and state that the intersection of two planes is a line 4. discover and state that the intersection of three planes is a point 5. apply concepts to real world situations Writing Exercise: Leonhard Euler (1707-1783) discovered a relationship between the vertices, edges and faces of polyhedra. What is this formula? Demonstrate the use of his formula using two different polyhedra.
GG4 GG5 GG6 GG7	101	Lesson #42 Aim: When are planes perpendicular? Students will be able to: 1. discover, state, and apply conditions for planes to be perpendicular a. If two planes are perpendicular to each other if and only if one plane contains a line perpendicular to the second plane. b. If a line is perpendicular to a plane, then every plane containing the line is perpendicular to the given plane. 2. discover, state, and apply the theorems: a. Two lines perpendicular to the same plane are coplanar. b. If a line is perpendicular to a plane, then any line perpendicular to the given line at its point of intersection with the given plane (known as its foot), is in the given plane. 3. apply concepts to real world situations Writing Exercise: 1. A net is a two-dimensional pattern that when appropriately cut and folded, forms a solid figure. Create a net for a tetrahedron, a cube and an octahedron. Describe how the nets are drawn so that they can be folded into these solids. 2. Regular polyhedra are also called Platonic Solids. Why? 3. There are only five Platonic Solids. Why?

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG8 GG9	102	Lesson #43 Aim: When are planes parallel? Students will be able to: 1. define parallel planes (compare this concept to parallel lines in two - dimensions) 2. define skew lines 3. postulate that two parallel lines determine a plane 4. investigate and state theorems: a. If a plane intersects two parallel planes then the lines of intersection are parallel. b. If two planes are perpendicular to the same line then they are parallel. c. If two planes are parallel to a third plane, they are parallel. d. A line perpendicular to one of two parallel planes is perpendicular to the other. 5. apply concepts to real world situations Writing Exercise: 1. Identify five real world examples of parallel and perpendicular planes. 2. Planes that intersect form angles called dihedral angles. Speculate on the dihedral angle relationships formed when two parallel planes are intersected by a third plane.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG11 GG12 GG14	103	Lesson #44 (May Require Two Lessons) Aim: How do we find the volume and surface area of prisms and cylinders? Students will be able to: 1. discover that the lateral edges of a prism are congruent and parallel 2. discover that two prisms have equal volumes if their bases have equal bases and their altitudes are equal 3. discover that the volume of a prism is the product of the area of its base and its altitude 4. state and apply the properties of a cylinder in verbal problems a. bases are congruent b. volume is product of the area of its base and its altitude c. lateral surface area of a right circular cylinder equals the product of its altitude and its circumference 5. identify a symmetry plane 6. experiment with changes in dimensions to determine the effect on the volume and the on surface area of prisms and cylinders 7. articulate in writing the effect on volume and surface area when dimensions are changed 8. discover and explain how to minimize surface area when holding volume fixed 9. identify appropriate situations to use volume and surface area formulas 10. apply discovered formulas to in-context situations Writing Exercise: 1. What is Cavalieri's Principle? How would two stacks of pennies illustrate this principle? (Hint: Look up Bonaventura Cavalieri, 1598-1647.) 2. A manufacturer must sell 216 cubic inches of fish tank gravel in a container that has the smallest surface area (packaging costs must be kept at a minimum). You are employed by the manufacturer as the packaging expert. Explore a container (cube, prism, cylinder or other shape) which has a volume of 216 cubic inches but the smallest surface area. Make a shape and size recommendation to your manager and give reasons for your recommendation.

PI	#	Aim and Performance Objectives – Term 2 – Integrated Geometry
GG13 GG15	104	Lesson #45 Aim: How do we find the volume and surface area of pyramids and cones? Students will be able to: 1. discover that the volume of a cone and a pyramid is one-third the volume of a cylinder and a prism, respectively 2. discover, state and apply, the lateral edges of a pyramid are congruent 3. identify the lateral faces of a pyramid as congruent isosceles triangles 4. discover that the lateral area of a right circular cone is one-half the product of its slant height and the circumference of its base 5. experiment with changes in dimensions to determine the effect on the volume and on the surface area of pyramids and cones 6. articulate in writing the effect on volume and surface area when dimensions are changed 7. discover and explain how to minimize surface area when holding volume fixed 8. identify a symmetry plane 9. apply discovered formulas to in-context situations Writing Exercise: Archimedes used displacement to compute the volume of a gold crown. What is displacement? How can displacement be used to compute volume?
GG16	105	Lesson #46 Aim: What are the properties of a sphere? Students will be able to: 1. state and apply formulas for the volume and surface area of a sphere 2. identify the great circle as the largest circle that can be drawn on a sphere 3. state and apply the theorems: a. the intersection of a plane and a sphere is a circle b. two planes that intersect a sphere and are equidistant from the center of the sphere, intersect the sphere in congruent circles Writing Exercise: Which of the latitude or longitude lines on a globe of the earth is considered a great circle? Explain why.