~~~Unit Plan~~~

Course: Math A
Unit Title: Analytic Geometry
Grade Level: 9th Grade

Duration of Unit: Twelve Days
Teacher: Ms. Smith

Rationale of the Unit:

The purpose of this unit is to teach students the components of the coordinate system and its many uses. Students will be re-introduced to the important vocabulary pertaining to the coordinate system. Students will plot points to graph polygons and relate their prior knowledge of area formulas to find the area of each figure on a coordinate plane. Linear relations form linear equations that exist in everyday life – buying movie tickets, the amount of points earned for a certain number of correct answers on a quiz, the height at which a ball bounces varies directly to the distance at which it was dropped from. These linear equations of these linear relations show many of the characteristics of its line – the slope, y-intercept, distance of the line, and the midpoint of the line. In examining the graph of a linear equation we can develop the relationships between lines that are parallel and perpendicular. The coordinate system contains many components, thus it is important to study each component and find relationships between them all. This unit will allow students to examine the many parts of the coordinate system and its importance in the real-world.

Material/ Resources:

- Blackboard & Chalk
- Overhead Projector & Pens
- Transparencies
- Graphing Calculator
- Graph Paper
- Rulers
- Worksheets (*see each lesson*)
- Homework dittos (*see each lesson*)

Goals for the Unit:

The goals of this unit are for students to:

- Understand the components and vocabulary associated with the coordinate system.
- Develop skills in reading and interpreting a graph on the coordinate plane.
- Enhance awareness of the use of linear relations in the real world.
- Increase use of graphs with appropriate linear equations.
- Develop the knowledge to interpret the equation of a line to find many of its characteristics – slope, y-intercept, distance, and midpoint.

Objectives of the Unit:

Upon completion of this unit the student will be able to:

- Define important terms dealing with the coordinate system - plane, x-axis, y-axis, origin, quadrant, and ordered pairs.
- Apply these definitions when plotting points on a coordinate system.
- Graph numerous polygons and calculate their areas.
- Define and calculate slope.
- Define and calculate direct variation and constant of variation.
- Produce the equation of a line using the slope-intercept form or the point-slope form of a line.
- Recall absolute value and its purpose.
- Determine the relationship between the equation of a line for parallel and perpendicular lines.
- Organize information from a line to calculate the distance and midpoint of a line.

Assessment:

To assess what students have learned throughout this unit plan I have incorporated a variety of teaching strategies – direct instruction, group work, class discussion, guided notes, and homework practice. Direct instruction allows me to teach students the topic while making sure to ask questions that ensure they are following along. During group work I will be able to walk freely about the classroom listening and participating in each group to make sure that groups stay on task and are understanding the material covered. Class discussion is a way to find out what the class is thinking and what they have learned. Homework assignments allow students to practice and express to me the information they have just learned. I think taking the first minute or two of each class to discuss the previous class is a good way to assess student learning. Beginning class with a problem of the day reinforces material learned from previous lessons. Connecting the material from lesson plan to lesson plan and unit plan to unit plan are ways to make sure students are learning.

Formal Assessment is also important. Quizzes given throughout the unit allow me to assess student learning on an individual level while giving me an overall view of progress of the entire class. Quizzes will allow me to see any misconceptions that need to be addressed to the entire class. Day eleven of this unit allows students to ask any final questions before a final unit test assessment while playing a fun game and reviewing material taught throughout the unit.

Overview of the Twelve Daily Lessons

Day 1: Introduction to Graphs

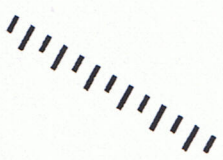
Objective: Students will be able to recall the important components and its vocabulary that are associated with the coordinate system.

Lesson Overview: Each student will be given a set of guided notes on the important terms one must know in working with the coordinate system. I will ask for volunteers to read each paragraph of the guided notes. The guided notes are set up with the important vocabulary missing. Students will have to fill in the important terms as we go along. Overhead sheets will be made, so students can see me also write in the important terms and point out what each term means. Students will have time during the lesson to practice using the terms – labeling the x and y axes, locating the origin, finding the coordinates of certain points, and determining what quadrant a point is located in. Homework will given in which students practice using the important vocabulary to label axes and the origin, find the coordinates of certain points, plot other points, and name quadrants.

Day 2: Area of Polygons

Objective: Students will be able to plot points to create a polygon and find its area.

Lesson Overview: The class will begin with a problem of the day relating to area. Students will be asked to recall area formulas learned from previous years of mathematics. We will discuss why area is measured in square units. The class will then be broken up into pre-assigned groups. Each group will be given a list of points and line segments (provided on a worksheet) to draw on their piece of overhead graph paper. The list of points given will be a polygon. Students will be asked to find the area of that polygon using information from the graph they create. Each group will present their graph to the class. They will list the points they plotted and line segments graphed, and the figure in which they created. They will then inform the class what the formula is for their polygon and how it is they found the area of their polygon. This is both a review of area formulas and practice graphing polygons. Students will have a further opportunity to practice finding the area of more polygons with a homework assignment.



Day 3: Graphing Linear Equations

Objective: Students will be able to define a linear relation and arrange its data to create its graph.

Lesson Overview: We will discuss the previous nights homework having students put their answers on the blackboard and review the steps for creating a graph – draw axes, label axes, label origin, and label scale. To introduce linear relations we will use the an example involving buying movie tickets and relate it to a linear relation – the relationship between the number of tickets and the price can be given in ordered pairs. We will graph this relationship and determine the characteristics of a linear equation. Through guided notes and practice problems we will examine another linear relation, and determine how to graph its linear equation following the three steps – find the coordinates of three points, create a table of points, and plot the points. Students will take some class time to do so, and then we will go over it as a class. Then students will work with a neighbor and graph the linear equation that is formed for converting Celsius temperatures to Fahrenheit temperatures. This is something very useful to people living so close to Canada in which they use Celsius temperatures. Students will be given two more linear equations to graph for practice at home.

Day 4: Finding the slope of a Line

Objective: Students will be able to define slope and find the slope of a line using two points on a line.

Lesson Overview: The problem of the day involving the pitch of a roof relates to the topic of today's lesson – slope. The pitch of a roof, the gradient of a road, or the slant of a ladder are all real-world examples of slope. Through direct instruction I will explain how each case involves talking about the rise of something compared to its run, or the change in y-coordinates over the change in x-coordinates. Each student will receive a worksheet with example line segments on a graph. We will find the slope of each segment and look at the characteristics of the slope – a negative falling slope, a positive rising slope, a slope of zero parallel to the x-axis, or an undefined slope parallel to the y-axis. I will allow students to work independently for a short amount of time, and then students will put their answers on the board, so we can discuss how each answer was formulated. A worksheet will be given for homework involving more practice problems on slope and an announcement will be made about a quiz on the following day.

Day 5: Assessment & Review

Objective: Students will be assessed on the information from the first three days of this unit – introduction to the coordinate system, finding area of polygons on the coordinate system, and graphing linear equations.

Lesson Overview: We will take the first fifteen minutes of class to discuss the previous nights homework on slope and take the time to review important concepts from the week – the steps to creating a graph, the area formulas for polygons, and the steps to graphing a linear equation. Then the students will be given a quiz to assess individual learning and tell me what concepts as a class we need to further work on.

Day 6: Direct Variation

Objective: Students will be able to define and calculate direct variation and constant of variation.

Lesson Overview: The quizzes will be returned and common mistakes and errors will be discussed. Students have the opportunity to come in during a study hall to find out what they did wrong and retake any questions they got wrong for half the points back. Each student will be given a worksheet of guided notes involving direct variation. We will discuss an example of a teacher giving a quiz and relationship between the number of correct answers and the number of points earned for each correct answer. This relationship between the variables y and x is a direct variation. We say that "y varies directly proportional to x." This constant ratio of y divided by x is called the constant of variation or k, and we can write the relation as an equation $y = kx$. Students will be given three model problems in which we will work on and discuss in class. A worksheet will be given out with more practice problem similar to the in class model problems.

Day 7: Slope-Intercept Form & Point-Slope Form

Objective: Students will be able to produce the equation of a line using the slope-intercept form or point-slope form of an equation of a line.

Lesson Overview: We will discuss the homework from the previous day. I will call on students to explain the answer they got. Any misconceptions or questions will be done on the board. I will use direct instruction with the use of an example from the previous quiz to demonstrate the slope-intercept form of an equation of a line. Students will then have the opportunity given common data to create the equation of several lines. Through class discussion we will originate the point-slope form of a line using the slope formulas. Students will once again be given common data to create the equation of several lines. A homework sheet will be given for students to practice creating the equation of a few lines and graphing these equations using the steps learned in previous lessons. A quiz will also be given tomorrow on slope, direct variation, and finding the equation of a line.

Day 8: Assessment & Review

Objective: Students will be assessed on the information from the previous three lessons – slope, direct variation, and finding the equation of a line.

Lesson Overview: Students will put the answers to their homework on the blackboard and we will go over each question as a class reviewing how to find the slope of a line and determining if the line was a direct variation, if so also find its constant of variation. Then the students will be given a quiz to assess individual learning and tell me what concepts as a class we need to further work on. Students will be given a homework sheet stating the definition of absolute value and practice exercises finding the absolute value.

Day 9: Midpoint & Distance Formula

Objective: Students will be able to organize information from the equation of a line to calculate the midpoint and distance of a line segment.

Lesson Overview: We will quickly discuss the answers to the homework worksheet on absolute value, and relate its importance to finding the distance of a line segment. Through class discussion we will deduce the distance and midpoint formula. The class will then be broken up into pre-assigned groups of three or four students. Each group will be given a worksheet with practice problems finding the distance and midpoint of numerous line segments and using their answers to make conclusions about the shape of a triangle. This class assignment will count as a graded assignment. Students will be allowed to use their notes, textbooks, and one another. A homework worksheet will be given out for students to practice more problems by oneself.

Day 10: Parallel & Perpendicular Lines

Objective: Students will be able to discover the similarities in the equations of parallel lines and the relationships between the equations of perpendicular lines.

Lesson Overview: We will begin class by briefly discussing the homework on midpoint and distance formulas. (Many mistakes on in-class work and homework assignments from this material come from wrong calculations – just be sure to use your calculator.) Each student will be given a graphing calculator. I will teach the students how to graph equations on the calculator – we will set our windows, enter the equation (y =), and zoom square the graph so that the scale for the x and y axes are the same. First we will graph two parallel lines to see that the slopes of parallel lines are always equal. Then we will graph a pair of perpendicular lines to see that the slopes of perpendicular lines are always negative reciprocals of one another. Unfortunately the students cannot take the calculators home with them, so they will be given a review packet for homework in which they will have to find the equation of lines that are parallel or perpendicular and graph each line by hand (practice for the Regents Exam) and review questions on the information from the entire unit.

Day 11: Review with Game

Objective: Students will be able to recall all the information they learned throughout the unit and ask questions on any concepts they are still do not understand.

Lesson Overview: We will discuss the homework from the previous class. Students will put their answers on the blackboard and any questions about the assignment will be discussed. I will then give the students an opportunity to ask me any questions from the review packet they are unsure of. If no questions are asked, then I will ask the students some questions testing their knowledge on the material they will need to know for the unit test. For the last fifteen or twenty minutes of the class we will play Math Pictionary where the class is broken up into two teams. I will pose a question to a student and they will have to draw the graph on the blackboard. All questions will relate to the chapter. They will then have to ask their team what the slope, y-intercept, x-intercept, constant of variation, or equation of the line is. The team has one guess, if they do not get the answer correct the other team gets a chance to steal. The team with the most correct answers will win a prize. Students will be reminded to use their class notes, worksheets, homework assignments, and review sheets to study for a unit test on the following class day.

Day 12: Formal Assessment

Objective: Students will be assessed on the information from this unit – vocabulary associated with graphing, area of polygons, graphing linear equations, slope of a line, direct variation, slope-intercept and point-slope forms of a line, distance and midpoints formulas.

Lesson Overview: Students will be given a unit test on materials covered in the past two weeks. Test questions will pertain to information discussed in class and in homework exercises. Prior Regents questions will be used on the test to prepare students for the upcoming Regents Exam.

~~~ Lesson Plan ~~~

Unit Title: Analytic Geometry
Lesson Title: Intro. To Coordinate System
Day Number: One

Duration of Lesson: 40 minutes
Teacher: Ms. Smith
Grade Level: 9th Grade

Rationale of the Lesson:

The purpose of this lesson is to teach the students the history and use of the Cartesian coordinate system. The Cartesian plane is named after a seventeenth century mathematician Rene Descartes, who demonstrated how algebraic relations can be described by points, lines, or curves in a plane. These methods are applied to astronomy, optics, and navigation. During this class we will discuss the characteristics and vocabulary associated with the coordinate system – plane, x-axis, y-axis, quadrants, origin, and ordered pairs. Students will practice using the coordinate system plotting specific points.

Materials/ Resources:

- Overhead Projector
- Overhead Markers (Different Colors)
- Straightedge
- Worksheets (Intro. To Coordinate System)
- Graph Paper

Objectives of the Lesson:

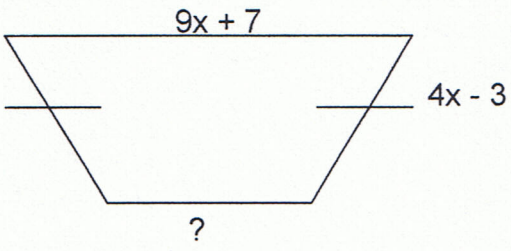
Upon completion of the lesson the student will be able to:

- Define important terms dealing with the coordinate system - plane, x-axis, y-axis, origin, quadrant, and ordered pairs.
- Apply these definitions when plotting points a coordinate system.
- Examine a graph with points and determine their quadrant location and exact coordinates.
- Determine what geometric figures can be drawn after plotting given ordered pairs and constructing line segments.

Instructional Procedure of the Lesson with an Approximate Time Line:

Problem of the Day (approx. 5 minutes) –

Find the length of the missing side when the perimeter equals 22x - 9.



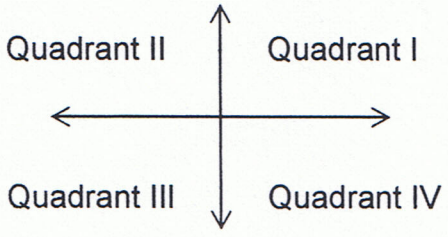
Return Tests to students explaining to them they have one week to make corrections during a studyhall for half credit. (We will go over the test on Tuesday or Wednesday, of the following week – no corrections will be allowed after this).

Set Induction & Guided Notes (approx. 30 minutes)

Show the word MATH spelled out on the coordinate system and briefly discuss the history behind the Cartesian coordinate system. Introduce the coordinate plane:

- Start with two signed number lines called **coordinate axes**. These two lines are perpendicular (⊥) to one another. The horizontal line is called the **x-axis** and the vertical line is called the **y-axis**. The point at which the x-axis and the y-axis intersect is called the **origin**.

- The x-axis and the y-axis separate the plane into four regions called **quadrants**. The quadrants are numbered I, II, III, and IV in a counterclockwise order.



- Each point in the plane is graphed by using an ordered pair of numbers. The first number in the ordered pair is called the **x-coordinate**, or the **abscissa**. The second number in the ordered pair is called the **y-coordinate**, or the **ordinate**. The two numbers in the ordered pair are called the **coordinates** of the point. The coordinates of a point are represented in the form **(x, y)**. For example, the origin would be represented by (0, 0).

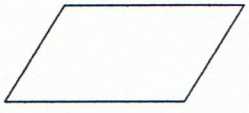
- When we graph a point described by an ordered pair, we are **plotting the point**. Begin at the origin and move right or left (depending whether the number is positive or negative, respectively) the number of units the **x-coordinate** states. For example, if the ordered pair is (2, -3) then you will move two units to the right. Secondly you will move up or down from the point in which you are (once again depending if the number is positive or negative, respectively) the number of the units the **y-coordinate** states. For example, with the above ordered pair (2, -3) you will move three units down. Put a small dot at this point, you have graphed the point (2, -3).

Students will be given a worksheet with the above notes. The worksheet will be used as a form of guided notes. As a class we will go through the notes/ worksheet, so that students can fill in the missing vocabulary and practice using the coordinate system.

Closure (approx. 5 minutes)

Have the students graph the following points:

A (2, 3)
B (4, -3)
C (-3, -3)
D (-5, 3)



Then connect the above points to form line segments: $\overline{AB}$, $\overline{BC}$, $\overline{CD}$, $\overline{DA}$. What figure have we created? (Parallelogram) Points can be plotted to form many geometric figures. Tomorrow we will discuss area and perimeter using a geometric figure represented on the coordinate system.

Homework Assignment (approx. 1 minute)

Textbook page 356 (1, 2, 3, 8, & 9 all) – practice finding the coordinates of a point, quadrant location of points, and determining geometric figures after plotting ordered pairs and constructing line segments.

Evaluation of Student Learning:

Because this lesson is an introduction to a unit on the coordinate system and analytical geometry, students are learning in this lesson will be evaluated through the guided notes. I will walk about the classroom making sure students are staying on task, while asking questions to involve students in learning the important vocabulary in this upcoming unit. The homework assignment will allow the students to practice using the coordinate system and the vocabulary used today, thus it will be a way for me to assess student learning. Further evaluation of the student's learning will occur throughout the unit in further homework assignments, quizzes, and a unit test.

Lesson Evaluation/ Revision:

(used to assess and improve a lesson after it has been taught)

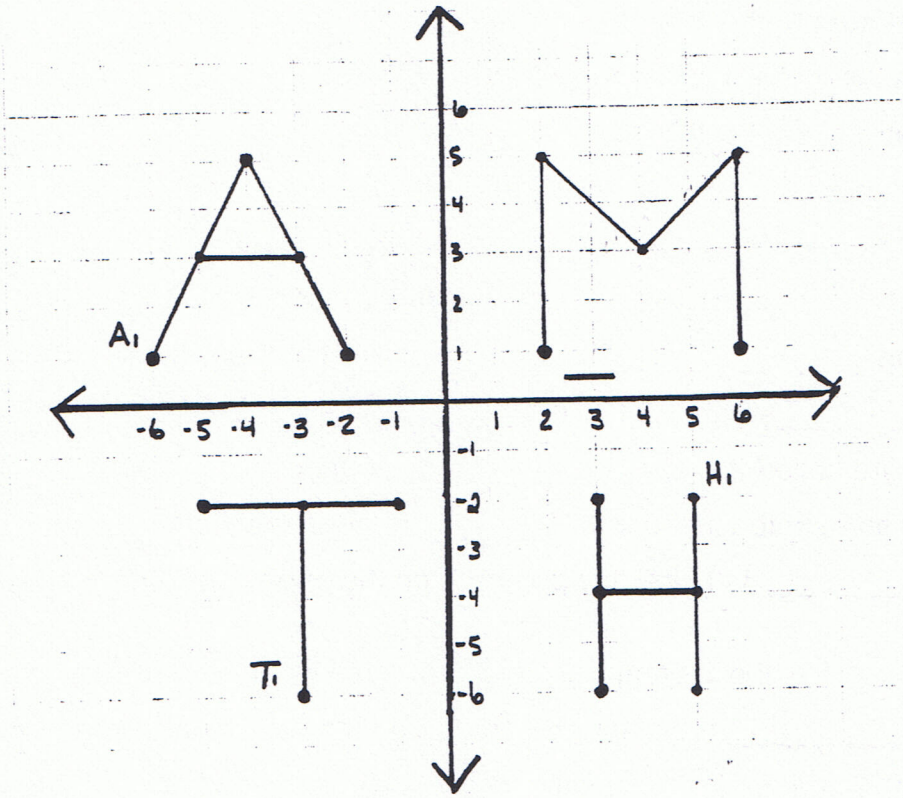
- What went well and why?

- What didn't go so well and why?

- If I were to re-teach this lesson, this is how I would change it.

Math A Name _____

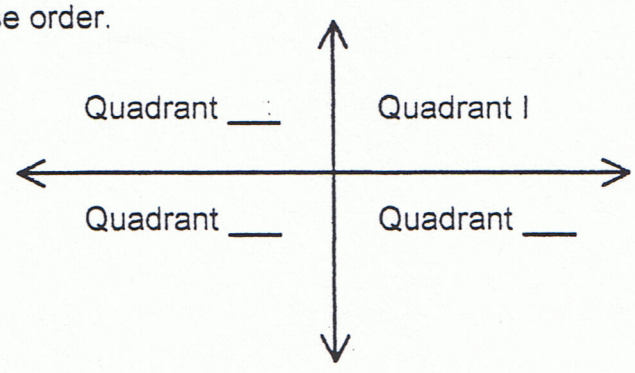
Notes – Intro. to Coordinate Plane Date _____



When observing a **coordinate plane** there are many important terms to know:

Start with two signed number lines called _____ _____. These two lines are perpendicular (⊥) to one another. The horizontal line is called the ___ - _____ and the vertical line is called the ____ - _____. Label both axes on the above graph. The point at which the x-axis and the y-axis intersect is called the _____.

The x-axis and the y-axis separate the plane into four regions called _____. The quadrants are numbered I, II, III, and IV in a counterclockwise order.



What quadrant is the letter "M" located in? _____

What quadrant is the letter "H" located in? _____

What quadrant is the letter "A" located in? _____

What quadrant is the letter "T" located in? _____

Each point in the plane is graphed by using an ordered pair of numbers. The first number in the ordered pair is called the ___ - _____, or the _____. The second number in the ordered pair is called the ____ - _____, or the _____. The two numbers in the ordered pair are called the _____ of the point. The coordinates of a point ~~are represented~~ in the form (___ , ___). For example, the origin is represented by (___ , ___). Label ~~this~~ point "O" on the above coordinate system.

When we graph a point described by an ordered pair, we are _____ the point. Begin at the origin and move right or left (depending whether the number is positive or negative, respectively) the number of units the ____ - _____ states. For example, if the ordered pair is (2, 1) then you will move two units to the right. Secondly you will move up or down from the point in which you are (once again depending if the number is positive or negative, respectively) the number of the units the ___ - _____ states. For example, with the above ordered pair (2, 1) you will move one unit up. Put a small dot at this point, you have graphed the point (2, -3). Label this point "M_1".

State the coordinates of the following points:

A_1 _____

T_1 _____

H_1 _____

What quadrant is the letter "M" located in? _____

What quadrant is the letter "H" located in? _____

What quadrant is the letter "A" located in? _____

What quadrant is the letter "T" located in? _____

Each point in the plane is graphed by using an ordered pair of numbers. The first number in the ordered pair is called the ___ - _____, or the _____. The second number in the ordered pair is called the ____ - _____, or the _____. The two numbers in the ordered pair are called the _____ of the point. The coordinates of a point ~~are represented~~ in the form (___ , ___). For example, the origin is represented by (___ , ___). ~~Label this~~ point "O" on the above coordinate system.

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State the coordinates of the following points:

A_1 _____

T_1 _____

H_1 _____