8-16-2006

Using GPS System in Determining the Shape and Position of School Grounds

John Picarella
The College at Brockport

Name: John Picarella

Grade Level(s)/Subjects: 9-12, Geometry, Intermediate Algebra, Algebra Honors

Objective: Students will use GPS to collect data concerning school grounds and use math modeling to provide a means of presenting and interpreting this data. Students will learn how to use and collect data from the GPS system and upon returning to the class, how that data will result in maps and graphs. Geometry students will graph the data and determine whether the grounds that are being surveyed represent a rectangle or other geometric shape.

Materials: Computers with ARC GIS software loaded and 2 handheld GPS systems. All students should have paper and pencil and TI-83 plus calculators.

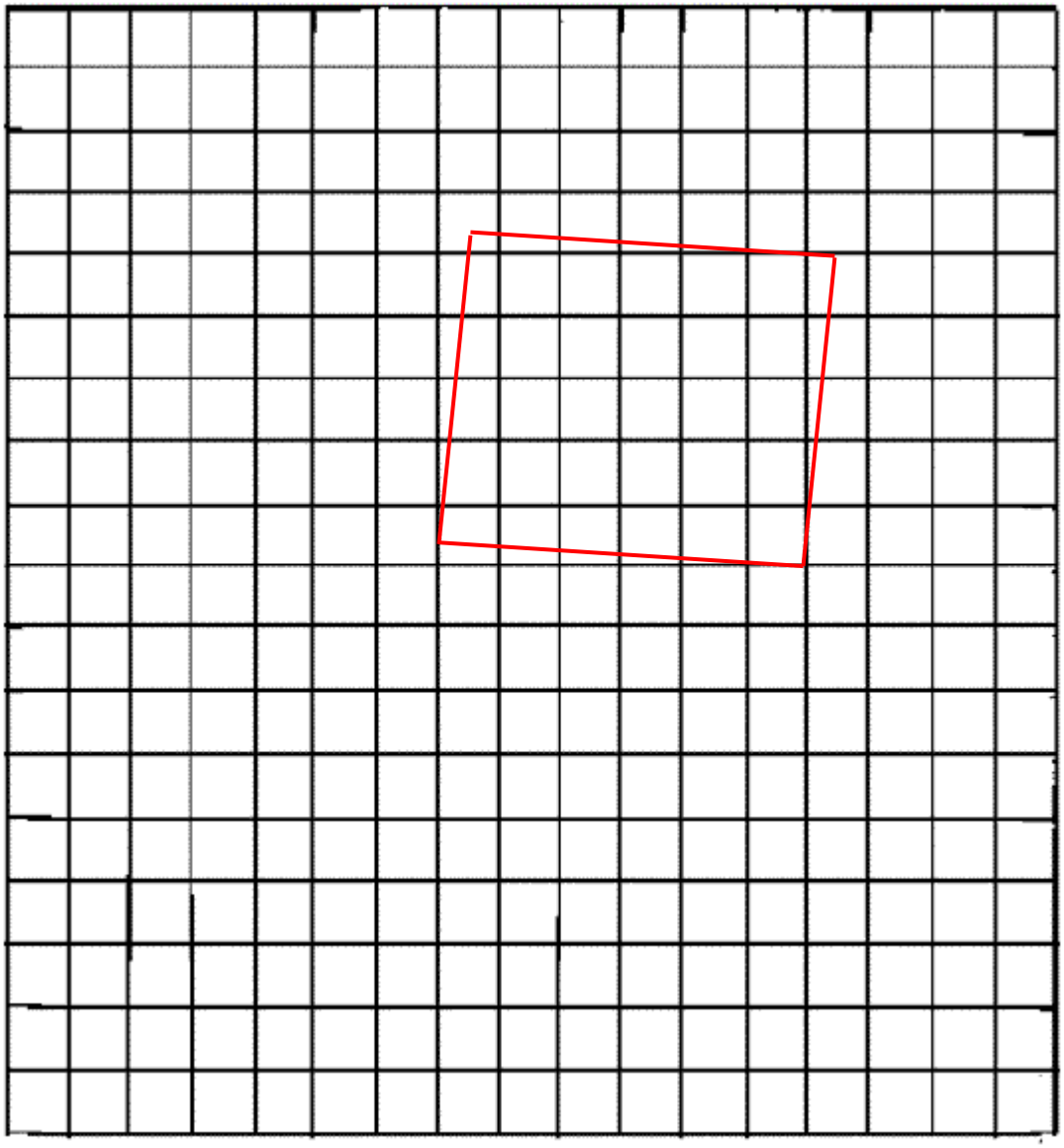
I expect that this series of lessons would take 2-3 class days. We would most likely to begin the lesson by showing the students the ARC GIS system and give a short demonstration of what are some of its capabilities. I will show them the school grounds from satellite like below;

We will then talk about the GPS system and how the two may work together in the collection of data. We will talk about the kind of data that a GPS system will deliver and how we may utilize that data in determining the shape and position of the system being measured. We would then separate the class into two groups and bring them outside to collect some data from the GPS system (ie the readings of the four corners of the tennis courts, or the athletic fields). This data will then be entered into a table such as the one below:

	A	B	C
1	**Longitude (x)**	**Latitude (y)**	**Attribute**
2			
3			
4			
5			

Most likely this is all that could be accomplished on the first day. On the second day we will return to the class and take the data that has been collected and enter it into the GIS software so we may overlay it on

the picture of the school grounds. We will then walk through finding the distance between the points and the slopes of the lines. The students will then transfer this information to graph paper. (This did not come out as well here as I would like, but it will be in a format for the students to easily graph an have the (x,y) coordinates in order to do their calculations.



Finally, they will be asked to determine algebraically whether the figure plotted is a rectangle or some other shape and what is the area of the object (ie. Tennis courts or school grounds). This will be determined by multiplying the slopes of adjacent lines to determine if it is equal to -1. This means the lines are perpendicular. Then, knowing the length of the sides in feet, we will determine the area encompassed by the school.

Geometric Shapes with GPS

Project Grade:	Excellent	Good	Needs Improvement	Poor
Participation and cooperation – 25%	Student participated during data collection and worked well with other students during group work. Student did not require redirection.	Student participated during data collection and worked well with other students during group work. Student required redirection one time.	Student did not participate during data collection and did not work well with other students during group work. Student required redirection two times.	Student did not participate during data collection and did not work well with other students during group work. Student had to be removed from group to work independently.
Tables - 25%	Tables for the latitude, longitude and location name for the section of ground the students were covering were completed and had no errors.	Tables for the latitude, longitude and location name for the section of ground the students were covering are completed and the table showed one or two errors.	Tables were incomplete and/or the table showed three or more mistakes each.	Tables were incomplete, not done and/or showed four errors or more each.
Worksheet – 25%	The data points were correctly graphed showing the coordinates, and the attribute data.	The data points were graphed showing the coordinates, and the attribute data, but 1-2 errors were made in graphing or labeling.	The data points were graphed showing the coordinates with up to 2 errors but no labels or attributes were listed.	The graph was not completed or more than 3 errors were made in graphing and labeling the plot.
Calculations– 25%	The slopes and lengths of the lines were done correctly, comparison of the slopes made, proper choice of object type made, and a correct area determined.	Up to 2 errors were made in determining the slopes and lengths of the lines, comparison of the slopes, choice of object type, and the area of the object.	From 3-5 errors were made in determining the slopes and lengths of the lines, comparison of the slopes, choice of object type, and the area of the object.	Incorrect equations were used, or work not done at all including the determination of the type of geometric shape that was plotted.