5E Lesson Template

Lesson Author(s)	Joyce Sevast
Lesson Title	Cartesian and GPS: The Link
Lesson Source	
Technology Needs (if any)	GPS units
Date/Time Lesson to be Taught	
School	
Supervising Teacher	
Math or Science?	Math
Lesson Concepts	Using a GPS device is much like making one's way around a Cartesian coordinate plane.
Objectives	Students will develop an understanding of the correlation between the Cartesian coordinate system and the longitude and latitude system used by GPS devices.
CO State Standards	6th grade Math: Standard 1.3.d: Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane including the use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate. (CCSS: 6.NS.8)
Materials List and Advanced Preparation	Recording sheet for GPS points.
Safety	Check on students as they work -- a large natural area with small landmarks is the best location for this activity.
Accommodations for Learners with Special Needs	Learners with special needs should be paired with others for this activity.

5Es

1. ENGAGEMENT	Time: 10 Minutes	
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
• Use four predetermined spots on the earth's surface that have the same longitude/latitude magnitudes, but different locations. (i.e. 40° N, 30° W; 40°S, 30°W; 40°S, 30°E; 40°N, 30°E) • Ask students to find each place • Walk around the room to monitor student progress • Where is each place?	• In which hemispheres should each point be located? • What makes each location unique? (The direction attached to the magnitude)	• Misunderstanding the difference between longitude and latitude and/or the direction element of the longitude/latitude designation.
Evaluation/Decision Point Assessment		**Student Outcomes**
Did the student make a concerted effort to locate the points?		Students should understand that the addition of a direction is mandatory for the understanding of longitude and latitude.

2. EXPLORATION		Time: 10 Minutes
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
• Pose the question, how are the Cartesian coordinate plane and longitude and latitude related? • Give the students time to converse with each other and make a list of similarities.	• What similarities do you see between the two systems? • What differences do you notice?	• Both have horizontal and vertical elements. • Both use a number to designate distance • One uses positive and negative symbols instead of direction labels
Evaluation/Decision Point Assessment		**Student Outcomes**
Student participation.		Students should be able to note at least two difference between the two systems.

3. EXPLANATION		**Time: 15 Minutes**
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
• Give each pair of students a GPS unit • Show students how to turn on the unit and the basic functions. • Have the students allow the unit to find their location. • Let them mark a few more locations • Ask them which system is used by the GPS: Cartesian or Longitude/Latitude? (Answer: Both – it notes longitude and latitude as labels, but the numbers are more like those on a Cartesian plane).	What do you notice about the location numbers? How do you think these numbers would be different if you were in S. America? Asia? Australia? Why does the GPS distinguish longitude from latitude?	Students often believe that technology is based on a N. American perspective. Thus, they think the US should have coordinates that are (+, +)
Evaluation/Decision Point Assessment		**Student Outcomes**
Students notice the similarities to the Cartesian system.		Students can articulate the similarities between the GPS system and the Cartesian system (both use positive and negative numbers to denote quadrants).

4. ELABORATION		**Time: 10 Minutes**
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Initiate discussion.	What application does the use of GPS have for you as a student?	GPS units are in many cell phones. It makes it easier to find places I have never been.
Evaluation/Decision Point Assessment		**Student Outcomes**
Student participation.		Students can make logical statements about the use of GPS in their world.

5. EVALUATION		**Time: 5-8 Minutes**
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Pose the question, "So, going back to the longitude/latitude exercise we started with, how would a GPS unit record these locations?" Have the students write a succinct statement for each location.		

Differentiation	**Time: N/A**
Students who are behind or need support	For advanced or gifted students
Students will work in a group during the learning process. As a final product, some students will give an oral response to the evaluation question.	Challenge these students to find specific world cities on the map, and note both their longitude/latitude coordinates and their GPS coordinates.