

Module: Mathematics

Lesson Title: Cartography and Math

Standards for the Lesson

Florida Adult Basic Education Mathematics Standards
Graph points on the coordinate plane to solve mathematical and real-world problems (CCR.MA.ABE.4.3.2)

Interpreting the Standard

1 Standards	2 Skills Included in the Standard	3 Concepts Included in the Standard	4 Through a Particular Context	5 Cognitive Demand/Levels of Thinking	6 Sample Activity
Graph points on the coordinate plane to solve mathematical and real-world problems (CCR.MA.ABE.4.3.2)	graph solve	points problems	Use of coordinate plane grids	DOK 1 DOK 2	Provide students with coordinates that create figures or things. Have students play games to find a point on a coordinate plane. Have students create their own design and graph it.

Objectives of the Lesson

Students will:

- Practice using the terms associated with the coordinate plane: *x-axis*, *y-axis*, quadrants, coordinate points, ordered pairs, origin, negative numbers, positive numbers
- Graph ordered pairs, in the form (x, y) in all quadrants
- State the location of points within all quadrants by giving ordered pairs in the form (x, y)
- Draw a picture on the coordinate plane using all quadrants and then create a set of directions such that, when followed, will recreate the image they originally drew
- Apply their knowledge of coordinates to the real-world skill of map making

Materials

- Pencil
- List of coordinates for each activity
- Copy of maps to compare student work
- Copy of maps showing cartography (complete a search to locate maps to share with class)
- **Handout A: Coordinate Grid**
- **Handout B: Grid Paper**
- **Handout C: Where in the World Am I?**
- **Handout D: Explore More**

Instructional Plan

Overview

This lesson focuses on how to grid coordinates onto either graph paper or a coordinate plane grid using each of the quadrants. Students should also be able to identify coordinates and provide clear directions in order for others to draw a figure or map based only on charting and connecting the coordinates provided.

Process

Show students a copy of an old map that used cartography. Maps such as this are easily located on the World Wide Web. Many maps are free for use in the classroom. Discuss with students that in today's world obtaining a map is as simple as completing a search on the computer and clicking on the icon to view the map of your choice. Thanks to satellites, Geographical Information Systems (GIS), and other technologies, creating and distributing accurate maps is much easier than in earlier days. For centuries, map making, or cartography, was a time-consuming and painstaking effort that blended mathematics, geography, and even art. New lands had to be carefully surveyed with precise measurements taken. Simple coordinates had to be skillfully transformed on paper into land masses and waterways.

Review the parts of the coordinate plane grid. Using a grid, show students the following items:

- x -axis
- y -axis
- four quadrants
- numbering system (positive and negative)

Show students how to graph points in each of the coordinates. Write the following ordered pair on the board: (2, 3)

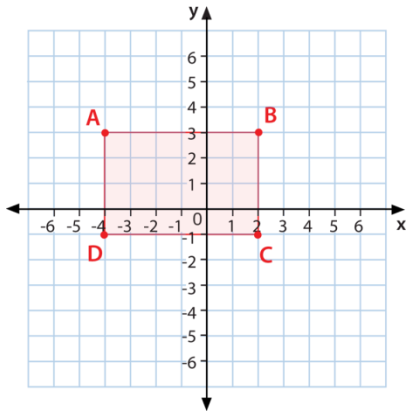
Model for students how to locate this coordinate. Model how to plot both positive and negative ordered pairs. Provide practice for students by giving them ordered pairs and having them plot the points.

You may wish to have students watch a video presentation on how to plot ordered pairs. One example is:

- Khan Academy. <https://www.khanacademy.org/math/algebra-basics/core-algebra-graphing-lines-slope/core-algebra-graphing-coordinate-plan/v/plot-ordered-pairs>

When students can accurately plot points, model for them how to graph a figure with the coordinates: $A(-4,3)$ $B(2,3)$ $C(2,-1)$ $D(-4,-1)$. Tell students that first you will plot each point on the coordinate grid and then you will connect the lines. Let students know that sometimes coordinates are named/lettered, such as A, B, C, etc., and sometimes they are just written as ordered pairs.

The result should be as follows:



Ask students what figure you have graphed. Students should answer that it is a rectangle.

Have students practice completing a geometric figure. The following is one example.

$D(1,3)$ $E(5,3)$ $F(7,-1)$ $G(1,-1)$

Students should have graphed a trapezoid.

Next, share with students that they will be completing a process very similar to that used by ancient mapmakers – the use of latitude and longitude degrees to create a map of a specific location. Tell students this is very similar to how they just created a geometric shape.

For this activity:

- Give each student a pencil and a sheet of graph paper or a coordinate plane grid.
- Have students locate 0 on the grid and identify the y axis (bottom to top) and the x axis (left to right).
- Provide students with **Handout C: Where In the World Am I?** and have them locate the coordinates (x, y) on the grid and mark them with a small dot. Have them connect the dots to see the outline of a location. Have students share their answers. Students should share that they are in Florida.

Sample Debriefing Questions

After students have completed the activity, have them compare their results to the actual map in Handout D: Florida.

- Did students follow the directions completely?
- Were their maps similar to those provided?

- What error patterns were made?
- How were the gridded maps similar/different from the picture? Why or why not?

Modifications for Different Levels

This lesson is for students at the ABE 3 and 4 levels. For students at lower math levels, use simple figures for students to plot, such as a line, square, rectangle, or parallelogram. An example that can be used is **Handout D: Explore More**.

Answer Key for Handout D: Explore More

1. Triangle
2. Trapezoid
3. Square
4. Rectangle

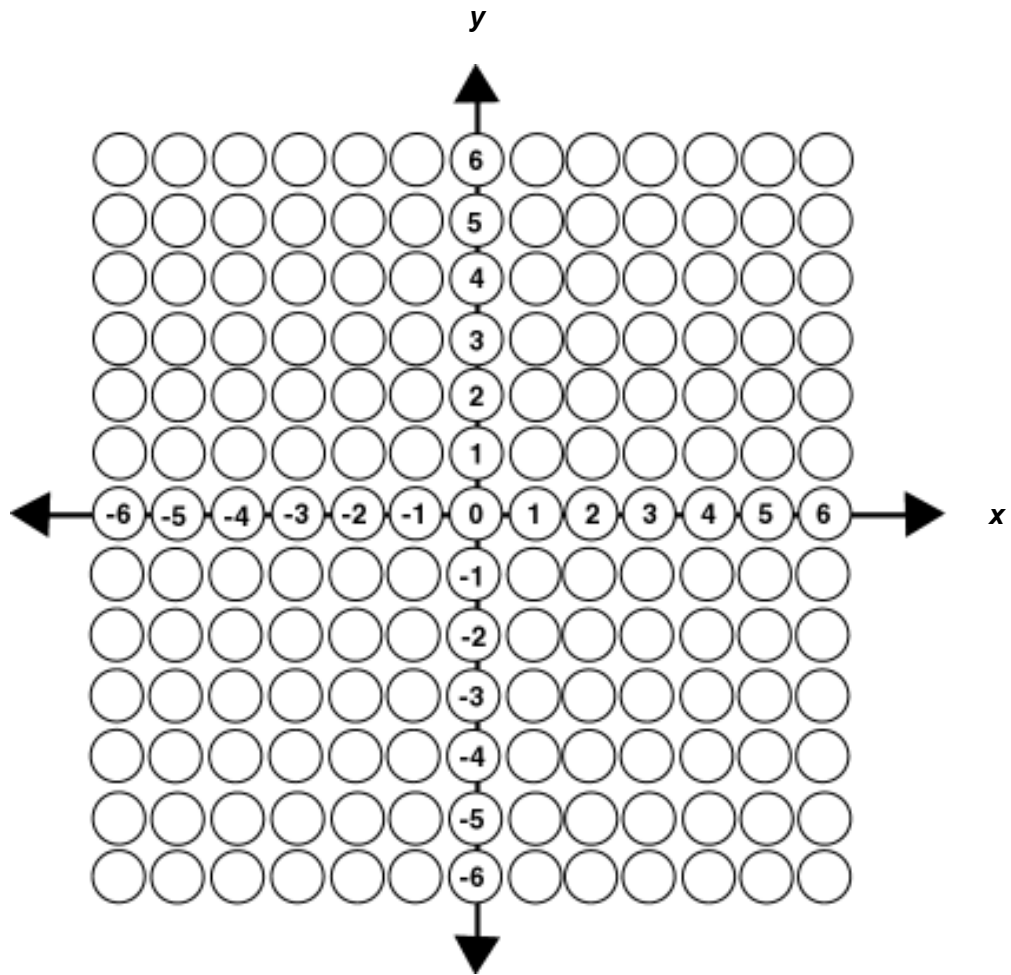
Have students at the ABE 3 and 4 levels access the following website to obtain an outline map of the state in which they were born or their favorite state: NetState. Retrieved from the World Wide Web at: <http://www.netstate.com/>

Have the students print their map.

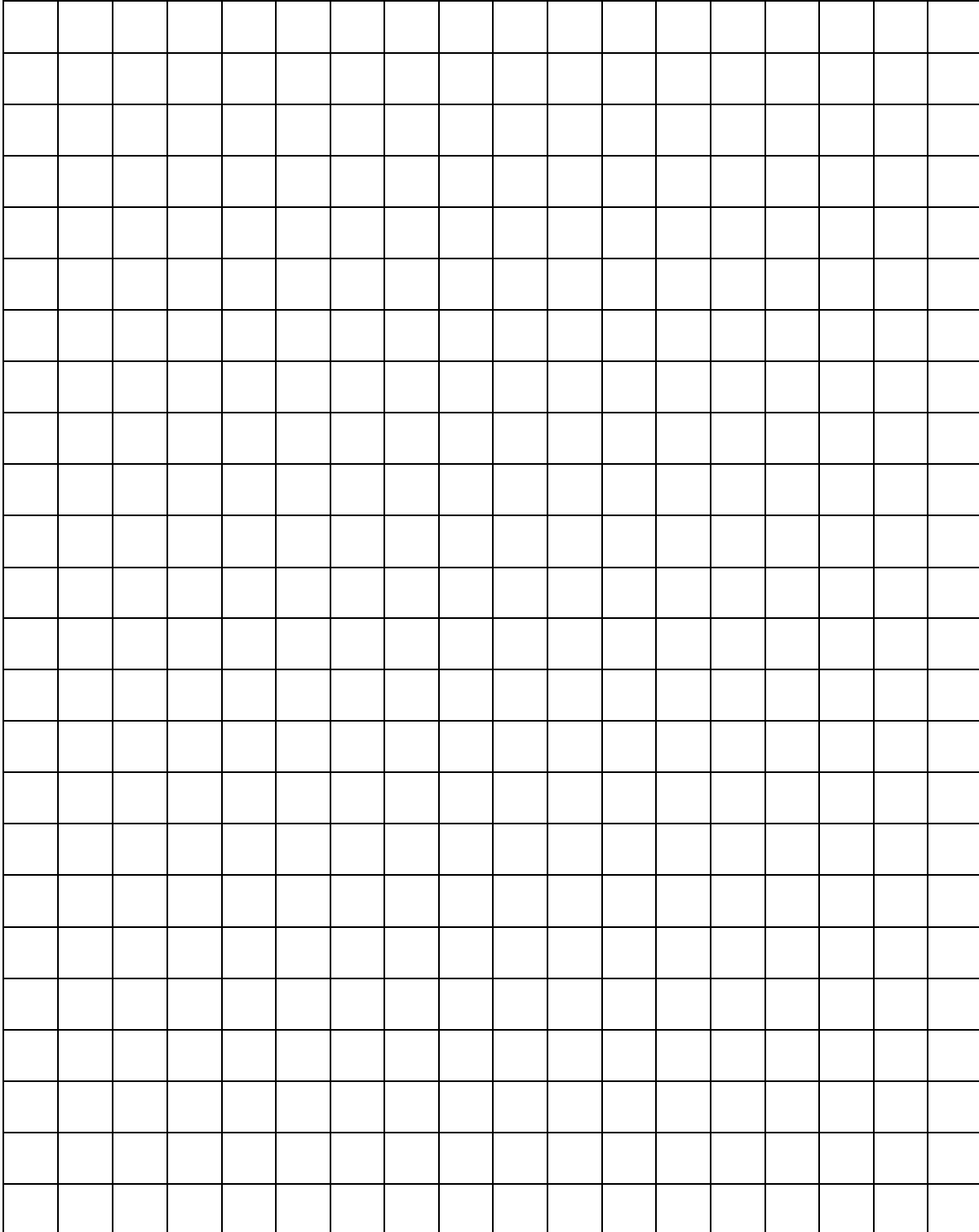
Provide students with a blank coordinate plane grid sheet with at least positive 10 and negative 10 as its maximums and minimums. Have students draw a picture on their grid and on a separate sheet of paper write directions using ordered pairs.

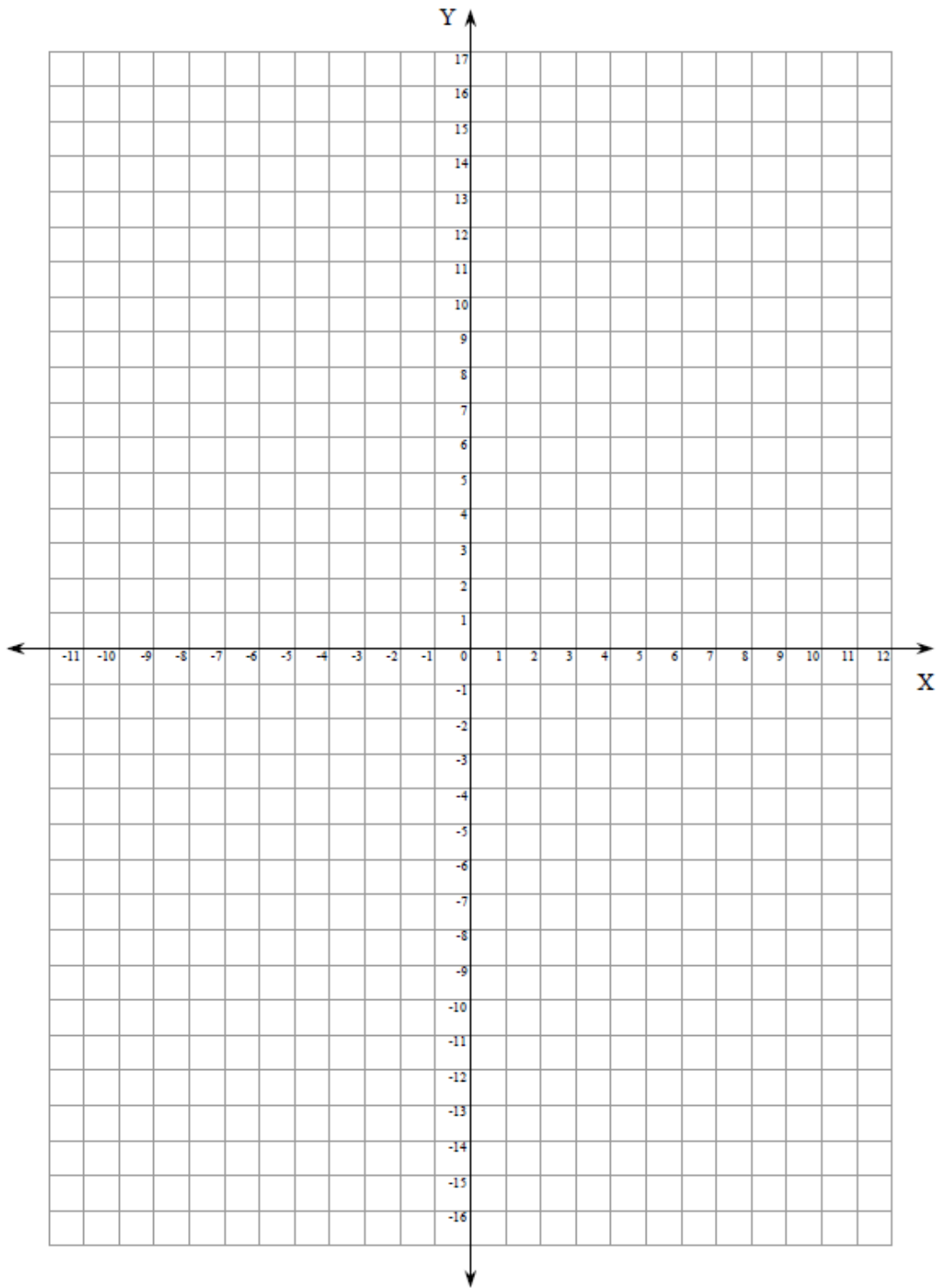
Have students exchange their directions with other students, along with a blank coordinate plane grid paper. Provide students with time to complete their drawing. The students should confirm with their classmates if their drawing is correct. When finished, debrief the activity by having students discuss what was easy or difficult about specific directions.

Handout A: Coordinate Plane Grid



Handout B: Grid Paper



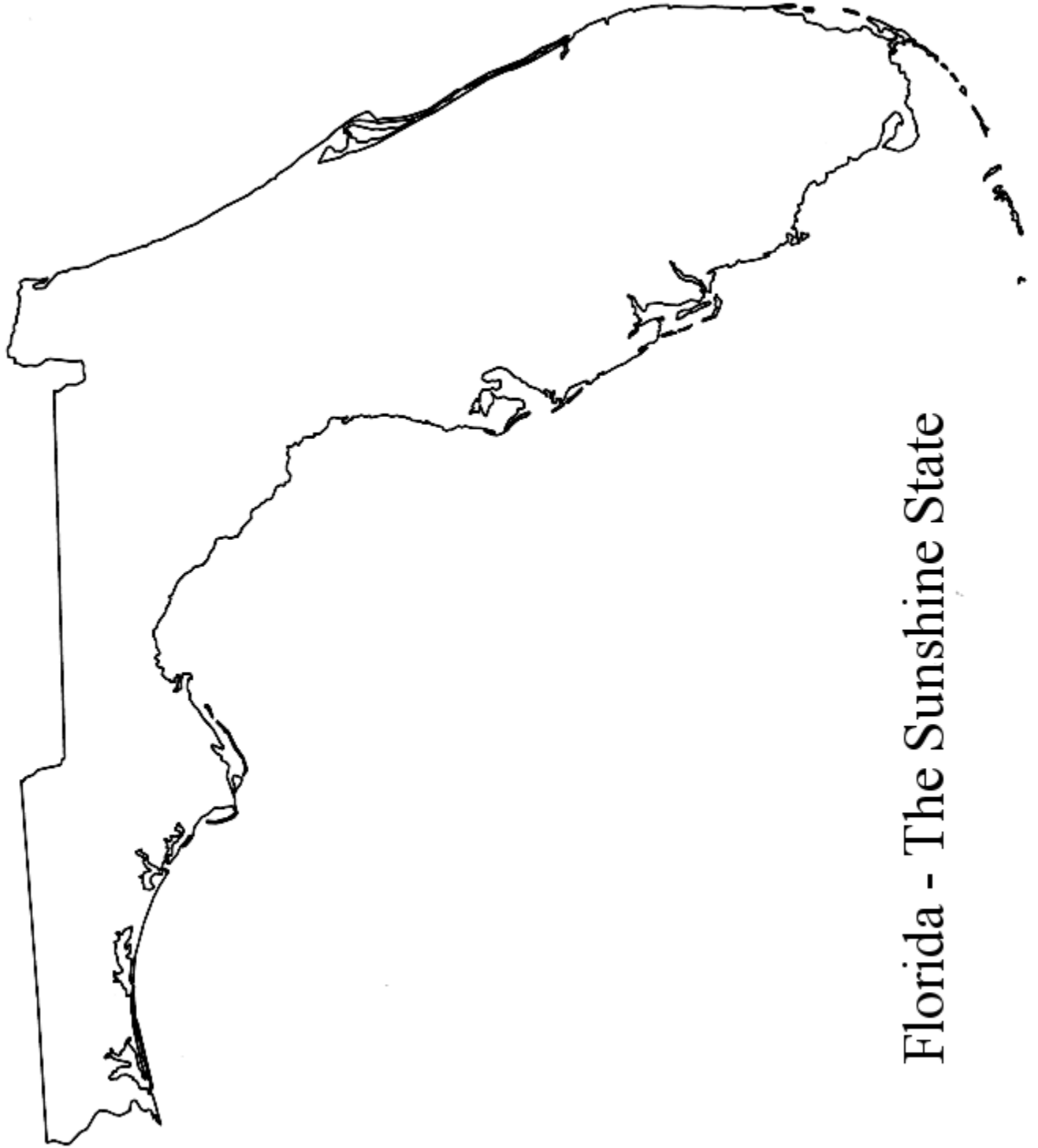


Handout C: Where in the World Am I?

Directions: Identify each of the following coordinates with a dot on your grid. Then connect the dots in order. If completed, correctly you will be able to identify a map of a familiar geographic location.

1. (-11, -12)
2. (-11, -10)
3. (-11, -7)
4. (-11, -4)
5. (-10, -3)
6. (-10, 0)
7. (-10, 5)
8. (-9, 6)
9. (-11, 8)
10. (-11, 9)
11. (-6, 10)
12. (-3, 12)
13. (-1, 12)
14. (1, 13)
15. (3, 14)
16. (6, 14)
17. (10, 13)
18. (10, 11)
19. (8, 10)
20. (7, 9)
21. (5, 8)
22. (4, 6)
23. (2, 5)
24. (0, 5)
25. (-2, 5)
26. (-4, 5)
27. (-5, 4)
28. (-6, 2)
29. (-8, 0)
30. (-8, -1)
31. (-7, -2)
32. (-6, -3)
33. (-6, -5)
34. (-8, -7)
35. (-9, -8)
36. (-9, -11)
37. (-8, -12)

The name of the place is: _____



Florida - The Sunshine State

Handout D: Explore More

Directions: Graph each figure using the vertices. Then name the graphed figure.

1. $(0,2)$ $(2,0)$ $(0,-3)$
2. $(-1,-3)$ $(-5,-3)$ $(-7,1)$ $(-1,1)$
3. $(3,3)$ $(0,3)$ $(0,0)$ $(3,0)$
4. $(-3,1)$ $(-3,5)$ $(2,5)$ $(2,1)$
5. Draw your own figure on the coordinate grid below. Identify basic coordinates of the shape. Write them down and share them with another person in the class. After your classmate has graphed the points and connected the lines, see if he/she identifies it as the correct shape.

