Coordinate Systems
Life Connection

Grade Level and Content

Geometry, 9th or 10th Grade Mathematics

Big Idea

Students will read about coordinate systems to reinforce the vocabulary they will need to know for the unit. Students will read about a real-life application of coordinate systems and compare and contrast the geographic system with the one we will use in class.

Objectives

Students will be able to …

1. Correctly define key terms using words and/or illustrations.
2. Adequately demonstrate an understanding of the real-life applications of coordinate planes.
3. Correctly recognize the similarities between the Cartesian and geographic coordinate systems.

PA State Standards

2.5.G.B (Geometry Communication) which states, "Use symbols, mathematical terminology, standard notation, mathematical rules, graphing, and other types of mathematical representations to communicate observations, predictions, concepts, procedures, generalizations, ideas, and results."

Common Core State Standards

From section "Reading Standards for Literacy in Science and Technical Subjects 6–12" (p. 62) of the *Common Core State Standards for ENGLISH LANGUAGE ARTS & Literacy in History/Social Studies, Science, and Technical Subjects*, states the following standards:

- Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*.
- Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).

Rationale for Students

Students will be interested in this lesson because it is highly visual and interactive and because they will make a connection between what they are learning and real-life. Students collaborate to understand and to compare and contrast coordinate systems.

Materials

- 1 SMART™ Board with computer and projector
- 25 copies each: Crossword Puzzle worksheet, Coordinate Systems reading, Geographic Coordinate System prediction guide, and Coordinate Systems Comparison Matrix
- 5 copies each: Vocabulary Illustration worksheets

The vocabulary illustration worksheet will assist ELL students in learning the vocabulary. It provides space for students to draw and write examples or definitions.

The reading material includes key terms in bold so ELL students can easily find each word as they complete the vocabulary illustration.

The prediction guide will assist ELL students and learning support students in comprehending the material. This exercise provides students with preparation for reading, assistance during reading, and reflection after reading.

The comparison matrix will aid ELL students and learning support students in organizing the higher level concepts.

Technology

The SMART Board will be used to present the lesson. The SMART Board enables the teacher and the students to work out solutions together. The PowerPoint presentation will be posted on the class website with automated animations and voice recordings to allow students receiving learning support, ELL, and/or disability services to review the lesson at home.

Anticipatory Set 5 minutes, 5 minutes

🖥 *FIRST SLIDE (OCEAN IMAGE)*

SCENARIO/QUESTION

> You are stranded in the middle of the ocean. You have a
> raft but no food or water. The sun is high and hot.
>
> What would make it possible for someone to find you and
> rescue you?
>
> 5 lines

If you're stranded in the middle of the ocean, what would make it possible for someone to rescue you?

- ✓ Knowing your exact location (latitude and longitude)

Think about your house. When someone is looking for your house, what do you give them?

- ✓ Directions, address

Your address is the location of your house. To find you, people need your exact location, which is indicated by your street and house number. You wouldn't have a house number and street in the ocean, but you will have an exact location. If you could tell someone that location, they could find you. Today we are going to talk about the system that makes that possible.

Procedure 35 minutes, 40 minutes

🗀 **COORDINATE SYSTEMS PACKET**

Vocabulary Preview with Partners

📄 **CROSS WORD PUZZLE: COORDINATE SYSTEMS**

Reading

📖 *Student reads Coordinate Systems section*

Vocabulary Answers and Additional Class Discussion

Across

1. The <u>geographic</u> coordinate system involves a grid and axes based on angles of arc of a great circle.
6. <u>Descartes</u> was the French philosopher who developed the idea of using points on a coordinate grid to describe geometric figures.

Down

2. The <u>Cartesian</u> coordinate system was named after Descartes.
3. The coordinate plane along with the process of graphing and locating points on the coordinate plane is called a coordinate <u>system</u>.
4. All coordinate systems use a grid and <u>axes</u> to locate points.
5. The Cartesian coordinate system is based on a <u>rectangular</u> grid.

What is the coordinate system that we constructed yesterday?

- ✓ Cartesian, rectangular

Why do we call it a rectangular system?

- ✓ It uses a rectangular grid

Why do we call it a Cartesian system?

- ✓ The idea of using points to represent geometric shapes originated with René Des*cart*es

What is another kind of coordinate system?

- ✓ Geographic coordinate system

The Earth is divided into a grid and labeled, much like the Cartesian coordinate system. This geographic grid enables us to locate specific locations on the Earth. If we know the coordinates of a stranded person or lost ship, we can find the person or ship.

Directed Reading—Thinking Activity and Collaboration

Previewing with Partners

Look at the illustration and the titles to preview the material.

Decision Making

After previewing, write notes in the "What I Know after Previewing" column. Consider what you need to learn.

Writing

Look at your Questioning Bookmark and write down some questions. Think about what we did yesterday and consider in what ways the Cartesian and geographic coordinate systems could be compared. Write your questions in the "What I Would Like to Know" column.

Reading

📖 *Students read Geographic Coordinate System section in their groups*

As you read, underline or highlight what you think is important. Write notes in the "Interesting or Important Concepts from My Reading" column.

Reflecting

Write the answers to your questions in the "What I know after the Reading" column.

Write questions that were not answered in the "What I still would like to know" column.

Class Discussion

🖥 *COMPARE AND CONTRAST*

📄 **COORDINATE SYSTEMS COMPARISON MATRIX**

(Write "Cartesian" and "Geographic" on the whiteboard.)

Look at the Cartesian coordinate system you constructed and labeled yesterday. Now look at the geographic coordinate system on today's reading. How are these coordinate systems similar? Write your thoughts on the board. As students write their ideas on the board, you can write notes on your worksheet.

- ✓ Both systems use a grid

- ✓ Both systems use number lines to provide way for determining coordinates and thus locating or graphing points

- ✓ They both have an origin

- ✓ They both have coordinates for locating points

How are they different? What are the grids like?

- ✓ The geographic grid is not made of squares / the Cartesian grid is made of squares

Our coordinate system is a rectangular coordinate system while latitude and longitude make up a geographic coordinate system based on the angles of arc on a sphere.

- ✓ The horizontal line on the Cartesian system is the x-axis while the horizontal line on the geographic system is the Equator.

- ✓ The vertical line on the Cartesian system is the y-axis while the vertical line on the geographic system is the Prime Meridian.

- ✓ The Cartesian system uses counting numbers while the other uses angles of arc.

- ✓ The origin on Cartesian system is (0, 0). The origin on the geographic system is 0° longitude and 0° latitude

- ✓ The coordinates in the Cartesian system are called the x-coordinate and y-coordinate while the coordinates in the geographic system are called longitude (x-coordinate) and latitude(y-coordinate).

Closing   5 minute, 45 minutes

What are some other real life uses for a coordinate system? How do coordinate systems help people in their careers or everyday life?

- ✓ Football field, grocery store, seating chart, calendar, 2-D table of values, pixels on a computer screen, archeological digs, etc.

Student Evaluation

📄 **EXIT TICKET**

🏠 **Homework**

Your unit project will be to create a city, amusement park, store, or anything that has locations and structures or objects within those locations. You will layout your "city" on poster board and create a coordinate system around it. There will be other requirements that I will tell you later. Tonight, begin thinking about what you will do for this project.

Coordinate Systems
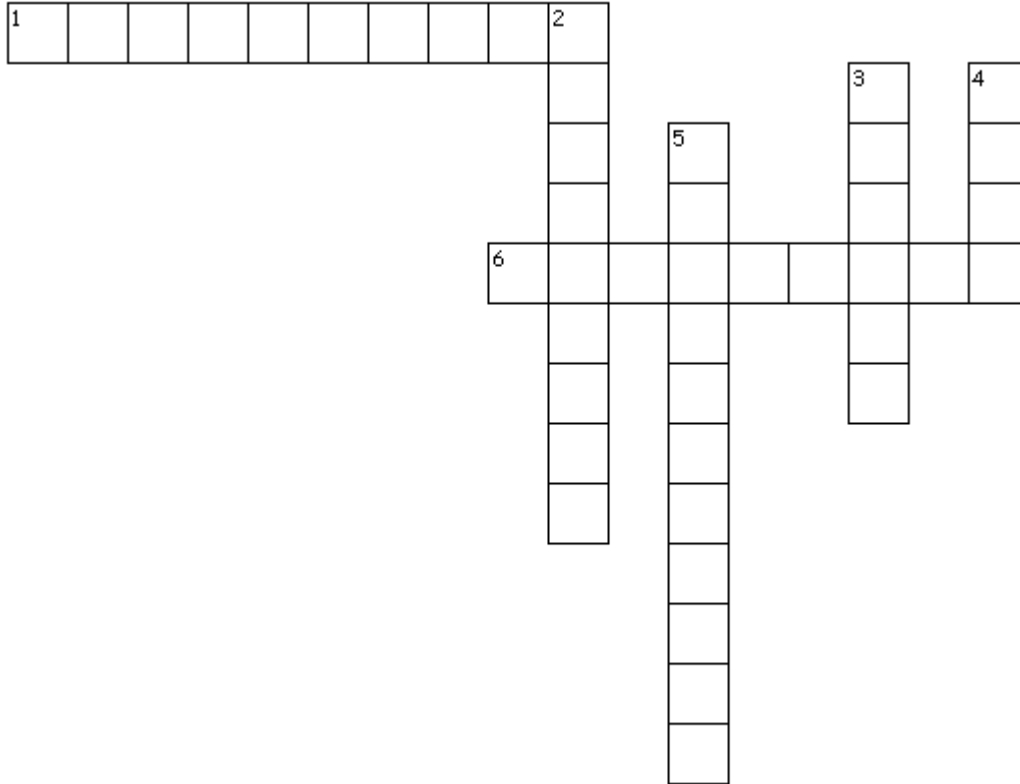
Across

1. The _____ coordinate system involves a grid and axes based on angles of arc of a great circle.
6. _____ was the French philosopher who developed the idea of using points on a coordinate grid to describe geometric figures.

Down

2. The _____ coordinate system was named after Descartes.
3. The coordinate plane along with the process of graphing and locating points on the coordinate plane is called a coordinate _____.
4. All coordinate systems use a grid and _____ to locate points.
5. The Cartesian coordinate system is based on a _____ grid.

Geographic Coordinate System

What I Know after Previewing	What I Would Like to Know	Interesting or Important Concepts from My Reading	What I know after the Reading	What I still would like to know

Questioning Bookmark

Fill in the "something" with "something" from the reading…

Identify and Recall Information

- Answer who, what, when, where, how?
- Describe something.

Organize and Select Facts and Ideas

- Retell in your own words.
- What is the main idea?

Use Facts, Rules, Principles

- How is something #1 an example of something #2?
- How is something #1 related to something #2?
- Why is something significant?

Partition a Whole into its Component Parts

- What are the parts or features of something?
- Classify something according to some characteristic.
- Outline, diagram, or web something.
- How does something #1 compare or contrast with something #2?
- What evidence can you list for something to be true?

Combine Ideas to Form a New Whole

- What would you predict or infer from something?
- What ideas can you add to something?
- How would you create or design a new something?
- What might happen if you combined something #1 with something #2?
- What solutions would you suggest for something?

Develop Opinions, Judgments, or Decisions

- Do you agree with something?
- What do you think about something?
- What is the most important something?
- Prioritize something.
- How would you decide about something?
- What criteria would you use to assess something?

Coordinate Systems

The coordinate plane along with the process of graphing and locating points on the coordinate plane is called a **coordinate system**. There are many different kinds of coordinate systems. All coordinate systems use a grid and axes to locate points. The system shown on the right is a **rectangular coordinate system** because it uses a rectangular grid. It is also called the **Cartesian coordinate system** after **René Descartes**, a French philosopher who developed the idea of using points on a coordinate grid to describe geometric figures. The coordinate system used to locate points on the Earth is called a **geographic coordinate system** and involves a grid and axes based on angles of arc of a great circle.
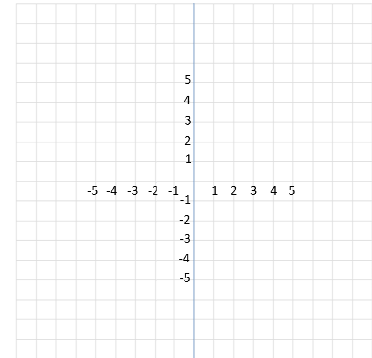
Geographic Coordinate System
A Global Grid

Have you ever looked closely at a map or globe? Look at the illustration at the right. Do you see the horizontal and vertical axes? The vertical axis is called the **Prime Meridian**. The horizontal axis is called the **Equator**. The horizontal lines are called lines of **latitude**. They are parallel to the Equator. The vertical lines are called lines of **longitude**. They are vertical like the Prime Meridian, but they are *not* parallel to it. They meet at the top and bottom of the sphere, called the poles. The latitude and longitude lines form a global grid.
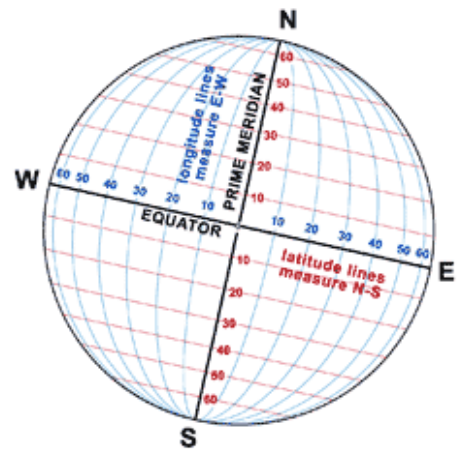
Where on Earth are you?

Each latitude and longitude line has a number assigned to it. These numbers are determined by the degrees of arc on a great circle. Together, the latitude and longitude lines help us find specific locations on our planet. The Equator measures from East to West using the lines of longitude. The Prime Meridian measures from North to South using the lines of latitude. When you know the numbers of the longitude and latitude lines for a specific location, you know the coordinates of that location.

The geographic axes divide the global grid into four quadrants based on the directions North, South, East, and West. The quadrant that corresponds to quadrant 1 on the Cartesian system, the top right quadrant, is the North East quadrant on the geographic system. When writing the coordinates, the latitude coordinate is more often written first, e.g. 23° N 18° S. However, the direction is also given so the order does not matter; latitude and longitude are not ordered pairs.

Coordinate Systems Vocabulary

Reading: *Coordinate Systems* **and** *Geographic Coordinate System*

Term	Illustration	Definition or Sentence
coordinate system		
rectangular coordinate system		
Cartesian coordinate system		
René Descartes		
geographic coordinate system		

Geographic Coordinate System Vocabulary

Reading: *Geographic Coordinate System*

Term	Illustration	Definition or Sentence
Prime Meridian		
Equator		
latitude		
longitude		

Coordinate Systems Comparison Matrix
READING: *Introduction to Coordinate Geometry, Coordinate Systems,* and *Geographic Coordinate System*

	Cartesian Coordinate System	Geographic Coordinate System
Grid		
Axes		
Quadrants		
Origin		
Coordinates		

Exit Ticket

Using at least five lines, explain one thing you learned in class today and one thing you would like to learn more about or did not fully understand.

_____

_____

_____

_____

_____

_____

Exit Ticket

Using at least five lines, explain one thing you learned in class today and one thing you would like to learn more about or did not fully understand.

_____

_____

_____

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