Introduction to Coordinate Geometry
The Coordinate Plane

Grade Level and Content

Geometry, 9th or 10th Grade Mathematics

Big Idea

Students will read about the coordinate plane to learn new vocabulary and to review how to graph points. Students will preview the unit to see how geometric figures are represented on a coordinate plane. Students will practice terminology by naming the x-coordinate, y-coordinate, and quadrant of several points. In groups, students will explore how to determine a point's quadrant without graphing the point. Finally, students will practice graphing by taking turns graphing points on the board.

Objectives

Students will be able to …

1. Correctly define key terms using words and/or illustrations given the terms.
2. Correctly construct and label a coordinate plane using mathematical language and notation given a grid worksheet.
3. Correctly graph points on a coordinate plane using mathematical language and notation given a grid and the coordinates of the points.
4. Correctly write the coordinates of a point on a coordinate plane.
5. Correctly determine the quadrant in which a point resides, without graphing the point, given the coordinates.

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. Students speak, listen, read, and write as they read a passage, label a diagram, and view an animated slideshow.

Materials

- 1 SMART™ Board with computer and projector
- 25 copies each: Introduction to Coordinate Geometry reading, Terms to Know: The Coordinate Plane pre-learning concept check, The Coordinate Plane graphic organizer, Graphing Points on the Coordinate Plane worksheet, Picture Points sheet, two different sheets of graph paper

- 5 copies each: The Coordinate Plane adapted worksheet and Vocabulary Illustration worksheets

Adaptations for Special Needs

The adapted coordinate plane worksheet will assist ELL students and learning support students in learning the material. The labels are indicated with a line and beginning letter, and the words are provided in a word bank. This will allow students to focus on understanding the material rather than figuring out what word goes where.

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.

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

SEATING CHART

SCENARIO/QUESTION

What is your location in this classroom?

If you had to give someone exactly where your seat was, what would you tell them?

- ✓ Some may specify the column and row, but others may specify classroom landmarks such as being next to something or somebody

With this seating chart, your location is represented by two symbols: the letter indicates what column your seat is in and the number indicates what row your seat is in. This is a special kind of address using a grid and two lines marked with symbols that are spaced equal distances apart. This is a coordinate grid or coordinate plane, which are what we are going to talk about today.

Now I want you to change your seats so you can be with a partner that I assigned specifically for today.

SCENARIO/QUESTION

Find your new seat.

Look at the chart carefully and note where you are and where you should be because some of you will move and some will not. Now find your new seat if you have one and take your pencil with you. You will be working with the person next to you.

What is the location of your new seat? How did you find your new seat? What did you do first?

- ✓ Found the column and then the row

So there was an order for how you found your seat. You found the column and then the row. We would write your location like this: D4. See how the letter comes first? That is because you find the column before the row.

Procedure 35 minutes, 40 minutes

🗁 **Introduction to Coordinate Geometry packet**

Pre-learning Concept Check

💻 *Terms to Know: The Coordinate Plane*

🗎 **Terms to Know: The Coordinate Plane**

Let's look at the vocabulary we will use today and throughout this unit. Turn to the first page in your packet. These words are words that are new to us **this year**. You may be familiar with these terms from algebra last year. We will be using them in this unit because coordinate geometry is the bridge between geometry and algebra.

Now let's say these words together. As we say each word, mark it as one you know a lot about (+), know a little about (✓), or don't know at all (0).

Reciprocal Teaching

💻 *Coordinate Plane (has blank grid).*

🗎 **Introduction to Coordinate Geometry**

🗎 **The Coordinate Plane**

🗎 **The Coordinate Plane (Adaptation)**

🗎 **Vocabulary Illustration (Adaptation)**

Turn to the *Introduction to Coordinate Geometry* reading. As you listen to the reading, underline anything that seems important. After the reading, you are going to draw and label a coordinate plane as I summarize this first paragraph. Student, would you read only the first paragraph.

🕮 *Student reads first paragraph (Coordinate Plane)*

Turn to *The Coordinate Plane* worksheet. If you have the *Vocabulary Illustration* worksheet, you can write down any notes or drawings that will help you to remember these terms.

In coordinate geometry, we locate and evaluate points on a grid. What is a grid? Look at the board and describe what you see. Does this look anything like our seating chart?

- ✓ A system of lines arranged in two directions

On the grid, we draw two number lines. What is a number line? If you don't remember, can you guess from this illustration? Our seating chart had letters across the top and numbers down the left.

- ✓ A line with counting numbers arranged at equal distances

How are these number lines oriented? Are they parallel? How do they intersect?

- ✓ Perpendicular

These are called axes.

The horizontal line is the x-axis, and the vertical line is the y-axis.

The two axes meet at the origin. What does the origin equal?

- ✓ Zero

The axes divide the grid into four quadrants: Quadrant 1, Quadrant 2, Quadrant 3, and Quadrant 4. The quadrants are labeled in a counterclockwise direction. As we look at each quadrant, note that we make a letter "C." Starting in the upper right, we have quadrant 1. Moving left, we have quadrant 2. Moving down, we have quadrant 3. Moving right, we have quadrant 4.

This is a coordinate plane. We have worked with planes a lot this year. Why do you think we call this a coordinate plane?

- ✓ It is two dimensional; it has length and width

We also call this a coordinate grid because its foundation is a grid.

What do you think the next paragraph is going to tell us? Take a minute to write down what you think on your reading handout.

🕮 *Student reads second paragraph (Coordinates)*

Now, you are going to summarize this paragraph. Student, come up and write the answers on the board.

What do we call the set of numbers within the parentheses?

- ✓ The ordered pair of numbers for that point

What does the term "ordered" in ordered pair mean?

- ✓ The order in which the numbers appear matters

What does the first number represent?

- ✓ Where the point is located along the x-axis

What does the second number represent?

- ✓ Where the point is located along the y-axis

What do we call an ordered pair when it is used on a coordinate plane?

- ✓ Coordinates

What do we call this first number?

- ✓ x-coordinate

What do we call this second number?

- ✓ y-coordinate

Representing Geometric Figures

Let's take a look at how are we going to use the coordinate plane in geometry. What is this figure? We've worked with it before. All the points on the line(s) are on the coordinate grid. The black dots indicate the endpoints or vertices. (continue until class names all of the figures)

- ✓ Line segment

- ✓ Angles
- ✓ Rays
- ✓ Circle, square, rectangle

In the next week, we will review the algebra we need to do coordinate geometry, including finding the equations of lines, slopes, midpoints, and distances between points. We will then use that knowledge to evaluate geometric figures on a coordinate plane. We will also explore equations for circles, which may be totally new to you.

Now let's do an exercise with graphing points. Remember the first number is the x-coordinate, and the second number is the y-coordinate.

Cooperative Learning and Popcorn Reading

🗎 **GRAPHING POINTS ON THE COORDINATE PLANE**

🗎 **GRID PAPER (LARGE SQUARES)**

🕮 *Students read instructions*

1. Individually, fill in the x-coordinate and y-coordinate columns.
2. With your partner, consider the quadrant that each point resides in. How do you think you can tell what quadrant the point is in before you graph the point? See if you and your partner can find the pattern.
3. With your partner, draw a coordinate plane on the graph paper with the larger squares and graph your points. Evaluate and correct the Quadrants column.

Did anyone see the pattern? How do you determine the quadrant that the point is in without graphing the point?

- ✓ You can tell the quadrant by the sign of the individual coordinates.

Individual Practice

🗎 **GRID PAPER (SMALL SQUARES)**

🗎 **PICTURE POINTS**

Now you are going to graph some points that will make a picture. Before we graph, look at your second piece of grid paper; it has smaller squares. Can anyone tell me how this grid is different from the one we just constructed?

- ✓ It has only positive numbers; It is just quadrant 1

Get started on your picture and make sure to graph the points in order starting with the first point in Part 1 and ending with the last point in Part 8. You can work together but graph on your own paper.

FROM: How Math Works by Carol Vorderman
(put a dot at the intersection of the first two points)

Part 1: (0, 0) (2, 8) (4, 16) (8, 24) (12, 32) (16, 36) (20, 38) (24, 38) (28, 36) (32, 28) (37, 16) (37, 8) (40, 0)

Part 2: (12, 12) (16, 5) (20, 3) (24, 5) (29, 12)

Part 3: (16, 12) (19, 13) (20, 12) (21, 13) (25, 12) (16, 12) (20, 10) (25, 12) (20, 8) (16, 12)

Part 4: (19, 15) (20, 14) (21, 14) (22, 15)

Part 5: (13, 22) (16, 23) (19, 22)

Part 6: (24, 22) (27, 23) (30, 22)

Part 7: (14, 20) (16, 22) (19, 20) (16, 21) (14, 20) (16, 19) (15, 20) (16, 21) (17, 20) (16, 19) (19, 20)

Part 8: (24, 20) (26, 22) (29, 20) (26, 21) (24, 20) (27, 19) (25, 20) (26, 21) (27, 20) (26, 19) (29, 20)

What is the picture?

Closing 5 minute, 45 minutes

Coordinate Plane and Graphing Review

Students write on the board.

Find the Coordinates: Find the coordinates of each point. What quadrant is A in? B? C?

Guess the Quadrant: Use the signs of the coordinates to determine the quadrant that each point resides in.

Graph the Point: Graph each point.

Tomorrow, we will see how people use coordinate planes in real life. Tonight, make sure you know the terminology and procedure for graphing points.

Student Evaluation

EXIT TICKET

Homework

Finish graphing project to reveal the picture.