Where Are the Points?

Summary

The students will be able to find coordinates on a Cartesian coordinate grid, give coordinates to items on a grid, locate regions on a map of Utah, and tell the class the regions on a map of Utah in the first quadrant of the coordinate grid.

Materials

Large masking tape
Postit easel pad
3" x 5" lined cards
Journal
Pencils
Crayons or colored pencils
Large graph pad
Connecting cubes
Book: *The Fly on the Ceiling: a Math Myth* by Dr. Julie Glass, ISBN-13: 9780679886075
- Worksheet for bingo (pdf)

Bingo pieces
Book: *Utah Atlas of Geography and History* by Cliff B. Craig and M. Elijah Carr, ISBN-13: 9781423600756
Book: *Algebra: Patterns, Functions, and Change*, by Deborah Schifter, Virginia Bastable, and Susan Jo Russell, ISBN-13: 9781428405202
- Coordinate grid handout (pdf)

Worksheet *Where Are the Animals?* (pdf)
- Maps of Utah (pdf)
- *Maps of Utah Worksheet* (pdf)

Dryerase markers
- *Dino worksheet* (pdf)

Graph paper with large squares (20 sheets per person)
Computer
Projector
Sound system
Clear copy paper

Background for Teachers

In the 17th century the French mathematician and philosopher Rene Descartes created the Cartesian coordinate system. This revolutionized mathematics by providing the first systematic link between algebra and Euclidean geometry. Using this coordinate system, geometric shapes can be described by Cartesian equations. For example, you might graph a curve using this type of grid system. Cartesian coordinates are the foundation of analytic geometry. They provide enlightening geometric interpretations for a lot of other avenues of mathematics. Some examples of these are linear algebra, differential geometry, complex analysis, and multivariable calculus.
The development of the Cartesian coordinate system was a major factor in the development of calculus by Isaac Newton and Gottfried Wilhelm Leibriz. Another interesting speculation is that this system may have been used by some of the Renaissance master artists to break their paintings into grids so that they could paint the component parts of their subjects more easily. The Cartesian coordinate system uses two perpendicular lines that set up a grid system. The horizontal line is called

the xaxis and the vertical line is called the yaxis. In the fourth grade curriculum, only ¼ of the coordinate grid is taught. Each point in the grid is placed in a geometric plane by pairs of numbers that can be found on the x and yaxes. Each point has a specific place on the grid, and all the points are measured by the same unit of length. The point where the x and y axis meet is called the origin. When three Cartesian grids are used together, a threedimensional object can be plotted. This grid system is the most common type used in computer graphics, computeraided geometric design, and other geometryrelated data processing systems. A line used for a Cartesian system is called a number line. Real numbers, such as integers, rational, or irrational, have a specific location on the number line. On the other hand, every point on the line can be interpreted as a number in an ordered continuum which includes the real numbers. There are many practical uses for this type of grid system. GPS systems are based on the coordinate grid. Maps use latitude and longitude, which are also a grid system. It is important for students to understand how to find coordinate pairs so they can use their knowledge in practical applicationsfor example, finding a town located on a map. Another important practical use for the Cartesian grid is organizing data for science experiments.
Students will learn the basic properties of the Cartesian grid system. They will learn the basic concepts behind finding coordinate pairs and graphing them. They will work with coordinate pairs using a variety of different grids.

Intended Learning Outcomes

Develop a positive learning attitude toward mathematics.
Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.
Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.
Represent mathematical ideas in a variety of ways.

Instructional Procedures

Invitation to Learn:
Place two threefoot pieces of tape on the floor in a perpendicular line. Label the horizontal line the x axis and the vertical line the yaxis. Give each student a card with a coordinate pair on it. Without talking, students will find their place on the grid. Discuss what a coordinate grid is and why it is important. Write important concepts students think of on a large paper taped to the front board. Use a large piece of graph paper and pens so students can write questions they have. Show the PowerPoint to students and discuss the history and importance of the Cartesian system.
Instructional Procedures:

Give students graph paper.
As a class, brainstorm some different graphing ideas.
Students will create their own graph using ordered pairs.

Read the book *The Fly on the Ceiling--A Math Myth* and discuss how the Cartesian system is important to fourth graders. Play *Fly on the Ceiling Bingo*. Each student will be given a graph with the coordinate numbers on it and a set of coordinates. The first player will pull a coordinate point for the other player and then the second player will pull a coordinate pair for the second player. They will continue to pull coordinates for each other until someone shouts "Bingo!"
The Basics of Coordinate Grids:

Go through the sheet on the basics of grids (pdf).
Do the worksheet on coordinate grids *Where Are the Animals?*
Have students write in their journal about key ideas learned during the lesson.

Utah Maps and Coordinate Grids:

Students will look at different maps of Utah.

They will find information about some of the locations they find on the map.
They will do the worksheet on maps.

Dino Graphing:

Draw a number line on the board and number it 0 through 10, leaving out some of the numbers and replacing them with letters. Use the letters A, B, C, and D.
Ask students to come to the board and tell the number value of the letters.
Ask the question, "Would locating points be different if the number line were positioned vertically?"
Hand out the *Dino Worksheet.*
Have students write a summary in their journal explaining how they found the coordinate pairs.

A Walk Through the Candy Store:

Students will be given a worksheet (pdf) of a coordinate grid containing items from a candy store.
They will be asked to find each type of candy using ordered pairs.
In small groups they will discuss how they found the pairs.

Create Your own Graph:

Students will create a worksheet for other students to try their graph.
Students will share their graphs.
The class will discuss the process of making graphs and sharing them.
Students will write in their math journals about their own personal experience of creating a graph and sharing the graph in class.

Guess My Location:

Please refer to the worksheet (pdf) for directions.
At the end of the class have students write in their math journals.
Have a discussion on the processes they went through during the activity.

Lesson and Activity Time Schedule:

Each lesson is 55 minutes.
Each activity is 30 minutes.
Total lesson and activity time is 90 minutes.

Activity Connected to Lesson:

This set of activities is from a wonderful set of books. The book I used is titled *Algebra: Patterns, Functions, and Change*. I hope you will take the time to investigate and read some of this wonderful information.

Cube Trains:

Place a cube train on the front board. For example, red, yellow, green, and blue, repeating the pattern until you reach the tenth block.
Ask students the follow questions:
What is a pattern?
What is the color of the 18th cube?
What numbers are all the yellow cubes? What do you notice about all of these numbers?
What are the numbers of all of the blue cubes? What do you notice about all of these numbers?
Use connecting cubes to make the train. Continue using the blocks as you work through the order of the different colors.
Continue the discussion by creating a chart with all the colors on the top. Begin writing the order of all the different colors. Look for patterns in the blocks.
Use x and y and help students discover an equation that will work for any number.

Penny Jars:

Draw a large jar on a piece of easel graph paper.
At the bottom, draw the amount of money in the penny jar before they start counting.

Draw a line above the money. Tell the students how many pennies will be added each day.
Draw a table with the days on the left side and the amount of money on the right side.
Look for patterns in the numbers and help students create an algebraic equation using x and y.
Use the coordinate grid to plot the graph.
Have students go through the processes on their own until they understand how to use this type of activity to graph different equations.
The traditional equation you will use is y = mx + b, where y is the total number of pennies, m is the increase in pennies, x is the slope, and b is the intercept.
Have a fullclass discussion on the activity and what they learned.

Extensions

Extensions:

Students will walk around the school and graph different parts of the school.
Students will create a maze using coordinate grids.
Students will be able to recognize locations on the coordinate grid and plot them.
Students will use graphs and create their own games.

Adaptations:

English Language Learners (ELL) will be given additional pictures of coordinate grids to ensure understanding.
Students who are struggling with the concepts taught will be placed in small groups or with a peer tutor for additional help.
Small group intervention for struggling students.
Additional graphing lessons will be taught in small groups for struggling students.

Integration:

Graph data in social studies on locations of the pioneers.
Graph different science projects throughout the year.

Family Connections:

Get maps of Salt Lake City and plan a trip to the University of Utah, using a coordinate grid to find the location.
Plan a trip to a different state using a map and a coordinate grid.
Create a game to share with your family using the Cartesian grid system.

Assessment Plan

Students will turn in a portfolio of their best graphs to be graded by the teacher.
Use a standardized test with different types of graphs and coordinate pairs to assess student knowledge.
Listen during class discussions for student knowledge.
Interview individual students to assess understanding of curriculum taught.
Have students work in groups to create a poster about graphs and report orally to the class.
Look at student journals. Make sure they contain detailed information and illustrations.

Authors

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