9-1 Hidden Treasure: A Coordinate Game

**Objective** To reinforce students’ understanding of coordinate grid structures and vocabulary.

### Teaching the Lesson

**Key Concepts and Skills**
- Translate numbers written in scientific notation into standard notation and number-and-word notation.
  [Number and Numeration Goal 1]
- Use ordered pairs of numbers to name, locate, and plot points in the first quadrant of a coordinate grid.
  [Measurement and Reference Frames Goal 4]

**Key Activities**
Students review coordinate grids, ordered number pairs, and coordinates. They use coordinate grids to graph a picture by choosing and connecting ordered number pairs. Students practice naming and plotting ordered number pairs by playing Hidden Treasure.

**Matching Number Stories to Graphs**
Math Journal 2, p. 294
Students match number stories to line graphs and explain their solution strategies.

**Math Boxes 9-1**
Math Journal 2, p. 295
Geometry Template * compass
Students practice and maintain skills through Math Box problems.

**Study Link 9-1**
Math Masters, p. 254
straightedge
Students practice and maintain skills through Study Link activities.

### Ongoing Learning & Practice

**Matching Number Stories to Graphs**
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**Study Link 9-1**
Math Masters, p. 254
straightedge
Students practice and maintain skills through Study Link activities.

### Differentiation Options

**READINESS**
Finding Locations on a Map
Math Masters, p. 255
Students locate points on a map.

**ENRICHMENT**
Finding Distances
Math Masters, p. 256
straightedge * computer with Internet access
Students use gridlines to identify point-to-point distances on a grid.

**ELL SUPPORT**
Building a Math Word Bank
Differentiation Handbook, p. 142
Students write, define, and illustrate the terms horizontal axis and vertical axis.

### Key Vocabulary
- coordinate grid
- axes
- perpendicular
- origin
- ordered pair of numbers
- vertical axis
- horizontal axis
- coordinate

### Materials
- Math Journal 2, pp. 292 and 293
- Student Reference Book, pp. 208 and 319
- Math Masters, p. 485
- transparencies of Math Masters, pp. 437, 438, and 485
- Class Data Pad
- slate
- straightedge
- red pencil or crayon

### Advance Preparation
Mental Math and Reflexes ★
Have students write numbers in standard notation and number-and-word notation. Ask students to explain how they determined the number of zeros to attach when writing the number in standard notation. Suggestions:

- 3 * 10^3 3,000; 3 thousand
- 5 * 10^2 500; 5 hundred
- 9 * 10^5 900,000; 9 hundred thousand
- 7 * 10^6 7,000,000; 7 million
- 6.5 * 10^4 65,000; 6.5 ten thousand
- 3.9 * 10^5 390,000; 3.9 hundred thousand

Math Message
Plot the following points on the small coordinate grid on journal page 292:

- (4.0); (0.4); (0.0); (5, 1 1/2); (1.25, 4.75)

Ongoing Assessment:
Recognizing Student Achievement
Use the Mental Math and Reflexes problems to assess students’ ability to translate numbers written in scientific notation into standard notation and number-and-word notation. Students are making adequate progress if they correctly write each number in standard notation.

[Number and Numeration Goal 1]

1 Teaching the Lesson

Math Message Follow-Up
(Math Journal 2, p. 292; Student Reference Book, p. 208; Math Masters, p. 437)

Use a transparency of Math Masters, page 437 to illustrate the following concepts:

- A plane is a flat surface that extends forever. A rectangular coordinate grid is used to name points in a plane.
- The coordinate grid is formed by two number lines called axes.
- The number lines intersect at right angles at their 0 points. The two number lines are perpendicular.
- The point where the lines meet (0,0) is called the origin.
- Every point on a coordinate grid can be named by an ordered pair of numbers. The first number in the pair is always the horizontal distance of the point from the vertical axis. The second number in the pair is always the vertical distance of the point from the horizontal axis.
The numbers in an ordered pair are the **coordinates** of the corresponding point. To plot the coordinates of a point, first move left or right along the horizontal axis, and then move up or down along the vertical axis.

- One or both coordinates may be a whole number, fraction, decimal, or mixed number.

- When one of the coordinates is 0, the point lies directly on an axis.

Ask volunteers to use the transparency to demonstrate and explain how to plot the Math Message points. Encourage students to make use of the Key Vocabulary terms in their explanations.

Write (3,4) and (4,3) on the board. Ask: *Do these coordinates name the same point? No Why?* The position of the numbers in an ordered pair determines the axis to be used for each of the coordinates. Unless the numbers are in the same positions in both ordered pairs, they will name different points.

Ask students to suggest ways to remember which axis the coordinates refer to in an ordered number pair. Write their suggestions on the Class Data Pad. *For example:*

- **Alphabetically**, horizontal comes before vertical.
- Think about painting the side of a house. You must move the ladder to where you want to paint before climbing up.
- Think about an elevator building. You go across the ground floor first and find the elevator to take you up to where you want to go.
- Think of the proverb: You must crawl before you can walk. Crawling is horizontal. Walking is vertical.

### Graphing a Picture

(Math Journal 2, p. 292; Math Masters, p. 438)

Tell students that they are going to graph a representation of the turtle shown at the top of journal page 292 as a class. Use the transparency of *Math Masters*, page 438 to model plotting and connecting points. Begin the picture by having students mark and label the point at (8,12), which is the tip of the turtle’s nose.

Ask volunteers to suggest whole-number coordinates for the next point on the turtle graph. Have students mark that point on their own graphs and then use a straightedge to connect it to the previous point.

Continue until an outline of the turtle has been drawn on the graph. Remind students that it is not important that their graphs exactly match the picture. Rather, they should choose points that will be a close representation of the picture.

Ask students to label the coordinates of 4 points on their graphs.
**Playing the Hidden Treasure Game**

(Math Journal 2, p. 293; Student Reference Book, p. 319; Math Masters, p. 485)

Ask students whether they have ever played Hot and Cold. It is a game where Player A leaves the room while the others hide some object. Then Player A returns and has to locate the object. The others provide clues by saying whether Player A is “hot” or “cold.” The farther away from the object, the “colder” Player A becomes. The closer to the object, the “warmer” Player A becomes. The game continues until Player A locates the object.

Tell students that Hidden Treasure is a game that is similar to Hot and Cold. Go over the rules on page 319 of the Student Reference Book. Be sure students understand the directions.

Use a transparency of the gameboard (Math Masters, p. 485) to play a sample round showing students how to complete the grids and how to answer a player’s guesses.

Have partners play two or more games. Players write in their own journals, using one of the two gameboards on journal page 293. Note that a gameboard consists of two grids.

Grid 1: Hide your point here.

Grid 2: Guess other player’s point here.

Circulate and assist. Pass out copies of Math Masters, page 485 if additional gameboards are needed.

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**Matching Number Stories to Graphs**

(Math Journal 2, p. 294)

Students match number stories to line graphs and explain their solution strategies. They also identify the rule that describes one of the stories.

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**Ongoing Learning & Practice**

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**Student Page**
Math Boxes 9-1
(Math Journal 2, p. 295)

Mixed Practice Math Boxes in this lesson are paired with Math Boxes in Lesson 9-3. The skill in Problem 5 previews Unit 10 content.

Writing/Reasoning Have students write a response to the following: Explain how you solved Problem 2d. How might you check your answer? Sample answer: I renamed $2\frac{1}{6}$ as $\frac{13}{6}$ and renamed $\frac{3}{4}$ as $\frac{13}{4}$. I multiplied $\frac{13}{6} \times \frac{13}{4} = \frac{169}{24}$. Then I divided 169 by 24 to rename the product as a mixed number. $169 \div 24 = 7 \frac{1}{24}$. To check my answer, I would use my calculator to divide $7\frac{1}{24} \div \frac{3}{4} = 2\frac{1}{6}$. Ask students to write a number story for Problem 2d. Answers vary.

Study Link 9-1
(Math Masters, p. 254)

Home Connection Students practice plotting points on a coordinate grid.

3 Differentiation Options

Finding Locations on a Map
(Math Masters, p. 255)

To provide experience with coordinate grids, have students identify locations on a map using ordered pairs of numbers. Students used a similar map structure to name points using ordered pairs of numbers in Fourth Grade Everyday Mathematics.

When students have finished, ask volunteers to share their solution strategies. Discuss which locations could be named with more than one point and why. Some locations are areas that contain several points, and other locations are a single place at a single point.

Finding Distances
(Math Masters, p. 256)

To apply students’ understanding of coordinate grids, have them use a grid to compare and analyze distances. Students compare distances across diagonals with distances where only lines along the grid and square corners are allowed.
When students have finished, ask them to connect the points they plotted in Problem 4. Ask: What shape was formed? A square
Discuss why the points did not form a circle. With a circle drawn on a grid, some of the points would be on a diagonal from the center. Because diagonals are not allowed, the shape couldn’t be a circle. Explain that this shape is a taxicab circle because all of the points are equidistant from the center point.

Taxicab geometry was developed by Russian mathematician, Hermann Minkowski. Consider assigning students to explore the interactive taxicab geometry activity on the Annenberg Foundation Web site at http://www.learner.org/teacherslab/math/geometry/shape/taxicab/.

To provide language support for coordinate grids, have students use the Word Bank Template found on Differentiation Handbook, page 142. Ask students to write the terms horizontal axis and vertical axis, draw pictures relating to the terms, and write other related words. See the Differentiation Handbook for more information. Point out the unusual spelling of the plural, axes, and distinguish this meaning from the plural of the cutting tool, ax.

Mrs. Thrasher’s fifth-grade class is taking a fieldtrip to two different locations: the aquarium, museum, or planetarium, depending on which two places are closest to each other.

1. Choose where the class should go and connect the points.

2. Think of the grid lines as streets. The class must take the bus, and the bus can travel along the grid lines only. Which location is closer to the museum now? aquarium
   Answers vary.
   Why or why not? Answers vary.

3. At the museum, the class learned about plans for the new Skateboard Park. Everyone thought that it should be located an equal distance from the aquarium, museum, and planetarium by bus.

4. Use the grid to show where the new Skateboard Park should be located.

Maggie said the city should have built Skateboard Park first. You could put a circle using Skateboard Park as the center. Then there would be many locations that were the same distance away.

5. Do you agree or disagree with Maggie’s idea? Explain your answer on the back of this page.

Answers vary.

Disagree.