



The Interactive Coordinate Plane: Embracing Student Mobility in the Math Classroom

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Target Grade: 6th Grade Math (Can be used in 7th grade Pre-Algebra)

Time Required: 40-50 minutes

Standards

Common Core Math Standards:

- 6.NS.C.6c: Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.
- 6.NS.C.6b: Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
- 6.G.A.3: Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side that joins two vertices (vertical or horizontal segments only). Know and apply these techniques in the context of solving real-world and mathematical problems.

Lesson Objectives

Students will be able to:

- name coordinates and quadrants in the coordinate plane.
- graph points in the coordinate plane.

Central Focus

In this lesson, students will learn about and get hands on practice with the coordinate plane.

This will include learning about quadrants, graphing ordered pairs, drawing polygons based on ordered pairs, and finding the length of a side that joins two vertices.

Key terms: Ordered pair, coordinates, axis, graph, plane, quadrant, polygons, vertices, geometry

Background Information

The students should have prior knowledge of the number line and experience with graphing integers on a number line. For example, given a number line from 1-10, students can graph where 4 would be and can determine that 4 would be to the left of 6, if they were to graph 6. Students should have an understanding of increasing and decreasing as well. Students may have



seen a coordinate plane before, but this is not required. It would also be helpful to have an understanding of negative numbers and know how those are represented on a number line as well.

Materials

- Interactive life-sized number line (including each integer for $-10 \leq x \leq 10$ typed on a separate piece of computer paper and taped in a line across the wall)
- Student worksheet handouts containing spaces for the warm-up answer, examples, and extra coordinate planes for extra practice (see attached)
- Digital Timer that counts down and beeps (optional)
- Interactive life-sized coordinate plane net (see picture – created with rope and zip ties purchased at the store using white rope for the overall grid, with a pink rope for the x-axis and a green rope for the y-axis)
- Spool of at least 30' of thin rope (about the thickness of a clothesline)
- Class set of coordinate plane whiteboards
- Dry eraser markers
- Sock erasers
- Blank sheets of paper each labeled with one of the following: x/y to label the axes, Quadrants I/II/III/IV, and the following ordered pairs: (0, 0), (-1, 0), (1, 2), (0, 2), (-3, -4), (4, -1), (-2, 3), (1, -1), (0, -1)
- Smartboard
- Teacher's Edition of the Prentice Hall/Pearson Mathematics Pre-Algebra Textbook copyrighted in 2004 Authors Charles, Davison, Landau, McCracken, and Thompson (Optional)

Instruction

- Opening/Warm-Up Activity:
 - Start the digital timer (set to 5 minutes) right before class starts.
 - As students enter the room, hand them the notes handout (includes warm-up, examples, and extra coordinate planes).
 - Instruct them to start the warm-up as soon as they sit down. This warm-up asks them to graph specified integers on the number line (a concept that they learned in a recent lesson in the past).
 - When the timer goes off, use the interactive life-sized human number line attached to the wall to check and go over their answers.
 - Remind the students that they should have numbered their number line with the integers from -10 to 10 in the same way that the number line on the wall is numbered.
 - Call students three at a time (there are 3 integers listed under each problem in the warm-up) to go up to the number line to show where they placed the point on the number line for each integer.



- Continue this until you have gone over all of the answers for #1-4, calling on 12 students to maximize the number of students who get to participate in the activity.
- Encourage the students that are still seated to tell whether they agree with the answers or not so that it stays as student directed as possible.

- Hook:
 - After going over the warm-up, explain to the students how this relates to today's lesson in that they will be learning about something called a coordinate plane that is composed of two number lines, one vertical and one horizontal, that are connected together to create a 2-dimensional grid.

- Essential Questions:
- Introduce these Essential Questions (posted on the board before the start of class) by reading them to the students. Ask the students to think about their answers to these questions as we proceed through the rest of the lesson.
 - How is a coordinate system used?
 - How does the location of a coordinate change as the values within the ordered pair change?

- Activities: 20-30 MINUTES TOTAL
 - Introduce vocabulary: coordinate plane, x-axis, y-axis, origin, quadrants I/II/III/IV, ordered pair (coordinate), x-coordinate, y-coordinate.
 - Hand out a sheet with two coordinate planes.
 - On the first coordinate plane, have the students label each axis, the origin, and the quadrants. Also, have them label each notch on the axis with integers (like a number line). Note: See the attached handout and key to see how to present this.
 - Have the students stand together and verbally practice these terms with hand motions. Repeat each one multiple times so the students start to memorize them.
 - Practicing the 4 quadrants: Have them use a windmill circular motion, swinging their hands in a counterclockwise motion with hand completely outstretched. As they swing around and point to the top right chant "one", top left "two", bottom left "three", and bottom right "four". At the end of each rotation, have them point directly in front of themselves and say "origin". Repeat multiple times in that same order. This allows students to kinetically practice the locations of the 4 quadrants and the origin.
 - Have the students raise their hands as high as they can above their head with their palms together (creating a y-axis with their entire body) and chant "y is high!". Then have them switch to having their hands and arms outstretched to their left and right sides (creating a horizontal x-axis with their arms) and chant "x is not". Repeat multiple times in that same order. This allows students to kinetically practice the location of the x-axis and y-axis.



- Go over the terms listed above the second coordinate plane in the handout. Complete examples 1 to 4. (Again, see the attached copy of the handout and its key).
- Guided Practice:
 - Have the students help you move the desks to the side and spread the life-sized human coordinate plane across the floor. (Note: you could set this up in a gym or the stage of an auditorium before class so that you can travel to that location as a class and complete this part of the lesson at that location.)
 - Have the students work together to form a line (human chain) on the x-axis and then on the y-axis.
 - Then have the students take the sheets of paper that have the “X” and the “Y” on them and place the x to the right of the x-axis and the y above the y-axis.
 - Instead of directing them as to where to place each label, ask them to collaborate to recall where they were placed (if they forget, remind them to do the hand motions one more time).
 - Randomly call out a quadrant (i.e. 1, 2, 3, or 4) and have the students all move collectively to that quadrant. Hold up the paper that lists the quadrant that you called out so that the students can refer to it if they get stuck. If the class is too large, split them into two groups and have each group take turns.
 - Have the students take turns being a human ordered pair.
 - One at a time, hand a student a paper with one of the following ordered pairs listed on it: (0, 0), (-1, 0), (1, 2), (0, 2), (-3, -4), (4, -1), (-2, 3), (1, -1), (0, -1).
 - Starting at the origin have them move to the correct position on the coordinate plane and hold up their paper for their classmates to see.
 - Have the student announce his movements (right/left/up/down) as he begins to move in any direction. Also, have them count their steps as they walk from one corner to another on the grid.
 - As each student takes a turn being the human point on the coordinate plane, the other students should sit on the floor facing the coordinate plane with coordinate plane whiteboards and markers in hand. Before having the human point take position, hold up the paper that lists the coordinate and have each student plot it on their whiteboard. This allows them to think through and get individual practice. When the human point plots the coordinate, have the students refer to their whiteboards and talk the human point through it if they are unsure. Have the students talk through whether the human point is in the correct position before jumping in as the teacher to show them if they are correct.
 - Have a student pick a spot on the coordinate plane and have the other students write the ordered pair on their whiteboard and hold it up for the teacher to see.
 - Finally, you can also have students use the spool of rope to connect an ordered list of coordinates to form a shape.



- Give each student a coordinate. After each student plots their coordinate, they can hand off the spool to the next student, who can slowly unravel it as they walk to their indicated coordinate.
- Continue the process until the students have graphed and connected all points in the order given. Then have them connect the rope from the last point back to the first point.
- Have them discuss what shape it forms and have them justify their answer mathematically.
 - Examples:
 - Rectangle: (0, 2), (1, 2), (1, -1), and (0, -1)
 - Right triangle: (-2, 1), (-2, 3), and (1, 3)
 - Square: (2, 2), (2, -1), (-2, -1), and (-2, 2)
- **Closure:**
 - Have the students repeat the hand motions and phrases for the x-axis, y-axis, origin, and quadrants (refer to the description earlier in the lesson plan).
 - **Ask:** In an ordered pair, which is listed first x or y?
 - Starting from the origin, using the x-coordinate, what are the 2 possible directions that you could move on the coordinate plane?
 - Starting from the origin, using the y-coordinate, what are the 2 possible directions that you could move on the coordinate plane?
 - **Restate the Essential Questions and allow for student discussion:**
 - How is a coordinate system used?
 - How does the location of a coordinate change as the values within the ordered pair change?
 - Some possible answers would include in geography, finding locations on a map...you could discuss how longitude and latitude are similar to the coordinate plane grid. Also, you could discuss how the x-axis and y-axis are similar (and different) to the equator and prime meridian. Also, you can allow the students point out how the values of the digits within the ordered pair changed the location of the coordinate. Gently guide them into discussing negative versus positive values as well as the magnitude of each value.
 - Assignment if you have the Pre-Algebra Textbook mentioned in the materials:
 - P.52: 1-12, 29-33, 38-44, 46-50 even, 56, 58, 60 (30 problems total)

Differentiation

You can have the students pair up in teams of two. Have each plot the point on their own whiteboard before checking with their partner (before the human point proceeds). This way you can pair stronger students with struggling students so they can help each other understand the concept.

The use of the whiteboards is a great opportunity for the teacher to have a visual overview of all of the student answers so that the teacher can determine if the class as a whole is



understanding. By seeing what the class has graphed on their whiteboards, you can easily determine what comments to make and what additional guided practice to add in to be sure that they have a firm graph.

Adjust the difficulty of the task based on the student who is volunteering at the moment.

Assessment

Formative:

Evaluate student understanding through class discussion and student responses to questions in the closure.

Summative:

Check for accuracy in the textbook homework assigned at the end of the closure. If you do not have that specific textbook, find similar material in the textbook you have available and assign homework to check for understanding and accuracy.

The Coordinate Plane

Warm-Up:

Directions: For each question, create a number line and then graph the given numbers on the number line. Note, you must create a separate number line for each question.

1. -2, 1, -5

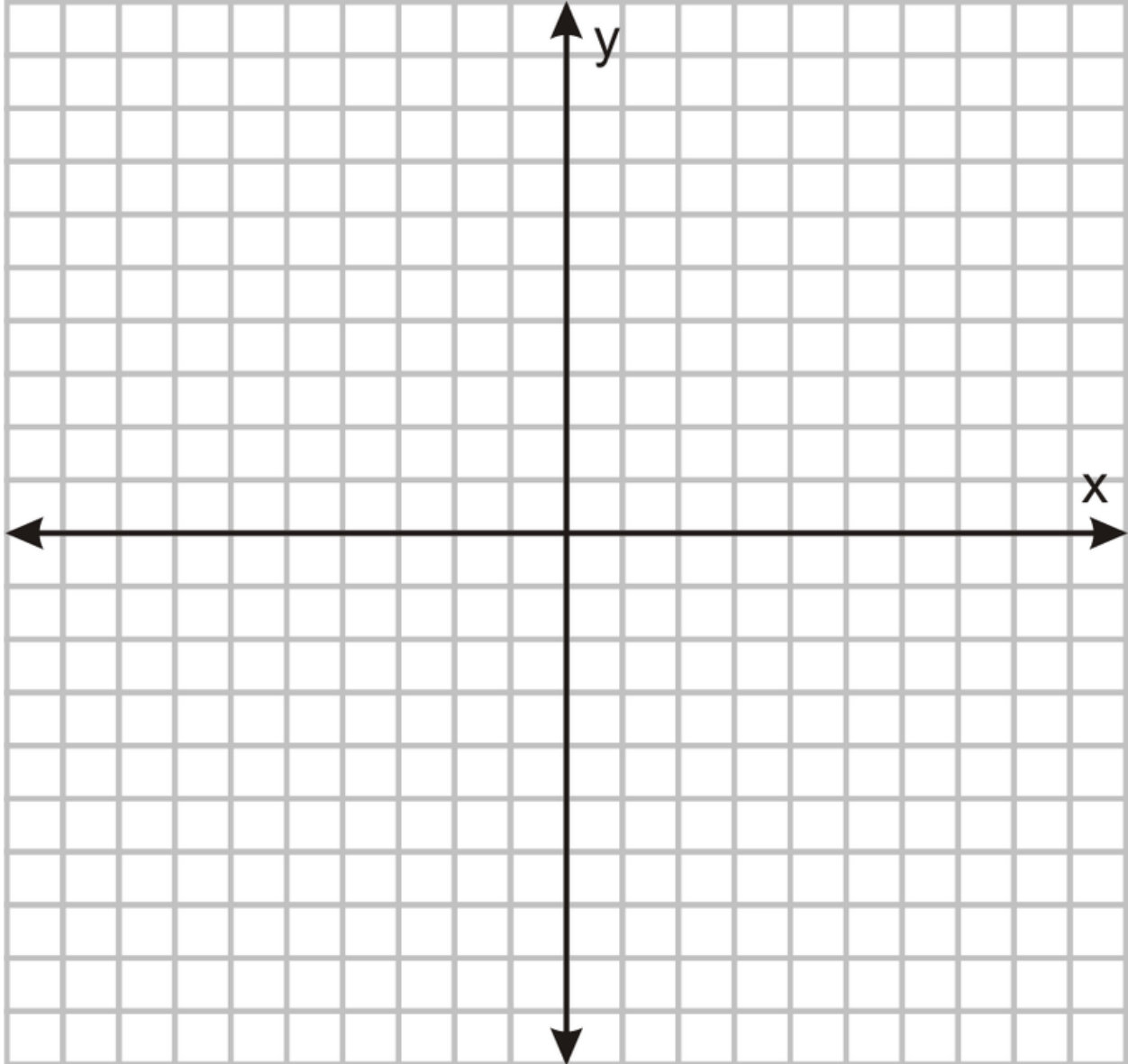
2. 0, 2, -4

3. -3, 3, -2

4. -1, -5, -8

Objective: Students will be able to

1. name coordinates and quadrants in the coordinate plane
2. graph points in the coordinate plane



Ordered Pair – gives the coordinates and location of a point on the coordinate plane. Written as (x , y)
REMEMBER: alphabetical order!!

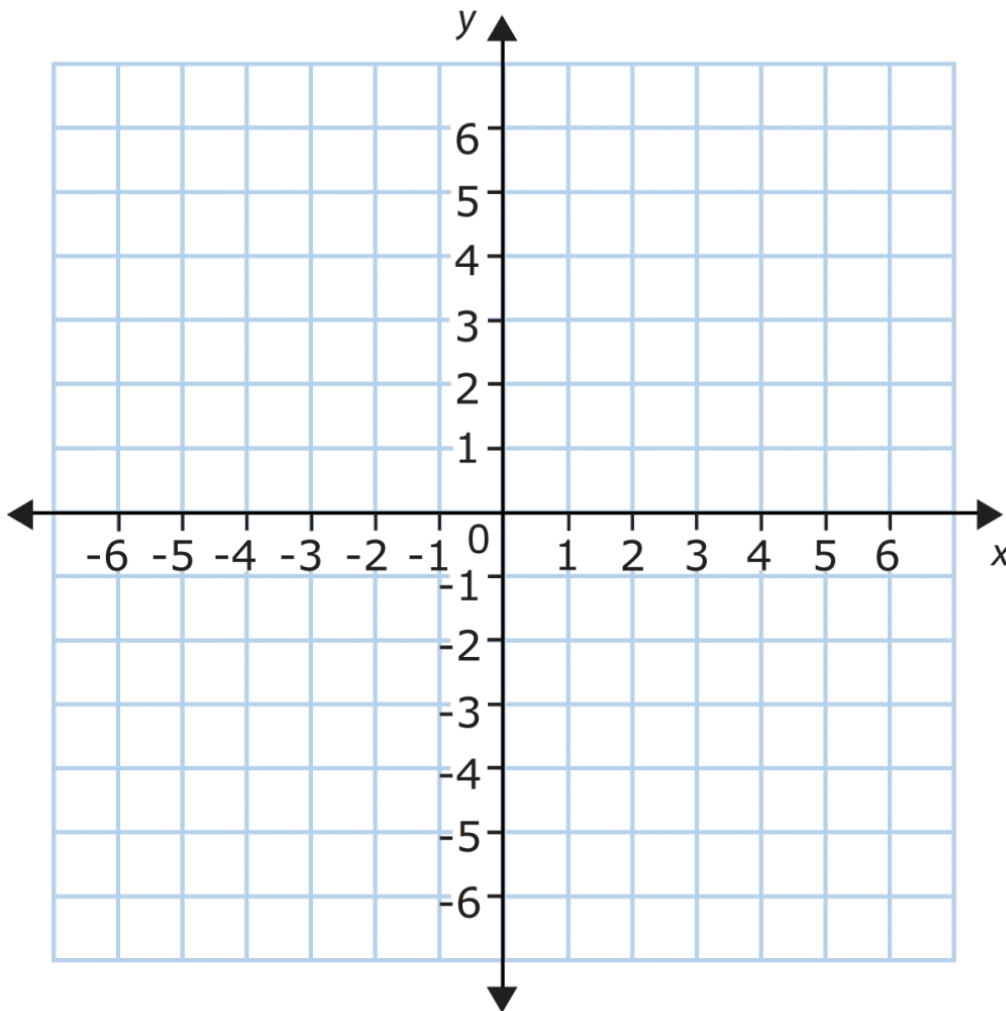
x-coordinate – shows the position right or left of the y-axis. In other words, it is how many spaces you move left/right from the origin when plotting the ordered pair on the coordinate plane.

+ Positive x-coordinate → move right - negative x-coordinate → move left

y-coordinate – shows the position above or below the x-axis. In other words, it is how many spaces you move up/down from the origin when plotting the ordered pair on the coordinate plane.

+ Positive y-coordinate → move up - negative y-coordinate → move down

Example 1: P (-5 , -4)
 ↗ ↖
 x-coordinate y-coordinate
5 units left of the origin 4 units below the origin



Example 2

Write the coordinates
of points A, B, and C.

A (,)

B

C

Example 3

Identify the quadrant
in which A and B are located.

A

B

Example 4

Graph and label these points
on the coordinate plane.

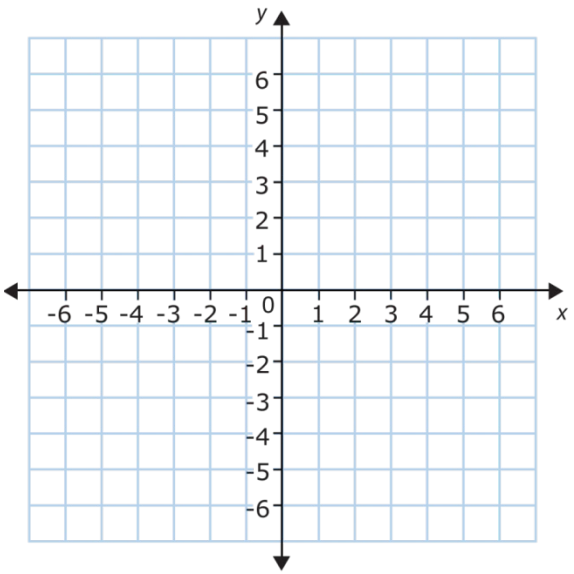
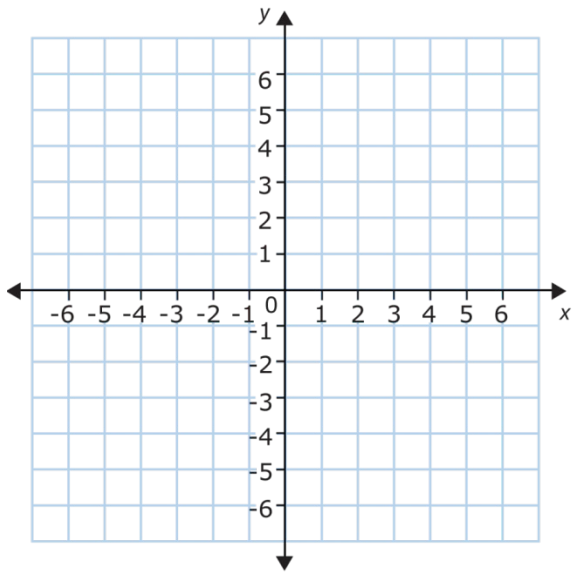
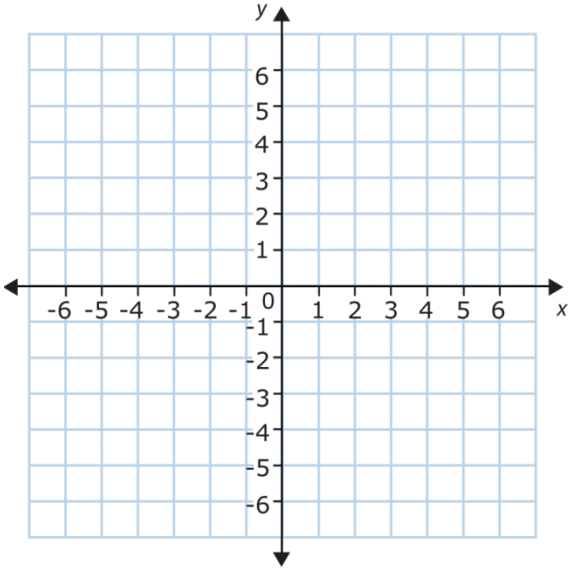
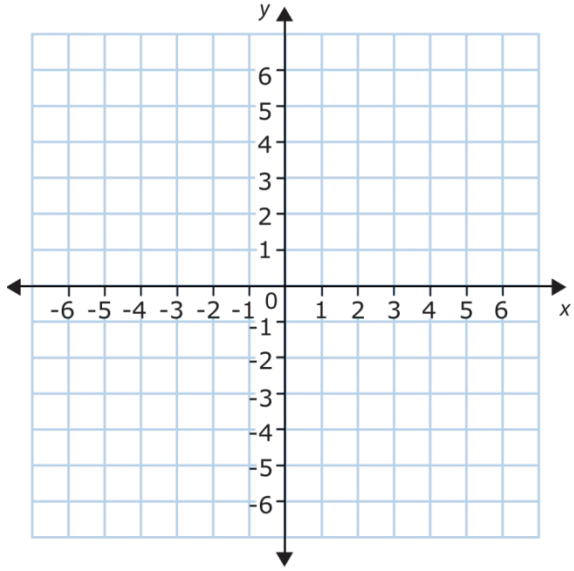
K (3 , 1)

L (-2 , 1)

M (-2, -4)

Draw lines to connect K, L, and M.

Describe the resulting figure:

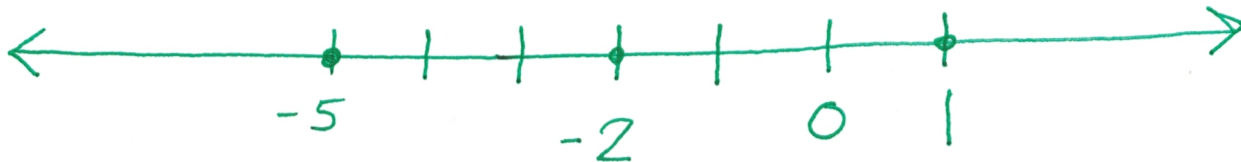


The Coordinate Plane

Warm-Up:

Directions: For each question, create a number line and then graph the given numbers on the number line. Note, you must create a separate number line for each question.

1. -2, 1, -5



2. 0, 2, -4



3. -3, 3, -2



4. -1, -5, -8

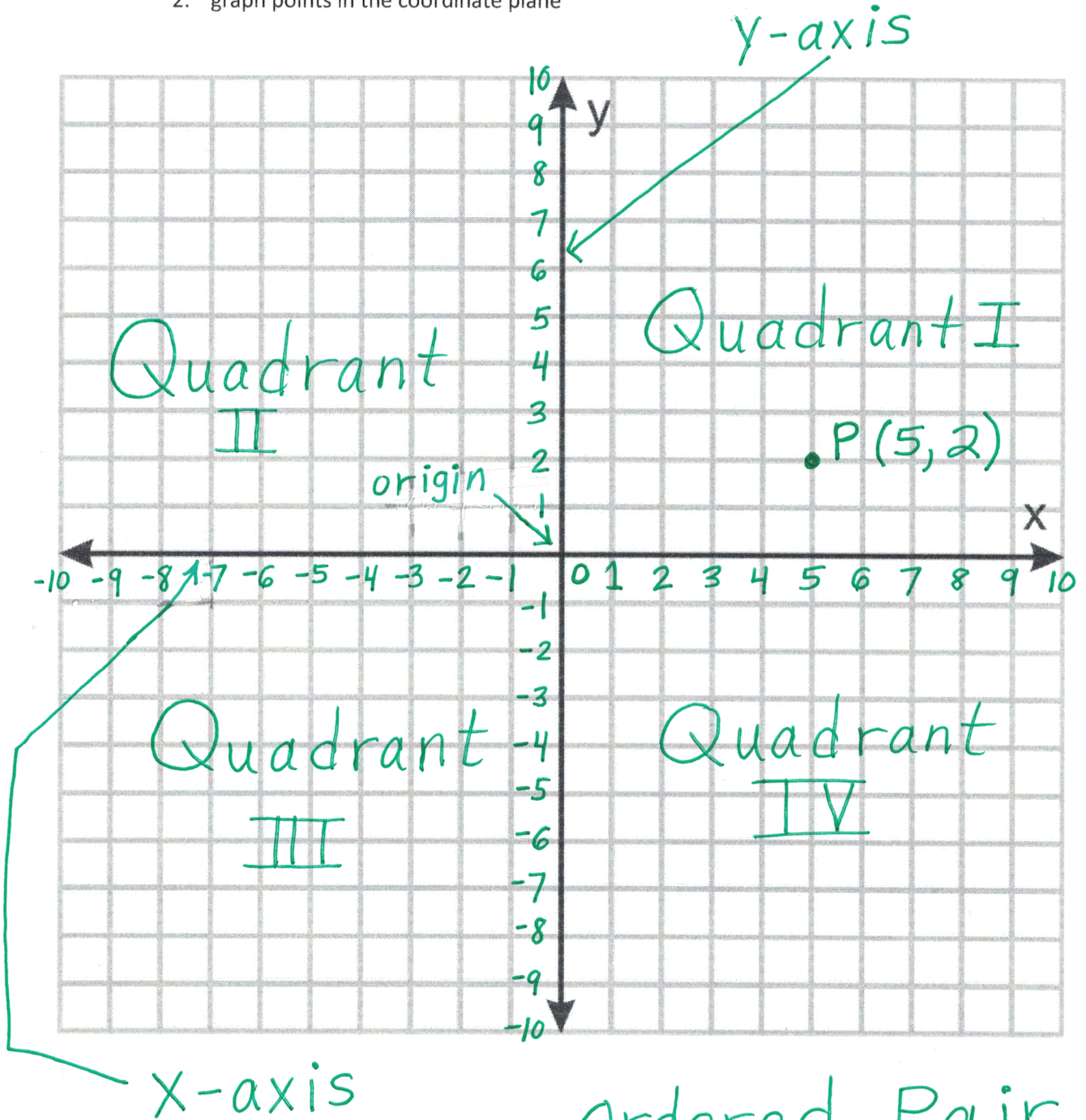


Key: Green will be added by students.

Lesson 1-10: The Coordinate Plane

Objective: Students will be able to

1. name coordinates and quadrants in the coordinate plane
2. graph points in the coordinate plane



Ordered Pair
(5, 2)
x-coordinate y-coordinate

Ordered Pair – gives the coordinates and location of a point on the coordinate plane. Written as (x, y)
REMEMBER: alphabetical order!!

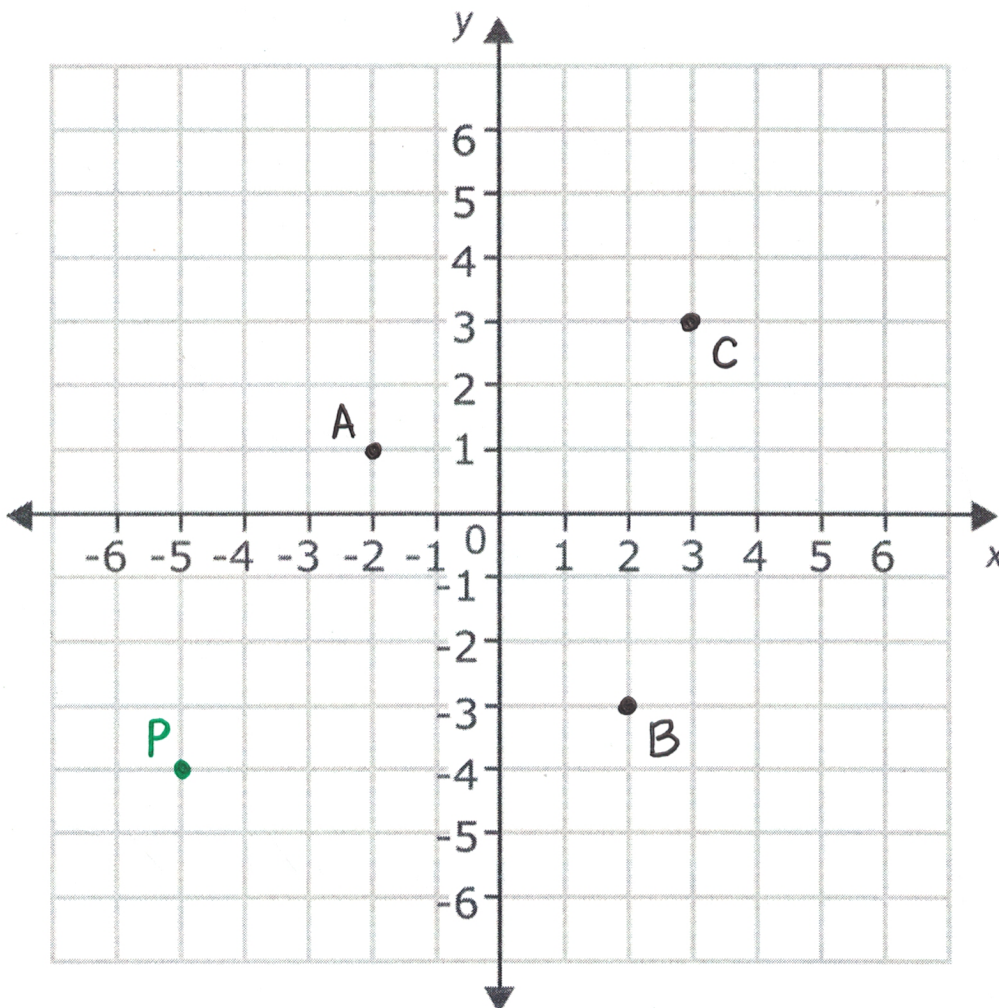
x-coordinate – shows the position right or left of the y-axis. In other words, it is how many spaces you move left/right from the origin when plotting the ordered pair on the coordinate plane.

+ Positive x-coordinate → move right - negative x-coordinate → move left

y-coordinate – shows the position above or below the x-axis. In other words, it is how many spaces you move up/down from the origin when plotting the ordered pair on the coordinate plane.

+ Positive y-coordinate → move up - negative y-coordinate → move down

Example 1: $P(-5, -4)$
 ↗ ↖
 x-coordinate y-coordinate
5 units left of the origin 4 units below the origin



Example 2

Write the coordinates
of points A, B, and C.

A $(-2, 1)$

B $(2, -3)$

C $(3, 3)$

Example 3

Identify the quadrant
in which A and B are located.

A II B IV

Example 4

Graph and label these points
on the coordinate plane.

K $(3, 1)$

L $(-2, 1)$

M $(-2, -4)$

Draw lines to connect K, L, and M.

Describe the resulting figure:

right triangle

Example 4:

