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5th Grade Math

Unit 13: Patterns on a coordinate plane

5.4C, 5.4D, 5.8A, 5.8B, 5.8C

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Numerical patterns help us make sense of the world, from telling time to predicting weather patterns. The concepts in this unit are foundational for the algebraic thinking required in future math classes.

- Delt a point in the first quadrant of the coordinate plane and name a point on the coordinate plane
- \Box Write points of the form (*x*, *y*) in a table
- \Box Complete an *xy* **table** when given rules for the *x* and *y*-values.
- □ **Graph** points from a table
- □ Interpret the meaning of points on a coordinate plane given a context



TEKS standards	Common misconceptions		
5.4C: Generate a numerical pattern when given a rule in the form $y = ax$ or y = x + a and graph	 Mixing up the x and y coordinates It's common for students to get confused about which coordinate is which in an ordered pair (x, y), as well as how to label axes on a graph. How to help: Review with students that the x-coordinate always 		
5.4D: Recognize the difference between additive and multiplicative numerical patterns given in a table or graph	comes first in an ordered pair and it tells us how far to move horizontally (right) on the x-axis (note: horizontal is like horizon to help remember). The y-coordinate is always second in an ordered pair and tells us how far to move vertically (up) on the y-axis. Make a poster for quick reference. Note that the points (3, 1) and (1, 3) are located in different places on the graph, order matters!		
5.8A: Describe the key attributes of the coordinate plane, including perpendicular number lines (axes) where the intersection (origin) of the two lines coincides with zero on each	(x, y) (\rightarrow, \uparrow) (\rightarrow, \uparrow) y (\rightarrow, \uparrow) y (x, ψ) (\rightarrow, \uparrow) (\rightarrow, \uparrow) (\rightarrow, \uparrow) $(1, 3)$ $(1, 3)$ $(3, 1) \rightarrow \text{ count 3 units right}$		

number line and the given point (0, 0); the x-coordinate, the first number in an ordered pair, indicates movement parallel to the x-axis starting at the origin; and the ycoordinate, the second number, indicates movement parallel to the y-axis starting at the origin **5.8B:** Describe the

process for graphing ordered pairs of numbers in the first quadrant of the coordinate plane

5.8C: Graph in the first quadrant of the coordinate plane ordered pairs of numbers arising from mathematical and real-world problems, including those generated by number patterns or found in an input-output table

Forgetting to start at the origin | The origin, (0, 0), is where the *x*- and *y*- axes intersect and is the place to start when counting to plot points.

How to help: When students first start learning to plot points on a coordinate grid, as they do in this unit, it's important that they start at the origin when plotting points. y

Once they have practice and get a feel for it, they can do fewer steps.



Counting in the coordinate plane incorrectly | Students sometimes count incorrectly on a coordinate grid. A common error is to count where they start first. For example, to move three units to the right, they count "0, 1, 2" and stop at x = 2.

How to help: Emphasize that where they start should count as 0 and they should count up after each jump. They can use arcs to show the jumping motion and then count the number of jumps.



Applying the rule | When using a rule to find additional numbers in a pattern, students might have difficulty understanding what they are supposed to do, especially when they are given different patterns for the *x*-values and *y*-values.

How to help: Encourage students to read each rule carefully and determine what exactly it applies to. Provide students with lots of practice!





Unit resources

- Students will be making tables and graphs in this unit. If students would benefit from extra practice on paper or completing problems on paper first, use this <u>Graph workspace</u> or this <u>Table workspace</u>.
- For the videos in this unit, use the Learning summary video notetaking guide.
- For the articles in this unit, use the <u>Article notetaking guide</u>.
- For the exercises in this unit, use the <u>Blank workspace template</u>.
- To record key terms and information, use the <u>Vocabulary and notation notetaker</u>.

Lesson overview

Lesson	Objective	Teaching tips
Lesson 1: Intro to the coordinate plane TEKS standard: 5.8A, 5.8C Video Article Exercise 3 1 5	Students will be able to plot a point in the first quadrant of a coordinate plane. Students will be able to identify the coordinates of a point plotted in the first quadrant of a coordinate plane.	 Warm up activity: Ask students to plot whole numbers on a number line. To make it more challenging, include fractions and decimals. You may want to use this <u>Number line template</u>. Review important vocabulary (coordinates, coordinate plane, axes, <i>x</i>-axis, <i>y</i>-axis, origin) with students and review how to graph points on a coordinate plane after watching the videos. Have students record words and diagrams in the <u>Vocabulary and notation notetaker</u>. The article can be particularly useful for students having difficulty with plotting points as it provides extra explanation and lots of practice.
Lesson 2: Coordinate plane word problems TEKS standard: 5.8C $\bigvee_{2}^{\text{Video}}$ $\bigwedge_{1}^{\text{Article}}$ $\bigotimes_{2}^{\text{Exercise}}$	Students will be able to find the vertical and horizontal distance between two points. Students will be able to interpret points on a coordinate plane in context.	• Students will find the vertical and horizontal distance between two points and begin to see how a coordinate grid can be relevant in daily life. If you live in a place where the streets are arranged in a grid, choose two locations and find the distance between (number of blocks you would walk to get from one to the other). You can also show pictures or maps of cities that are arranged in blocks, like New York City.
Lesson 3: Patterns on the coordinate plane TEKS standard: 5.4C,	Students will be able to complete an <i>xy</i> table when given rules for the <i>x</i> - and <i>y</i> -values. Students will be able to graph	 Discuss with students how the rule, table, and graph represent the same information in different forms. Go over how to interpret the rules that get applied

5.4D, 5.8C Video Article Exercise 5 0 6	points from a table.	to <i>x</i> - or <i>y</i> -values. It will be helpful for students to see examples and discuss the language used before jumping into the exercises. Review that <i>x</i> -values are <i>input</i> and <i>y</i> -values are <i>output</i> . Rule: Multiply the input by 3 and then add 1 to get the output.
		Input Output 6 $(6 \cdot 3) + 1 = 19$ 2 $(2 \cdot 3) + 1 = 7$
		 Students may need extra support to see how a coordinate pair is shown in a table, and vice versa. Do a few examples together. (3, 5) → 3 5 (0, 2) → 0 2 The exercises present different ways of following patterns. Sometimes students will relate <i>x</i>-values to <i>y</i>-values with a rule, while other times they will
		continue a pattern in a table with separate rules for the <i>x</i> -values and <i>y</i> -values. Students will need to read the problems carefully to determine what they are supposed to do.
Lesson 4: Describing coordinate plane relationships TEKS standard: 5.8B	Students will be able to describe the process for graphing ordered pairs in the first quadrant of the coordinate plane.	• Students will continue to build on their knowledge of ordered pairs and graphing as well as describing patterns in graphs.



Best practices

Coordinate plane vocabulary

There is a lot of vocabulary that goes with learning about the coordinate plane and most of it will be new for students. Spend time reviewing and have them record words and diagrams in the <u>Vocabulary</u> and notation notetaker. Here are some important words, diagrams, and ideas to explicitly review with students.

Students are familiar with **number lines** as they've worked with them in previous years and past units in this course. A number line measures in 1 dimension, only left/right or only up/down depending on its orientation, and we only need 1 number to tell us where to place a point.



In a **coordinate plane**, there are two number lines that intersect at a right angle, which allows us to work in 2 dimensional space.

In a coordinate plane, we need *two* values to tell us where to place a point, one that tells us where to go along the horizontal axis (x-axis, input), and one that tells us where to go along the vertical axis (y-axis, output). The values are given in the form of an ordered pair. An **ordered pair**, (x, y), tells us the vertical and horizontal distance of a point to the origin. Note that we are only working in the first quadrant here, so students will only need to move right and up, as opposed to right/left and up/down if we were working in all four quadrants.



v-axis

origin

2 3

x-axis

3

2

CLASSROOM ACTIVITIES YOU CAN TRY

Battleship!

Battleship is a great game to play to help students get used to a two dimensional coordinate grid. It uses numbers on one axis and letters on the other, but the idea is the same. If you don't have access to the game or don't want to do an activity with that theme, you can create your own with graph paper and colored pencils. Have students sit back-to-back with their partner or stand up folders between the students to block their view. Give each student a piece of graph paper with axes labeled up to 20 in each direction (or however many will fit). Designate one student to place the objects and one student to guess. You'll need to give students "objects" to be placed on the grid and the guessing student will also need to know what the "objects" are. The "objects" can be as simple as 5-6 different rectangles for students to color in on their grid. When the guesser gets a "hit," that coordinate can be crossed off of the picture.

Connect the dots

Have students make their own connect the dots activity! Give each student a piece of graph paper with the axes as large as possible. Have each student plot and connect points to make a picture. They will write out the ordered pair for each dot in the order they want them to be connected. Trade lists of ordered pairs to see if they get the correct pictures back.

Grid-finding challenge

Have students find examples of grids in their lives. They could bring them in, take a picture, or simply describe them. For example, the back of some wrapping paper has a grid pattern to help measure and cut correctly, or city blocks are often arranged in grids which helps estimate distances.

GENERAL CLASSROOM IMPLEMENTATION RESOURCES:

- <u>Weekly Khan Academy quick planning guide</u>: Use this template to plan your week using Khan Academy.
- <u>Using Khan Academy in the classroom</u>: Learn teaching techniques and strategies to support your students and save time with Khan Academy.
- <u>Differentiation strategies for the classroom</u>: Discover strategies to support the learning of all students.

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