TOPIC 1 OVERVIEW

Signed Numbers and the Four Quadrants

How are the key concepts of *Signed Numbers and the Four Quadrants* organized?

The *Signed Numbers and the Four Quadrants* topic introduces students to and explores the entire system of rational numbers, including negative rational numbers. The lessons are designed to enable students to see this topic as an extension of prior learning about number systems.

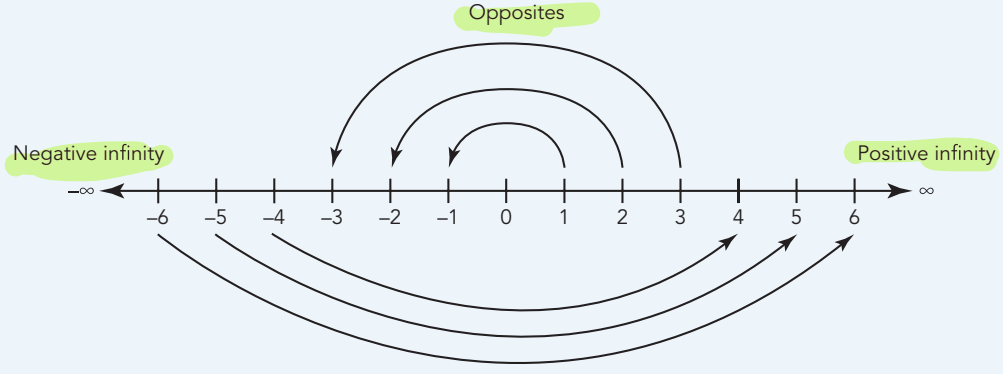
Students begin by reflecting the positive number line across zero to build the entire rational number line. They focus on the meaning assigned to positive and negative rational numbers, with particular focus on the meaning of zero in real-world and mathematical situations.

Rational number systems including negative rat. #s

Math Representation

Negative numbers are to the left of 0 on the number line. Positive numbers extend to positive infinity, and negative numbers extend to negative infinity.

Infinity, represented by the symbol ∞, means a quantity with no end or bound. The number line goes on forever in both directions.



Key points
- positive #s
- negative #s
- infinity (∞)

Students develop an understanding of the relationship between opposites and distance on a number line, leading to the concept of absolute value. They use absolute value to determine distances between positive and negative rational numbers in real-world situations. Students classify numbers into their respective number systems and explore the density of the rational number set.

Students then use their knowledge of the rational number line to build their own four-quadrant coordinate plane. They look for patterns in the signs of the ordered pairs in each quadrant and for ordered pairs that lie along the vertical and horizontal axes.

Key points
- Relationship between oppos. numbers
- Absolute value
- Classify Rat. #s
- four quad. coor

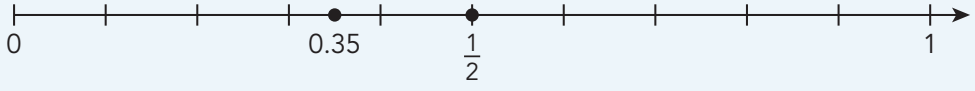
What is the entry point for students?

In previous courses, students positioned positive numbers, including fractions and decimals, on number lines and operated with these numbers using number lines as references.

Math Representation

Consider $\frac{1}{2}$ and 0.35. Which value is greater?

Plot each value on a number line.



Because $\frac{1}{2}$ is to the right of 0.35 on the number line, $\frac{1}{2}$ is greater than 0.35, or $0.35 < \frac{1}{2}$.

The opening activities in *Signed Numbers and the Four Quadrants* draw on this prior knowledge of number lines and numbers' positions relative to each other. Students then use hands-on materials to reflect the positive number line across 0, creating the full rational number line. Both horizontal and vertical number lines are used throughout this topic to provide students with a visual reference, to deepen their understanding of number relationships, and to visualize absolute value, magnitude, and relative positioning of numbers.

Students have prior knowledge of representing real-world and mathematical problems in the first quadrant of a coordinate plane and interpreting the coordinate values of points. They will build off of this foundation along with the knowledge developed in this topic with negative numbers to construct the four-quadrant coordinate plane.

Why is *Signed Numbers and the Four Quadrants* important?

The *Signed Numbers and the Four Quadrants* topic provides students with a comprehensive view of the number system with which they will primarily operate in the next few years of their mathematical journey. The focus in *Signed Numbers and the Four Quadrants* is on understanding and positioning rational numbers. The foundation provided in this topic will enable students to develop strategies for operating with signed numbers in the *Operating with Integers* topic.

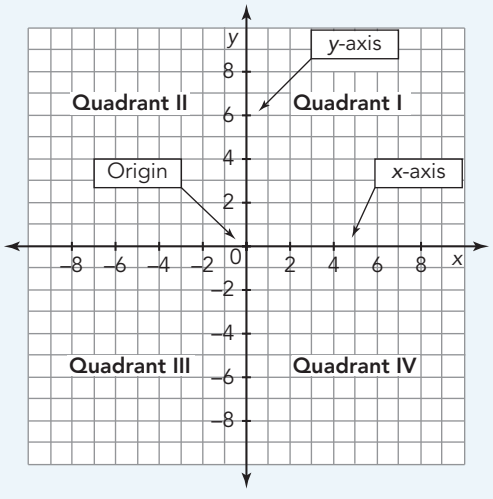
To contrast with rational numbers, students will learn about irrational numbers, such as π, in future courses. As students move into higher levels of mathematics, they will broaden their knowledge of number systems to include complex numbers, including imaginary numbers. Developing a formal understanding of nesting number systems will prepare students to study additional number systems.

Students will continue using the ideas from this topic throughout the remainder of the course. Just as they reflected the number line to include negative values, in *Signed Numbers and the Four Quadrants*, students will reflect the first quadrant of a coordinate plane to create the four-quadrant coordinate plane.

Math Representation

You can reflect number lines that form axes of Quadrant 1 and 0 to create the entire coordinate plane.

Four-Quadrant Coordinate Plane



They will explore the coordinate plane in ways similar to their exploration of negative numbers on the number line. Students will also use absolute values to solve problems on a coordinate plane. Throughout their mathematical journey, students will represent quantitative relationships on the coordinate plane and interpret the meanings of points, lines, and other graph elements.

4 Quad. coordinate plane

How does a student demonstrate understanding?

Students will demonstrate understanding of the standards in *Signed Numbers and the Four Quadrants* when they can:

- Identify a rational number and its opposite.
- Use rational numbers to represent quantities in real-world situations.
- Identify and position a rational number on a vertical or horizontal number line.
- Identify and recognize numbers with opposite signs as numbers on opposite sides of 0 on a number line.
- Classify whole numbers, integers, and rational numbers using a visual representation to describe relationships between sets of numbers.
- Order rational numbers on a number line.
- Order a set of rational numbers arising from real-world contexts.
- Define the absolute value of a rational number as its distance from 0 on a number line.
- Interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.
- Identify the absolute values of rational numbers.
- Identify in which quadrant a point is located based on the signs of the numbers in its ordered pair.
- Plot points in all four quadrants of the coordinate plane using ordered pairs of rational numbers.
- Calculate the distances between two points with the same first coordinate or the same second coordinate using absolute value.

How do the activities in *Signed Numbers and the Four Quadrants* promote student expertise in the TEKS mathematical process standards?

Each topic is written with the goal of creating mathematical thinkers who are active participants in class discourse, so elements of the TEKS mathematical process standards should be evident in all lessons. Students are expected to make sense of problems and work toward solutions, reason using concrete and abstract ideas, and communicate their thinking while providing a critical ear to the thinking of others.

Signed Numbers and the Four Quadrants focuses on reasoning quantitatively and abstractly, considering the meaning of numbers in and out of context, and understanding how numbers relate to each other (6.1F). The focus is on reasoning rather than on computation. The lessons in *Signed Numbers and the Four Quadrants* highlight the importance of reasoning about numbers, generalizing meanings, and being precise in ordering and describing numbers as members of nested number systems (6.1G).

Signed Numbers and the Four Quadrants highlights the connections between the rational number line and the coordinate plane. Students are expected to see the structural similarities between the two representations. They are also expected to discern patterns and conjecture about the signs of pairs of coordinates in each systems (6.1E). Throughout the topic, students should contextualize and decontextualize as they solve real-world problems, representing the scenarios on the coordinate plane and interpreting the meanings of points on graphs. As students engage in problem solving, they extend to modeling real-world situations with mathematics (6.1A), analyzing the tools used for solving problems (6.1C), and reasoning about representations in terms of their context (6.1D).

How can you use cognates to support EB students?

Cognates are provided for new key terms when applicable. Encourage students to create short stories or comics with a mathematical theme incorporating cognates into the narrative. Encourage students to write in one language and then verbally narrate the story in the other language (possibly through a digital recording), using the cognates as anchors for translation and comprehension.

NEW KEY TERMS

- negative numbers [números negativos]
- infinity [infinito]
- absolute value [valor absoluto]
- integers [enteros]
- ellipsis
- rational numbers [números racionales]
- Density Property [Propiedad de Densidad]
- quadrants [cuadrantes]

NEW SYMBOL

Symbol	Description
∞	Infinity symbol

MODULE 3, TOPIC 1 PACING GUIDE

~~165-Day Pacing~~
150 Day Pacing

3 Moving Beyond Positive Quantities

TOPIC 1: Signed Numbers and the Four Quadrants

1 DAY PACING = 45-MINUTE SESSION

TEKS Mathematical Process Standards: 6.1A, 6.1D, 6.1E, 6.1F, 6.1G

ELPS: 2.D, 2.I, 3.C, 3.D, 3.F, 4.C, 4.F, 4.G

Topic Pacing: 11 Days

Lesson	Lesson Title	Highlights	TEKS*	Pacing
1	Introduction to Negative Numbers	Students extend their knowledge of numbers to the negatives by building on prior knowledge of ordering positive rational numbers and plotting them on a number line. Students learn that an opposite on a number line means to reflect over the origin. They also learn that the negative sign is used as notation for opposites. Students explain the meaning of 0, positive numbers, and negative numbers in a variety of contexts. **Materials Needed:** Masking Tape, Blank Paper	6.2C **6.2D**	2
2	Absolute Value	Students formalize the idea that opposites are the same distance from zero and call this distance the absolute value of a number. Students continually revisit the meaning of absolute value, focusing on distance from 0. Students evaluate absolute value statements and compare numbers using absolute values. Students solve problems using absolute value statements. **Materials Needed:** Masking Tape, Blank Paper, String Problem-Solving Model Graphic Organizer	6.2B	2
3	Rational Number System	Students formally classify numbers as rational numbers and understand that all numbers they have studied so far are subsets of the rational numbers. Students sort and classify numbers. They investigate the density of rational numbers by locating rational numbers between other rational numbers. **Materials Needed:** Scissors Number Set Bullseye, Index Cards, Push Pins or Tape	6.2A 6.2C	2
4	Extending the Coordinate Plane	Students build from working with rational numbers, including integers, fractions, and decimals on a number line to rational numbers on a coordinate plane. They identify the four quadrants, identify points, and make generalizations about points located in given quadrants. Students determine distances between two points that have a common coordinate. **Materials Needed:** Masking Tape, Index Cards, Graph Paper, T-Rex Dig Game Board (located at the end of the lesson)	6.2B **6.11A**	2
End of Topic Assessment				1
Learning Individually with Skills Practice *Schedule these days strategically throughout the topic to support student learning.*				2

Read TEKS

*Bold TEKS = Readiness Standard

MODULE 3, TOPIC 1 PACING GUIDE

~~165-Day Pacing~~
150 Day pacing

1 DAY PACING = 45-MINUTE SESSION

Day 1	Day 2	Day 3	Day 4	Day 5
TEKS: 6.2C, **6.2D** **LESSON 1** Introduction to Negative Numbers GETTING STARTED ACTIVITY 1 ACTIVITY 2 ACTIVITY 3	**LESSON 1** continued ACTIVITY 4 ACTIVITY 5 TALK THE TALK	TEKS: 6.2B **LESSON 2** Absolute Value GETTING STARTED ACTIVITY 1 ACTIVITY 2	**LESSON 2** continued ACTIVITY 3 TALK THE TALK	**LEARNING INDIVIDUALLY** Skills Practice *This is a suggested placement. Move based on student data and individual needs.*
Day 6	**Day 7**	**Day 8**	**Day 9**	**Day 10**
TEKS: 6.2A, 6.2C **LESSON 3** Rational Number System GETTING STARTED ACTIVITY 1	**LESSON 3** continued ACTIVITY 2 ACTIVITY 3 TALK THE TALK	TEKS: 6.2B, **6.11A** **LESSON 4** Extending the Coordinate Plane GETTING STARTED ACTIVITY 1	**LESSON 4** continued ACTIVITY 2 ACTIVITY 3 TALK THE TALK	**LEARNING INDIVIDUALLY** Skills Practice *This is a suggested placement. Move based on student data and individual needs.*
Day 11 **END OF TOPIC ASSESSMENT**				

*Bold TEKS = Readiness Standard

- Skills prac. is flexible
- Distribute spaced & interleaved practice
- use data to strategically assign probs.

Extension probs are available

How can you incorporate Skills Practice with students?

There are two Learning Individually days scheduled within this topic. The placement of these days within the topic is flexible. The intent is to distribute spaced and interleaved practice throughout a topic and throughout the year. It is not necessary for students to complete all Skills Practice for the topic and different students may complete different problem sets. You should use data to strategically assign problem sets aligned to individual student needs. You should analyze student responses from the following embedded assessment opportunities to help assess individual needs: Essential Questions, Talk the Talks, Student Self-Reflections, and End of Topic Assessments. For students who are building their proficiency, you can assign problem sets to target specific skills. For students who have demonstrated proficiency, there are extension problems of varied levels of challenge.

How can you identify whether students are ready for new learning?

The Prepare section of the Lesson Assignments and the Spaced Practice set of Skills Practice can serve as diagnostic tools. Depending on available time, you can assign the Prepare section of the Lesson Assignments as homework or as a warm-up to identify students' prior knowledge for the upcoming lesson's activities. You can also use the Spaced Practice sets of Skills Practice to analyze individual students' level of proficiency on standards from previous topics.

prepare section and lesson assn can be used as homework.