Human Number Line **1**

Introduction to Negative Numbers

Lesson Overview

Students extend their knowledge of number to the negatives by building on prior knowledge of ordering positive rational numbers and plotting them on a number line. Students learn that *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.

Grade 6 The Number System

Apply and extend previous understandings of numbers to the system of rational numbers.

5. Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

6. Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.
   a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself and that 0 is its own opposite.
   c. 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.

7. Understand ordering and absolute value of rational numbers.
   a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.
   b. Write, interpret, and explain statements of order for rational numbers in real-world contexts.

Essential Ideas

- Positive and negative numbers describe quantities having opposite directions or values.
- Positive and negative numbers are used in real-world situations.
- Zero has different meanings in different real-world situations.

Lesson Structure and Pacing: 2 Days

Day 1

Engage

Getting Started: Number Line Geography
Students review the basics of number lines: continuity, plotting values, indicating values greater than and less than a given value.

Develop

Activity 1.1: Investigating Time on a Number Line
Students plot time on a human number line. Students formally learn about number lines with positive and negative numbers. They analyze number lines and discuss the meaning of 0 in the context of their number line. Negative numbers are described as the numbers to the left of zero on the number line. The symbol for infinity is introduced.

Activity 1.2: Representing Opposites on a Number Line
Students plot numbers and their opposites on a human number line. Students learn the notation for the opposite of a number. Opposite numbers are described as two different numbers that are the same distance from zero on the number line. Students name and graph pairs of opposite numbers while describing the distance each pair is from zero.

Activity 1.3: Representing Money on a Number Line
Students consider a context of having enough money to go to the movies. They analyze two number line representations of the scenario, one with $0 as the benchmark for comparison and one with the movie price as the benchmark for comparison. The points plotted on one number line are translations of the same points on the other number line. Students then consider how the two number lines would be different if the movie price was different.

Day 2

Activity 1.4: Temperature Connection
This problem uses temperatures on a thermometer to illustrate a use of negative numbers. Students locate various temperatures on a thermometer. They also order several temperatures from least to greatest.

Activity 1.5: Comparing and Ordering Rational Numbers
Students represent, compare, and order positive and negative numbers on horizontal number lines. They consider the balance sheet of a company, explaining the meaning of zero and positive and negative values. Students then compare and order rational numbers using number lines.

Demonstrate

Talk the Talk: Putting It All Together
Students answer generalization questions to summarize their learning about positive and negative numbers on a number line.

Facilitation Notes

In this activity, students answer a series of questions regarding the locations of points on a number line.

Discuss Question 1 as a class. The discussion may or may not include negative numbers.

Questions to ask
- What are some characteristics of a number line?
- Do all number lines have arrows at each end?
- If there are no labels, what does each tick mark represent?
- Where is the "beginning" of the number line?
- Do number lines have an end?
- How have you used number lines in the past?
- What is an example of using a number line in real life?

Ask students to complete Question 2 individually, then share responses as a class. Students may not know the answers to part (d). If they don't, let it go for now.

Questions to ask
- Where is 0? Why did you place it there?
- Why did you select your chosen number?
- What is your interval?
- Which direction would indicate numbers larger than your number?

As students work, look for
- Placement of 0 at the middle, far left, or far right on the number line.
- Use of an interval of 1, 2, or other numbers.
- Two or three different versions of number lines to share with the class.

Differentiation strategy
For students who may struggle to start, provide them with a pre-labeled number line or give them a specific location for 0.

Have several students share their number lines for comparison purposes.

Questions to ask
- How are the number lines similar?
- How are the number lines different?

Summary

There are values to the left of zero on the number line.

Activity 1.1
Investigating Time on a Number Line

Facilitation Notes

In this activity, a human number line is used to show locations of time in the past, present and future. Students analyze number lines and discuss the meaning of 0 in the context of their number line. Negative numbers are described as the numbers to the left of zero on the number line. The symbol for infinity is introduced.

Prior to class, use masking tape to create a number line on the floor with 14 to 20 equally-spaced tick marks. Ensure that the tick marks are spaced far enough apart for students to stand at each tick mark. Mark 0 in the middle of the number line.

Facilitate Question 1 as a whole class activity.

Select 6 students to participate in this activity. Assign each of the 6 students a letter from A through F, and have them write it large on a piece of paper. Have a student read where Student A should stand. The class should determine the time represented by Student A. Student A should record that time on the piece of paper and hold it up for the class to see and stand at the appropriate place on the number line. The rest of the class should record what is on Student A's paper on the number line in their textbooks. Repeat the process for Students B through F.

Questions to ask
- How did you decide to walk to the right or left of 0?
- How did you decide what time it would be?
- What if another student stood at a time $3\frac{1}{4}$ hours from now? Where would they stand? What about $3\frac{1}{4}$ hours ago?

Have a student read the paragraph about a number line aloud. Discuss as a class.

Differentiation strategies
- Have students highlight information about a number line, negative numbers and infinity.
- Explain that the opposite of infinite is finite. For example, a day is finite, the length of a desk is finite. Have students provide an example of something else that is finite.

Questions to ask
- What does it mean to reflect the positive numbers across zero?
- Have you used negative numbers before? If so, how were they used?

- Have you heard the word *infinity* before? How does that relate to the mathematical use of the word?
- On our class timeline, which numbers would have been negative?

Ask students to work with a partner or in groups to complete Questions 2 through 7. Share responses as a class.

Differentiation strategies
For students who struggle with left and right,
- Place 2 labelled post-its on their desks marking left and right.
- Show them how they can use their hands to remember left and right. If a student uses their left hand, they can make the letter L with their index finger and thumb; L stands for left. The same cannot be done with their right hand; the L is backwards.

Questions to ask for Question 6
- Would the location of the students change?
- Would the times for those locations change?
- Would the number line value change?
- How would the number line be different if we did the activity at midnight? 8:00 A.M.? 3:00 P.M.?
- Why would the location of the students stay the same even if the start time is different?

Summary

A number line includes positive and negative numbers and can model time in the past, present, and future.

Activity 1.2
Representing Opposites on a Number Line

Facilitation Notes

In this activity, a human number line is used to plot numbers and their opposites. The notation for the opposite of a number is introduced. Opposite numbers are described as two different numbers that are the same distance from zero on the number line.

As a whole-class activity, facilitate Questions 1 and 2. Have students draw a number line in their book to document the locations of students on the human number line.

Select 7 students to participate in the activity. Assign each of the 7 students a letter from A through G, and have them write it large on a piece of paper.

Have a student read where Student A should stand. Student A should record that value on the piece of paper and hold it up for the class to see and stand at the appropriate place on the number line. The rest of the class should record what is on Student A's paper on the number line and table in their textbooks. Repeat the process in pairs, B and C, D and E, and F and G.

Questions to ask
- How did the pairs know where to stand?
- How are the locations of the opposites related to each other?
- What do you think *opposite* means on a number line?
- What would be the opposite of 9? How would you write it?
- What would be the opposite of −2.25?
- Is the opposite of a number always a negative number? Explain.

Have a student read the paragraph about opposites aloud. Discuss as a class.

Questions to ask
- What does it mean for opposites to be reflections across 0?
- What is the opposite of the opposite of a positive number?
- What is the opposite of the opposite of a negative number?

Have students work with a partner or in groups to complete Questions 4 through 8. Share responses as a class.

Questions to ask
- How do you read –(4.5)?
- Explain why the opposite of 4.5 and –4.5 mean the same thing.
- Are the parentheses necessary in this expression?
- How do you read –(–6)?
- Explain why the opposite of –6 and positive 6 mean the same thing.
- On the number line, why doesn't zero have an opposite?
- On the number line, how far is the number from zero?
- On the number line, how far is the opposite of the number from zero?
- Was it helpful to number the entire number line before you plotted the points?

Assign pairs of students to use the Human Number Line to show their answers to Question 8.

Summary

Opposite numbers are reflections of each other across 0 on the number line. The opposite of a positive number is a negative number and the opposite of a negative number is a positive number.

Activity 1.3
Representing Money on a Number Line

Facilitation Notes

In this activity, students analyze two number line representations of a real life scenario, one with $0 as the benchmark for comparison and one with the movie price as the benchmark for comparison.

Ask a student to read the scenario aloud. Discuss as a class.

Questions to ask
- What information was provided by each of the friends?
- Who has enough money to go to the movie?
- Who does not have enough money?
- Can you determine the amount of money each person has?

Have students work with a partner or in groups to complete Questions 1 through 3. Discuss as a class.

Questions to ask
- How are the number lines similar? How are they different?
- What do you notice about the spacing of pairs of points from each other on the two number lines? For example, how far apart are *S* and *E* on the two number lines?
- What title would you give to each number line?
- Which number line is best if you want to know how much money each person has?
- Which number line is best if you want to look quickly and see who can go to the movie?

Have students work with a partner or in groups to complete Question 4. Discuss as a class. Make sure that students take the entire original scenario into consideration, including the original ticket price and the comments of the 4 friends.

Differentiation strategies
- Assign half the class to revise Myron's number line and the other half of the class to revise Paulie's number line. Pair up with someone who completed the other number line to share and compare.
- Use volunteers to plot each set of points on the Human Number Line.

Questions to ask
- What title would you give to each number line?
- Why didn't Myron's number line change?
- Why did Paulie's number line change?

Summary

To accurately interpret a number line, you must know what 0 means in context of the problem. Adjusting the benchmark up or down by a constant amount results in the points on the number line being translated left or right while maintaining the same distance between those points.

Activity 1.4
Temperature Connection

Facilitation Notes

In this activity, students interpret the meaning of vertical number lines, including the meaning of 0 in context. This problem uses temperatures on a thermometer to illustrate a use of negative numbers.

Have students complete Question 1 individually. Share responses as a class.

Temperature and sea level are two contexts that will recur; it is important for students to have an understanding of the role of positive and negative numbers in these contexts.

Questions to ask
- Did anyone draw a picture?
- Do you think the weather forecaster meant below zero Celsius or Fahrenheit?
- What is sea level? Have you ever heard someone refer to sea level in another context?
- What is the difference between the submarine's "below sea level" and Badwater Basin's "below sea level"?

Misconception
Some students may think that water freezes at 0°F. This may be a good time to clarify this misconception.

Have students work with a partner or in groups to complete Questions 2 through 6. Share responses as a class.

Questions to ask
- How would you describe the order of the numbers on this thermometer to someone who has never seen one?
- Is there a temperature higher than 140°F?
- What is an example of something that reaches a temperature that is higher than 140°F?
- Is there a temperature lower than $-80°F$?

- What is an example of something that reaches a temperature that is lower than −80°F?
- What words or phrase does a weather person usually use to describe a −4°F temperature?
- How did you decide which was colder?
- How did you decide which temperature was the least?
- How did you decide which temperature was the greatest?
- Which temperature is greater, −33°F or −32°F?
- How far is each number from 0°F? Does distance from zero determine greater than or less than when comparing positive and negative numbers?

Differentiation strategies

For students who struggle,

- Help them make the generalization that in a horizontal number line, numbers get larger as they go to the right. In a vertical number line, numbers get larger as they go higher.
- When ordering a series of numbers, such as in Question 6, suggest they plot the values first, and then order them from how they are placed on the number line (or thermometer in this case).

Summary

Positive and negative numbers are commonly used in real life scenarios. Thermometers are common vertical number lines that use positive and negative numbers.

Activity 1.5
Comparing and Ordering Rational Numbers

Facilitation Notes

In this activity, students interpret the meaning of horizontal number lines, including the meaning of 0 in context. This problem uses the balance sheet of a company including overdrafts to illustrate a use of negative numbers.

Have a student read the introduction before Question 1 aloud. Discuss as a class.

Questions to ask
- What does the term "balance" mean in this context?
- Who else might use a balance sheet?
- What is an overdraft?
- If you own a business, is it better to make money or owe the bank money?
- How are negative numbers represented in this table?

Misconception

For students who struggle with the concept of balance, they may not realize that the balance for a current week already takes into account the balances of previous weeks. Students do not need to combine any values in the balance sheet.

Have students work with a partner or in groups to complete Question 1. Share responses as a class.

Questions to ask
- How did you decide which numbers were negative?
- How did you know where to plot each week's balance?
- How did you determine the company's highest bank balance?
- How did you determine the company's largest overdraft?
- How did you decide which number was larger?
- How did you use the number line to decide which number was larger?
- What does it mean for -12 to be greater than -456? What does this mean for the company? Which is a greater overdraft?

Have students work with a partner or in groups to complete Questions 2–3. Share responses as a class.

Questions to ask
- How did you decide where to place the value $-6\frac{2}{3}$ on the number line?
- How did you decide where to place the value -7.98 on the number line?
- On the number line, where is the number with the least value located, with respect to all of the other values?
- On the number line, where is the number with the greatest value located, with respect to all of the other values?
- How is -10.25 greater than $-15\frac{2}{3}$ when 10.25 is less than $15\frac{2}{3}$?

Summary

Rational numbers, including fractions and decimals, can be compared on number lines.

DEMONSTRATE

Talk the Talk: Putting It All Together

Facilitation Notes

In this activity, students answer generalization questions to summarize their learning about positive and negative numbers on a number line.

Have students complete the Questions 1 through 4 individually and then share their responses with a partner.

Questions to ask

- How have you used 0 on the number line in this lesson?
- Does 0 on a number line always mean the quantity 0? If not, how else have you used 0 on a number line?
- What is the opposite of 4? How do you locate that value on a number line?
- What is the opposite of −2.3? How do you locate that value on a number line?
- Which rational number has a greater value, 5 or −8? Explain.
- Which rational number has a greater value, 0 or 15? Explain.
- Which rational number has a greater value, 0 or −18? Explain.
- Which rational number has a greater value, 2 or 56? Explain.
- Which rational number has a greater value, −12 or −77? Explain.
- Does your statement work for comparing any two numbers?
- Does your statement work for comparing two positive numbers? Two negative numbers?
- Does your statement work for comparing a positive number and a negative number?
- Does your statement work for comparing zero to a positive or negative number?

Summary

Rational number lines are used to compare positive and negative numbers.

Human Number Line

1

Introduction to Negative Numbers

WARM UP

Plot each number on a number line. Then, insert a $>$ or $<$ symbol to make each inequality statement true.
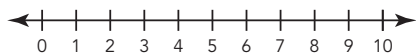
1. $\frac{3}{4}$ _____ $1\frac{1}{2}$

2. 5.6 _____ 5.06

3. 7.65 _____ 6.75

LEARNING GOALS

- Use positive and negative numbers to describe quantities having opposite directions.
- Explain the meaning of 0 in contexts represented by positive and negative numbers.
- Identify and represent a number and its opposite on a number line.
- Represent, interpret, and order positive and negative integers and other rational numbers using number lines and inequality statements.

KEY TERMS

- negative numbers
- infinity

You have used numbers equal to or greater than 0 to represent real-world situations. But how can you use numbers less than 0 to describe real-world situations?
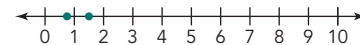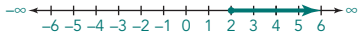
Number Line Geography

1. **What do you know about a number line?**

   ←——+—+—+—+—+—+—+—+—+—+—+—+—→

2. **Label the number line and be sure to include 0. Then plot and label a single point of your choice on the number line.**

   a. **Draw a ray, or an arrow, beginning at your point to represent the numbers larger than the value at your point.**

   b. **Draw a ray, or an arrow, beginning at your point to represent the numbers smaller than the value at your point.**

   c. **At the ends of a number line, there are arrows going in both directions. What do these arrows indicate?**

   d. **What do you think is on the number line to the left of 0?**

ACTIVITY 1.1

Investigating Time on a Number Line

Let's use a number line to represent time.

Your teacher will assign students to participate in the activity. Be sure to record what happens on the number line.

1. **For each student, plot and label the point where the student stands on the number line. Also identify what time is represented by the point.**

0
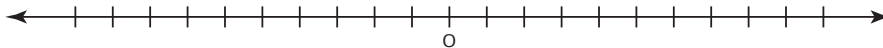
Student A: Stand at 0 to represent the time right now.
Student B: Stand at the point that represents 3 hours from now.
Student C: Stand at the point that represents 3 hours ago.
Student D: Stand at the point that represents 5 hours from now.
Student E: Stand at the point that represents 2 hours ago.
Student F: Stand at the point that represents 7 hours ago.

A number line can be created by reflecting the positive numbers across zero. The values to the left of zero on the number line are called **negative numbers** and are labeled with a negative sign. The positive values extend to positive infinity, and the 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!
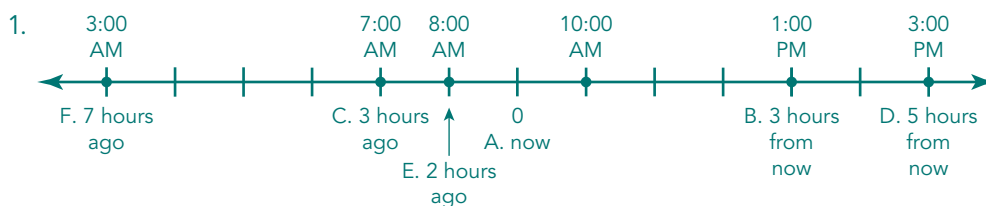
A negative number is written with a negative sign. You can write a positive number with a positive sign or without any sign. For example, positive 5 can be written as +5 or 5.

Negative infinity

−∞   −6   −5   −4   −3   −2   −1   0   1   2   3   4   5   6   ∞

Positive infinity

1.

| 3:00 AM | | | 7:00 AM | 8:00 AM | | 10:00 AM | | | 1:00 PM | 3:00 PM |

F. 7 hours ago   C. 3 hours ago   0   A. now   B. 3 hours from now   D. 5 hours from now

E. 2 hours ago
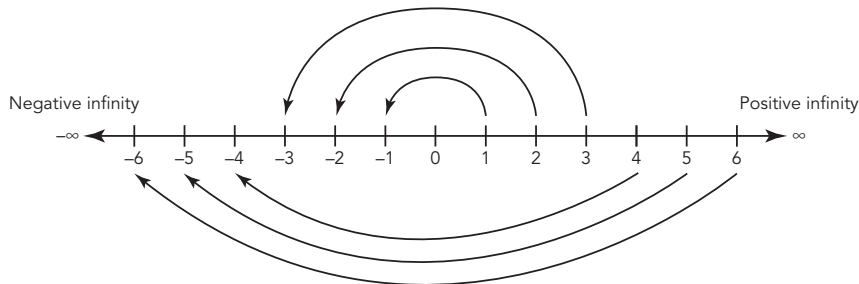
Answers

2. The numbers get larger.

3. The numbers get smaller.

4. Time in the future is represented by points to the right of the current time.

5. Time in the past is represented by points to the left of the current time.

6. The number line would be the same but each label for the actual time would be different.

7. 3 hours before now and 3 hours after now are plotted the same distance from zero.

   6 hours before now and 6 hours after now are plotted the same distance from zero.

2. **Describe the change in the values of the numbers as you move to the right on the number line.**

3. **Describe the change in the values of the numbers as you move to the left on the number line.**

Consider your class time number line.

4. **Describe the locations of the points that represent time in the future.**

5. **Describe the locations of the points that represent time in the past.**

6. **How would your number line be labeled differently from one created by a class that starts at a different time?**

7. **What observations can you make about where a given number of hours before or after time 0 is plotted? What do you notice about its distance from 0? For example, what do you notice about 3 hours before and 3 hours after now? Or 6 hours before and 6 hours after now?**

ELL Tip

Help English Language Learners understand the term *infinity* using a Concept Attainment Q&A:
- Can you think of synonyms for infinity? (forever, endless, eternity)
- What are some examples? (space, the number of numbers)
- Can you draw a picture to describe it? (a line with arrows at the end)

Representing Opposites on a Number Line

Let's think more about both sides of 0 on a number line.

Your teacher will model a number line.

1. **Create and label a number line according to the model.**

2. **Plot and label the location where each student stands on the number line. In the table, identify the value represented by the location where the student is standing.**

   Student A: Stand at 0.
   Student B: Stand at 4.5.
   Student C: Stand at the opposite of 4.5.
   Student D: Stand at −6.
   Student E: Stand at the opposite of −6.
   Student F: Stand at a location between 2 and 3.
   Student G: Stand at the location that is the opposite of Student F.

Student	Value
A	
B	
C	
D	
E	
F	
G	

3. **Describe the number line relationship of the students who were opposites of each other.**

1. Sample number line.
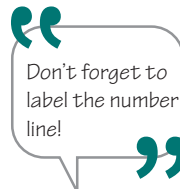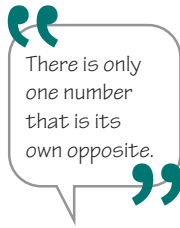
Opposite numbers are reflections of each other across 0 on the number line.

- The opposite of a positive number is a corresponding negative number.

- The opposite of a negative number is a corresponding positive number.

Attaching a negative sign to a number means reflecting that number across 0 on the number line.

> *There is only one number that is its own opposite.*

4. Use symbols to represent the opposite of 4.5 and the value it represents.

$-(4.5) = $ _____

5. Use symbols to represent the opposite of −6 and the value it represents.

$-(-6) = $ _____

6. What do you notice about the distance from 0 of corresponding opposite numbers?

> *Don't forget to label the number line!*

7. What is the opposite of 0?

8. Name the opposite of each number. Then, plot each number and its opposite on the number line.

a. $1\frac{1}{2}$ b. −5   c. −9.9
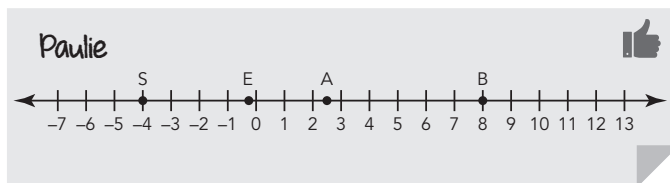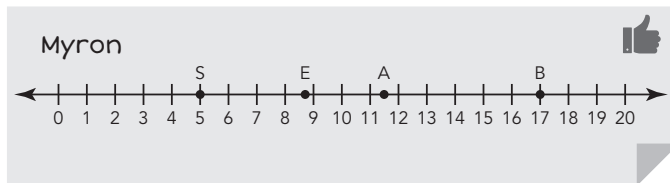
8.

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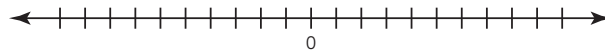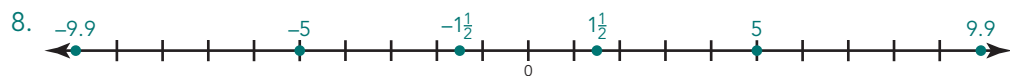
ACTIVITY
1.3

Representing Money on a Number Line

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Alyson and her friends are trying to decide if they can go to the movies. Each ticket costs $9.00. After checking their wallets, each friend comments on how much money they have.

- Alyson: I have $2.50 more than the movie costs.

- Sharon: Oh, I don't have enough money. I'm $4.00 short.

- Brian: Not only can I buy a ticket, but I have just enough money to buy the $8.00 snack combo!

- Eileen: If I can find one more quarter, I can go.

Myron and Paulie created different number lines to represent the scenario.

Myron

```
      S         E     A            B
←--+--+--+--+--●--+--+--+--●--+--●--+--+--+--+--+--●--+--+--+--→
   0  1  2  3  4  5  6  7  8  9  10 11 12 13 14 15 16 17 18 19 20
```

Paulie

```
         S         E     A            B
←--+--+--●--+--+--+--●--+--●--+--+--+--●--+--+--+--+--+--→
  −7 −6 −5 −4 −3 −2 −1  0  1  2  3  4  5  6  7  8  9  10 11 12 13
```

Analyze each representation of the scenario.

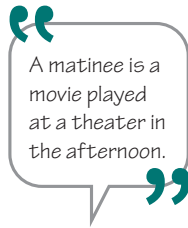**1. What does each point represent on Myron's number line?**

2. What does each point represent on Paulie's number line?
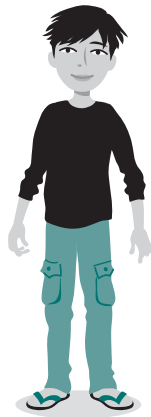
3. Myron and Paulie are thinking about 0 differently. Explain what 0 represents on each number line.

> A matinee is a movie played at a theater in the afternoon.

4. Suppose the four friends decide to go to a matinee instead, where the ticket price is $7.50.

   a. How would Myron's number line change?

   b. How would Paulie's number line change?

Temperature Connection

Number lines can also be vertical, like a thermometer or a measure of elevation.

1. **Discuss and write a sentence to describe the meaning of each statement.**

   a. **The weather forecaster predicts the temperature will be below zero.**

   b. **A submarine travels at 3000 feet below sea level.**

   c. **Badwater Basin in Death Valley, California, is 86 meters below sea level.**

2. **Mark each temperature on the thermometer shown.**

   a. **The highest temperature on record in the United States is 134°F. It occurred in 1913 in Death Valley, California.**

   b. **The lowest temperature on record is −80°F. It occurred at Prospect Creek Camp, Alaska.**

   c. **The lowest temperature recorded in the contiguous 48 states is −70°F. It occurred in Montana.**

   d. **The highest winter average temperature in the United States is 78°F, which occurs in Honolulu, Hawaii.**

140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80

°F
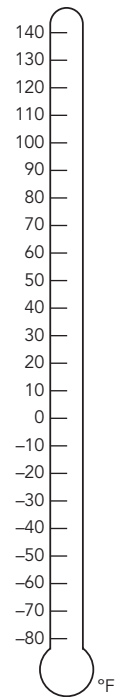
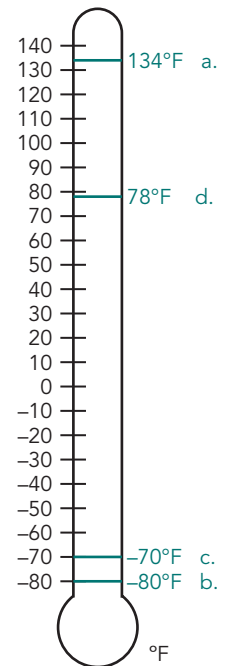**Answer**

Sample answers.

1a. The temperatures will be negative.

1b. The submarine travels 3000 feet below the sea or at a height of −3000 feet.

1c. Badwater Basin is at an elevation of −86 meters.

2.

140
130 —— 134°F   a.
120
110
100
90
80 —— 78°F   d.
70
60
50
40
30
20
10
0
−10
−20
−30
−40
−50
−60
−70 —— −70°F   c.
−80 —— −80°F   b.

°F

Answers

3. The lowest temperature in Alaska is colder than the lowest temperature in Montana because −80 is below −70 on the vertical number line.

4. Eric is correct. On a vertical number line, numbers further up the number line have a greater value, regardless of the distance from 0 of the two numbers.

5.
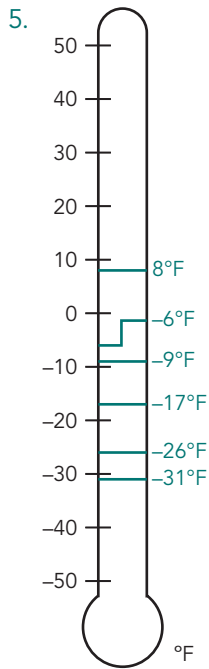
5a. −26°F > −31°F

5b. −6°F > −17°F

5c. −9°F < 8°F

6. −40°F, −33°F, −5°F, 0°F, 25°F, 67°F, 105°F

---

3. Which is colder, the lowest temperature recorded in Alaska or the lowest temperature recorded in Montana? How do you know?

4. Yadi and Eric were comparing 25 degrees to −27 degrees.

   - Yadi wrote 25 < −27 and justified her comparison by stating that the further a number is from zero, the greater the number.

   - Eric wrote 25 > −27 and justified his comparison by stating that the greater temperature will be above the second temperature on a thermometer.

   Who is correct? Explain your choice.
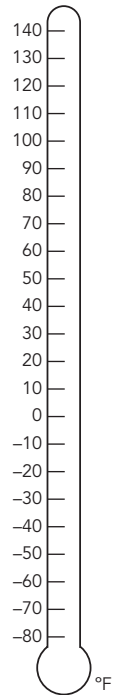
5. Plot each set of temperatures on the thermometer. Then insert a > or < symbol to make each number sentence true.

   a. −26°F _____ −31°F

   b. −6°F _____ −17°F

   c. −9°F _____ 8°F

6. Order the temperatures from least to greatest.

   25°F   −33°F   0°F   105°F   −40°F   −5°F   67°F

1a. See below.

1b. 0 is when Helen and Grace have a balance of $0 in their account.

1c. Week 7

1d. Week 4

2a. Week 1 > Week 5 or 159 > −156. Helen and Grace had a balance of $159 at the end of Week 1 but owed the bank $156 at the end of Week 5.

2b. Week 4 < Week 6 or −456 < −12. Helen and Grace owed the bank more money, $456, at the end of Week 4 than they did at the end of Week 6, $12.

ACTIVITY 1.5

Comparing and Ordering Rational Numbers

Helen and Grace started a company called Top Notch. They check the company's bank balance at the end of each week. The table shown represents the first 10 weeks of operation. Overdrafts, or weeks when they owe the bank money, are represented by amounts within parentheses. For example, ($25) denotes an overdraft of $25; they owe the bank $25. Amounts that are not in parentheses are when they made money.

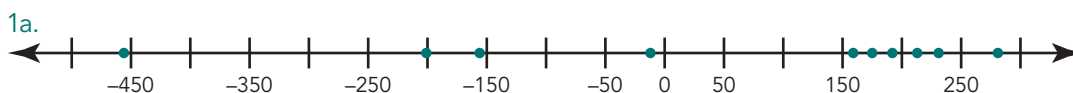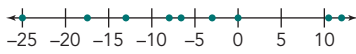| Week	1	2	3	4	5	6	7	8	9	10
Balance	$159	($201)	$231	($456)	($156)	($12)	$281	$175	$192	$213
+/− Number										
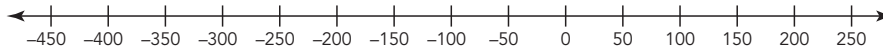
1. Use the table and number line to answer each question.

   a. Write each as a positive or negative number and then plot the number on the number line.

   b. What does 0 represent in this situation?

   c. In which week did they have the highest bank balance?

   d. In which week did they show greatest overdraft?

2. For each pair of weeks, write an inequality statement to compare the positive and negative numbers. Interpret the statement in context.

   a. Week 1 and Week 5   b. Week 4 and Week 6

1a.

Answers

3a.

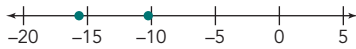3b. −20 has the least value. It is the value farthest to the left on the number line.
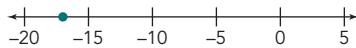
3c. 12 has the greatest value. It is the value farthest to the right on the number line.

3d. $-20, -17\frac{1}{2}, -13, -7.98,$ $-6\frac{2}{3}, -3, 0, 10.5, 12$

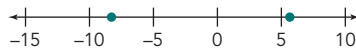4a. $-10.25 \quad > \quad -15\frac{2}{3}$

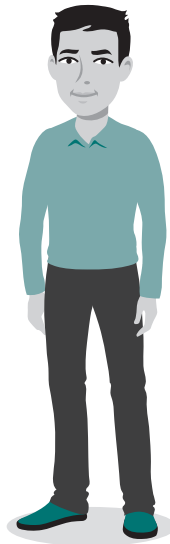4b. $-17 \quad = \quad -17$

4c. $5\frac{2}{3} \quad > \quad -8.28$

You can compare different types of numbers by plotting the numbers on a number line.

3. **Use the number line to answer each question.**

    a. **Plot each value on the number line.**

    $$-6\frac{2}{3} \quad -20 \quad 0 \quad 10.5 \quad -17\frac{1}{2} \quad -7.98 \quad 12 \quad -3 \quad -13$$
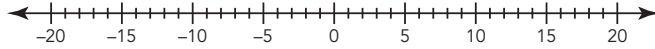
    b. **Which of the numbers has the least value? How do you know?**

    c. **Which of the numbers has the greatest value? How do you know?**

    d. **Order the numbers from least to greatest.**

4. **Plot each rational number on the number line. Then, insert a >, <, or = symbol to make each number sentence true.**

    a.   **−10.25 _____ $-15\frac{2}{3}$**

    b.   **−17 _____ −17**

    c.   **$5\frac{2}{3}$ _____ −8.28**

> *How do you know which rational number is greater by looking at the number line?*

TALK the TALK

Putting It All Together

1. What does 0 mean on a number line?

2. What does *opposite* mean in terms of a number line?

3. Compare the types of numbers. Use what you know about number lines to explain your reasoning.

   a. Which is greater—a negative or a positive rational number?

   b. Which is greater—zero or any positive rational number?

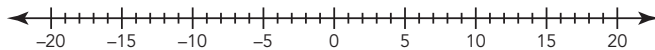   c. Which is greater—zero or any negative rational number?

   d. How do you decide which of two numbers is greater if both numbers are positive?

   e. How do you decide which of two numbers is greater if both numbers are negative?

Answers

1. 0 is the benchmark on a number line. All values to the right are positive and all values to the left are negative.

2. On a number line, opposites are on opposite sides of 0 and the same distance from 0.

Sample answers.

3a. A positive rational number is greater because it is farther to the right.

3b. A positive rational number is greater because it is always to the right of 0.

3c. Zero is greater because it is always to the right of the negative numbers.

3d. The number that is farther to the right is always greater.

3e. The number that is farther to the right is always greater.

Answers

4. To compare two numbers, compare their locations on a number line. The number that is farther to the right (or higher on a vertical number line) is the greater number.

NOTES

4. Your sixth grade cousin goes to school in a different state. His math class has not yet started comparing integers. Write him an email explaining how to compare any two numbers. Be sure to include 1 or 2 examples and enough details that he will be able to explain it to his class.

Assignment

Write

Write a sentence to explain the relationship between *opposites* and *negative numbers.*

Remember

The rational number line is used to represent positive numbers, negative numbers, and zero. The values to the left of zero on the number line are reflections of the values on the right across 0.

Practice

1. Plot each number and its opposite on the number line.
   a. -1
   b. 0.1
   c. $1\frac{3}{4}$
   d. -1.9
   e. 0.009

2. Order the numbers from least to greatest.

   $0.125 \quad 1\frac{1}{5} \quad -\frac{4}{9} \quad \frac{4}{11} \quad -\frac{3}{2} \quad -2.75$

3. The Ravine Flyer II is a steel and wood roller coaster that takes advantage of the terrain in Erie, PA, to make the ride more exciting. Although the coaster is only 80 feet high, it follows the line of a cliff in order to drop to -35 feet (0 represents the height of the cliff).
   a. Plot the highest and lowest points of the roller coaster on a vertical number line.
   b. Explain why a vertical number line better represents the problem context than a horizontal number line.
   c. How many total feet does the roller coaster drop?

4. The Monster is a roller coaster that uses a design similar to the Ravine Flyer II. The Monster reaches a height of 120 feet, but then drops to -25 feet. Order the highest and lowest points of the two roller coasters from least to greatest.

5. An amusement park wants to design a coaster that rises 60 feet above ground and then drops the same distance below ground through a tunnel. Represent the underground depth with a number, and explain its relationship with the above ground height.

Assignment Answers

Write

Answers will vary.
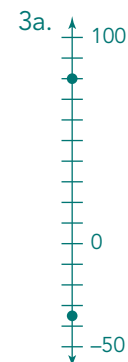
Practice

1. See below
1a. -1, 1
1b. 0.1, -0.1
1c. $1\frac{3}{4}$, $-1\frac{3}{4}$
1d. -1.9, 1.9
1e. 0.009, -0.009

2. $-2.75 \quad -\frac{3}{2} \quad -\frac{4}{9} \quad 0.125$
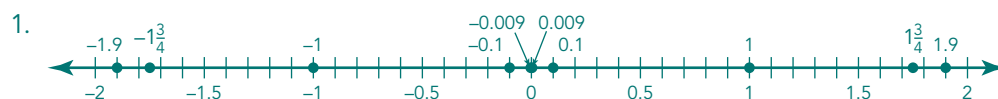 $\frac{4}{11} \quad 1\frac{1}{5}$

3a.

3b. A vertical number line better represents the problem context than a horizontal number line because the problem deals with height above and below ground level.

3c. The roller coaster drops a total of 115 feet.

4. -35, -25, 80, 120

5. The depth underground would be represented by -60. This integer is the opposite of 60, the above ground height.

1.

Assignment Answers
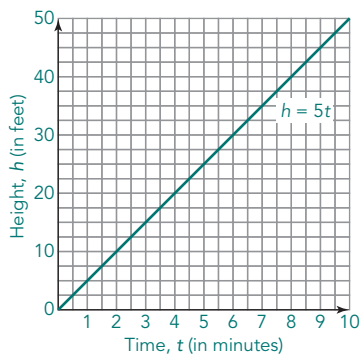
Stretch

Answers will vary.

Review

1. The total number of words typed is the dependent quantity. The total number of minutes Terrence types is the independent quantity.

2. The total weekly wages is the dependent quantity. The total number of hours worked by the employees is the independent quantity.

3. A mountain climber is ascending a mountain at a rate of 5 feet per minute.

   t = time in minutes

   h = height that the climber ascends in feet

   $h = 5t$

4. $17\frac{7}{15}$

5. $4\frac{1}{2}$

Stretch

Create a new situation, similar to Activity 1.3 *Representing Money on a Number Line*, in which zero can have two different meanings.

Review

Name the two quantities that are changing in each and determine which quantity is the dependent quantity and which is the independent quantity.

1. Terrence types 80 words per minute.
2. To determine the total weekly wages of his employees, Mr. Jackson multiplies the total number of hours his employees work by $12.
3. A mountain climber is ascending a mountain at a rate of 5 feet per minute. Define variables and write an equation that represents the situation. Graph the equation on a coordinate plane.

Perform the indicated operation.

4. $11\frac{4}{5} + 5\frac{2}{3}$

5. $\frac{27}{4} \div \frac{3}{2}$