Lesson 11: Absolute Value—Magnitude and Distance

Student Outcomes

- Students understand the absolute value of a number as its distance from zero on the number line.
- Students use absolute value to find the magnitude of a positive or negative quantity in a real-world situation.

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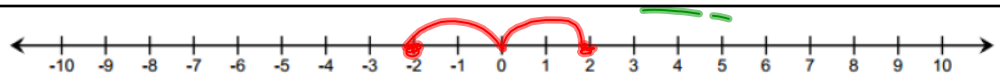
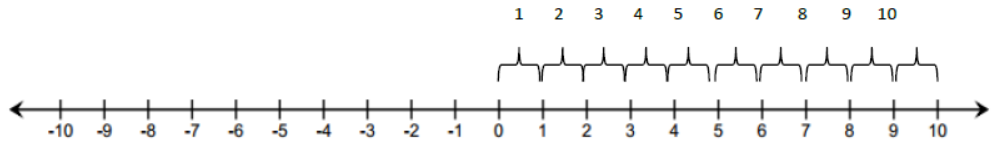


$|-2| = 2$ $|2| = 2$

Example 1: The Absolute Value of a Number

The absolute value of ten is written as: $|10|$. On the number line, count the number of units from 10 to 0. How many units is 10 from 0? $|10| =$ 10



What other number has an absolute value of 10? Why?

$|-19| = 19$ $|-10| = 10$ $|5| = 5$

The **absolute value** of a number is the distance between the number and zero on the number line.

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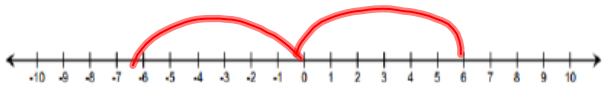
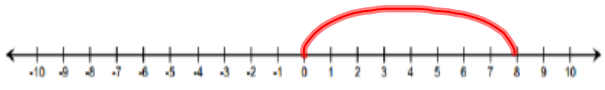
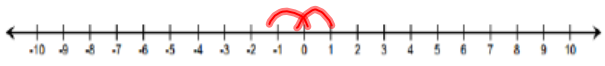
Exercises 1–3

Complete the following chart.

	Number	Absolute Value	Number Line Diagram	Different Number with the same Absolute Value
1.	−6	|−6|=6		6
2.	8	|8|=8		−8
3.	−1	|−1|=1		1

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Example 2: Using Absolute Value to Find Magnitude

Mrs. Owens received a call from her bank because she had a checkbook balance of −45 dollars. What was the magnitude of the amount overdrawn?

$|-45| = 45$

The magnitude of a quantity is found by taking the absolute value of its numerical part

Exercises 4–8

For each scenario below, use absolute value to determine the magnitude of each quantity.

4. Maria was sick with the flu and her weight change as a result of it is represented by −4 pounds. How much weight did Maria lose?

$|-4| = 4$ lbs lost

5. Jeffrey owes his friend $5. How much is Jeffrey's debt?

$|-5| = \$5$ owed

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6. The elevation of Niagara Falls, which is located between Lake Erie and Lake Ontario, is **326** feet. How far is this above sea level?

7. How far below zero is −16 degrees Celsius?

8. Frank received a monthly statement for his college savings account. It listed a deposit of \$100 as +100.00. It listed a withdrawal of \$25 as −25.00. The statement showed an overall ending balance of \$835.50. ~~How much money did Frank add to his account that month~~? ~~How much did he take out~~? What is the total amount Frank has saved for college?

$|100| = \$100$ added to acct.

$|-25| = \$25$ taken out

$|835.50| = \$835.50$ saved

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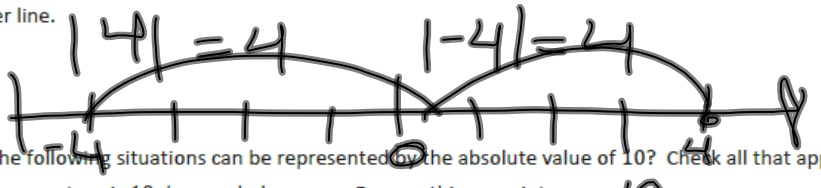
Exercises 9–19

9. Meg is playing a card game with her friend Iona. The cards have positive and negative numbers printed on them. Meg exclaims: "The absolute value of the number on my card equals 8!" What is the number on Meg's card?

$|-8| = 8$ or $|8| = 8$

10. List a positive and negative number whose absolute value is greater than 3. Explain how to justify your answer using the number line.



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11. Which of the following situations can be represented by the absolute value of 10? Check all that apply.

___ The temperature is 10 degrees below zero. Express this as an integer. −10

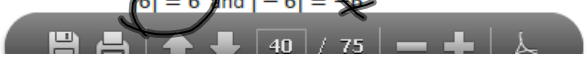
X Determine the size of Harold's debt if he owes \$10.

X Determine how far −10 is from zero on a number line. 10

X 10 degrees is how many degrees above zero?

12. Julia used absolute value to find the distance between 0 and 6 on a number line. She then wrote a similar statement to represent the distance between 0 and −6. Below is her work. Is it correct? Explain.

$|6| = 6$ and $|-6| = -6$



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13. Use absolute value to represent the amount, in dollars, of a $238.25 profit.

14. Judy lost 15 pounds. Use absolute value to represent the number of pounds Judy lost.

15. In math class, Carl and Angela are debating about integers and absolute value. Carl said two integers can have the same absolute value and Angela said one integer can have two absolute values. Who is right? Defend your answer.

$|-7|=7$ $|7|=$
$|7|=7$

16. Jamie told his math teacher: "Give me any absolute value, and I can tell you two numbers that have that absolute value." Is Jamie correct? For any given absolute value, will there always be two numbers that have that absolute value?

$|16|=16$ -15
$|-16|=16$

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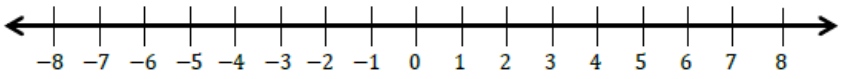
17. Use a number line to show why a number and its opposite have the same absolute value.



18. A bank teller assisted two customers with transactions. One customer made a $25.00 withdrawal from a savings account. The other customer made a $15 deposit. Use absolute value to show the size of each transaction. Which transaction involved more money?

19. Which is farther from zero: $-7\frac{3}{4}$ or $7\frac{1}{2}$? Use absolute value to defend your answer.

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For each of the following two quantities in problems 1–4, which has the greater magnitude? (Use absolute value to defend your answers.)

1. 33 dollars and −52 dollars $|33|=33$ $|-52|=52$

2. −14 feet and 23 feet

3. −24.6 pounds and −24.58 pounds

4. $-11\frac{1}{4}$ degrees and 11 degrees

For problems 5–7, answer true or false. If false, explain why.

5. The absolute value of a negative number will always be a positive number.

6. The absolute value of any number will always be a positive number.

7. Positive numbers will always have a higher absolute value than negative numbers.

8. Write a word problem whose solution is: $|20| = 20$.

9. Write a word problem whose solution is: $|-70| = 70$.

10. Look at the bank account transactions listed below and determine which has the greatest impact on the account balance. Explain.
    i. A withdrawal of $60.
    ii. A deposit of $55.
    iii. A withdrawal of $58.50.

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1. Jessie and his family drove up to a picnic area on a mountain. In the morning, they followed a trail that led to the mountain summit, which was 2,000 feet above the picnic area. They then returned to the picnic area for lunch. After lunch, they hiked on a trail that led to the mountain overlook, which was 3,500 feet below the picnic area.

   a. Locate and label the elevation of the mountain summit and mountain overlook on a vertical number line. The picnic area represents zero. Write a rational number to represent each location.

   picnic area: 0

   mountain summit: _____

   mountain overlook: _____

   b. Use absolute value to represent the distance on the number line of each location from the picnic area.

   Distance from the picnic area to the mountain summit: _____

   Distance from the picnic area to the mountain overlook: _____

   c. What is the distance between the elevations of the summit and overlook? Use absolute value and your number line from part (a) to explain your answer.

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Lesson 12: The Relationship Between Absolute Value and Order

Student Outcomes

- Students understand that the order of positive numbers is the same as the order of their absolute values.
- Students understand that the order of negative numbers is the opposite order of their absolute values.
- Students understand that negative numbers are always less than positive numbers.

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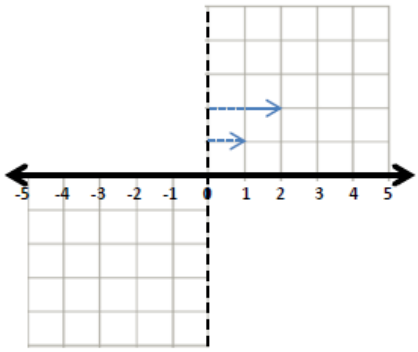
Example 2: The Order of Negative Integers and their Absolute Values

Draw arrows starting at the dashed line (zero) to represent each of the integers shown on the number line below. The arrows that correspond with 1 and 2 have been modeled for you.



As you approach zero from the left on the number line, the integers _____, but the absolute values of those integers _____. This means that the order of negative integers is _____ the order of their absolute values.

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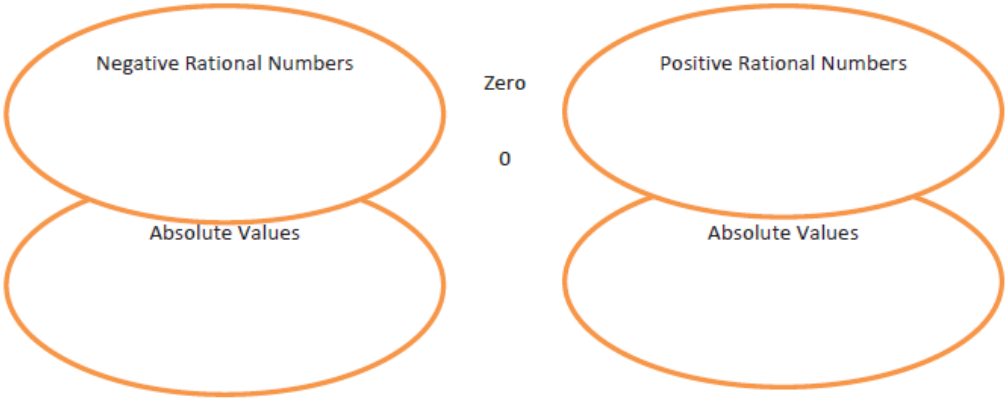
Exercise 1

Complete the steps below to order these numbers:

$$\left\{2.1, -4\frac{1}{2}, -6, 0.25, -1.5, 0, \quad 3.9, -6.3, -4, 2\frac{3}{4}, \quad 3.99, -9\frac{1}{4}\right\}$$

a. Separate the set of numbers into positive and negative values and zero in the top cells below.

b. Write the absolute values of the rational numbers (order does not matter) in the bottom cells below.



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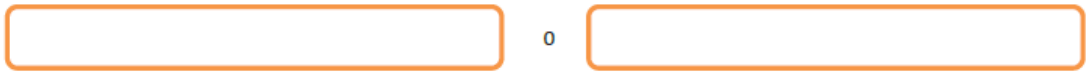
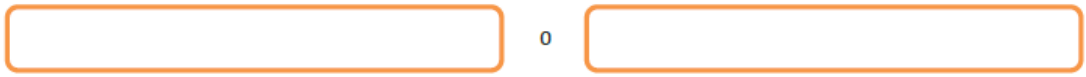
c. Order each subset of absolute values.



d. Order each subset of rational numbers.



e. Order the whole given set of rational numbers.

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Exercise 2

a. Find a set of four integers such that their order and that of the order of their absolute values is the same.

b. Find a set of four integers such that their order and the order of their absolute values are opposite.

c. Find a set of four non-integer rational numbers such that their order and the order of their absolute values is the same.

d. Find a set of four non-integer rational numbers such that their order and the order of their absolute values are opposite.

e. Order all of your numbers from parts (a)–(d) in the space below. This means you should be ordering 16 numbers from least to greatest.

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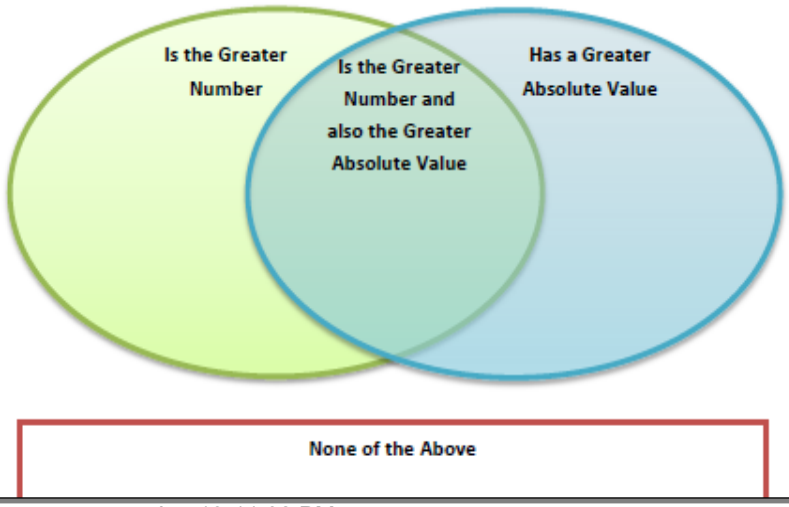
Problem Set

1. Micah and Joel each have a set of five rational numbers. Although their sets are not the same, their sets of numbers have absolute values that are the same. Show an example of what Micah and Joel could have for numbers. Give the sets in order and the absolute values in order.

   Enrichment Extension: Show an example where Micah and Joel both have positive and negative numbers.

2. For each pair of rational numbers below, place each number in the Venn diagram based on how it compares to the other.
   a. $-4, -8$
   b. $4, 8$
   c. $7, -3$
   d. $-9, 2$
   e. $6, 1$
   f. $-5, 5$
   g. $-2, 0$



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