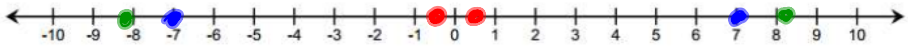
Lesson 11: Absolute Value—Magnitude and Distance

Classwork

Opening Exercise

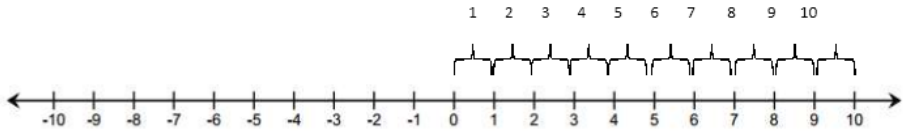
They are opposites.



Each pair is an equal distance from zero.

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



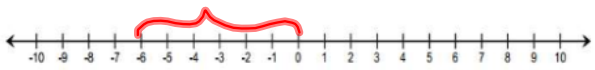
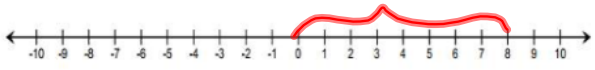
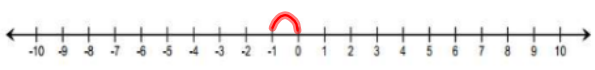
What other number has an absolute value of 10? Why?

|−10| = 10 It is 10 units from zero.

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

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

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?

$|-45|=45$ Mrs. Owens overdrew her checking account by $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?

$|-4|=4$ Maria lost 4 pounds.

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

$|-5|=5$ Jeffery has a $5 debt.

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?

$|326| = 326$ It is 326 feet above sea level.

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

$|-16| = 16$ $-16^{\circ}C$ is 16 degrees below zero.

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?

$|100| = 100$
$|-25| = 25$
$|835.50| = 835.50$ Frank added \$100 to his account. Frank took \$25 out of his account. His total savings is \$835.50

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?

$|-8| = 8$
$|8| = 8$
Meg has eith an 8 or -8 on her card.

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

$|-4| = 4$
$|6| = 6$
The distance from zero of either number is more than 3.

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
✓ ___ Determine the size of Harold's debt if he owes \$10.
✓ ___ Determine how far −10 is from zero on a number line.
✓ ___ 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 $|-6| = -6$

No, The distance from zero is 6, whether you start a 6 or -6.

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

$|238.25| = 238.25$

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

$|-15| = 15$

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.

Carl is right. An integer and its opposite are the same distance from zero.

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? No, Jamie is not correct because zero is its own opposite. Only one number has an absolute value of 0, and that would be 0,

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

A number and its opposite are the same distance from zero, but on opposite sides. An example is 5 and -5. These numbers are both 5 units from zero. Their distance is the same, so they have the same absolute value, 5.

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? The $25 withdrawl involved more money.

$|-25| = 25$

$|15| = 15$

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

The number that is farther from 0 is $-7\frac{3}{4}$.

$|-7\frac{3}{4}| = 7\frac{3}{4}$ $|7\frac{1}{2}| = 7\frac{1}{2}$

Problem Set

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

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.