Absolute Value

PLUG IN — Understanding Absolute Value

The **absolute value** of a number is its distance from 0 on a number line.

$|-5|$ means "the absolute value of -5."

You can use a **number line** to help you find the absolute value of a number.
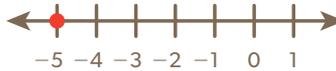
The point is on -5 on the number line.

The distance from -5 to 0 is 5 units. That means the absolute value of -5 is 5.
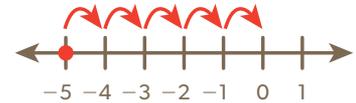
$|-5| = 5$

I can think of absolute value as a distance.

Count the number of units from the point to 0.

I get it! Since a distance is always positive, the absolute value of a number is always positive.

Words to Know

absolute value
a number's distance from 0 on a number line

$|-3|$ means "the absolute value of -3."

number line
a line that shows numbers placed in order
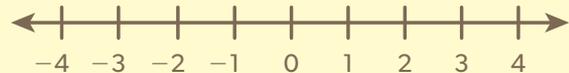
DISCUSS Can an absolute value be 0? Explain.

A You can find the absolute value of a positive number.

DO Find $|7|$.

1 Plot the number 7 on a number line.

2 Count the number of units to 0.

3 This distance is the absolute value.

Think: I need to find the absolute value of ___**7**___.

There are _____ units from 0 to 7.

$|7| =$ _____

B You can find the absolute value of a negative number.

DO Find |−10|.

1 Draw a point on a number line for −10.

2 Count the number of units to 0.

3 This distance is the absolute value.

Think: I need to find the absolute value of __−10__.
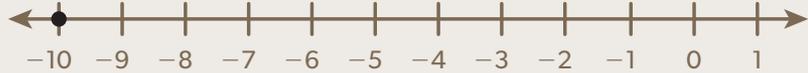
There are _____ units from −10 to 0.

|−10| = _____

I get it! Taking the absolute value of a positive number doesn't change the number. Taking the absolute value of a negative number makes it positive.

C You can find the absolute value of a number by keeping or changing its sign.

DO Find |12| and |−50|.

1 Think about the meaning of absolute value.

2 Write the absolute values.

The absolute value of a number is always ___**positive**___.

Since 12 is already positive, to find |12| remove the absolute value symbols and _____ its sign.

Since −50 is negative, to find |−50| remove the absolute value symbols and change its sign from _____ to _____.

|12| = _____ and |−50| = _____

PRACTICE

Draw a point on a number line to show the integer and find its absolute value.

1 |4| = _____

2 |−2| = _____
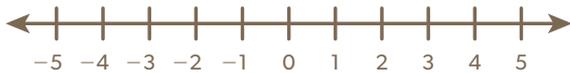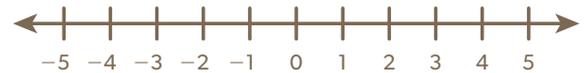
Find the absolute value of the integer.

3 |−8| = _____

4 |15| = _____

5 |−126| = _____

Finding Opposites on a Number Line

Negative numbers are to the left of 0 and **positive numbers** are to the right of 0.

$$|-5| = 5$$
$$|5| = 5$$

$$-5 \quad -4 \quad -3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5$$
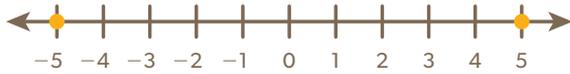
Numbers are **opposites** when they have the same absolute value but are on different sides of 0.

The numbers 5 and -5 both have an absolute value of 5. They are both 5 units away from 0. -5 and 5 are opposites.

$$-5 \quad -4 \quad -3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5$$
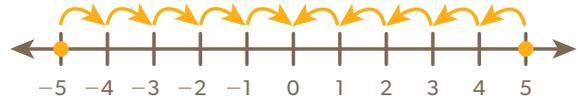
> Positive and negative numbers are on opposite sides of zero on the number line.

> I get it! The numbers 5 and -5 are both 5 units from 0 on the number line, but have opposite signs.

Words to Know

positive number	negative number	opposites
a number greater than zero	a number less than zero	numbers that have the same absolute value but different signs
15	-15 read as "negative fifteen"	15 and -15 are opposites.

DISCUSS Does every whole number, fraction, integer, and decimal except 0 have an opposite? Explain.

A You can use a number line to find the opposite of a positive number.

DO Find the opposite of 7.

1. Determine which side of 0 the given number is on. Draw a point.

The number 7 is ___**7**___ units to the _____ of 0.

$$-8 \quad -7 \quad -6 \quad -5 \quad -4 \quad -3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8$$

2. Count the same number of units in the opposite direction from 0 and draw a point.

To find its opposite, count _____ units to the _____ of 0.

3. Write the answer.

The opposite of 7 is _____.

B You can use a number line to find the opposite of a negative number.

DO Find the opposite of −4.

The opposite of a positive number is negative, and the opposite of a negative number is positive.

1 Determine which side of 0 the given number is on. Draw a point.

The number −4 is ____4____ units to the _____ of 0.

−6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6

2 Count the same number of units in the opposite direction from 0 and draw a point.

To find its opposite, count _____ units to the _____ of 0.

The opposite of −4 is _____.

3 Write the answer.

DISCUSS On the number line below, locate a number (other than 0) and its opposite. What is the opposite of the opposite of your original number? Explain.

−8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8
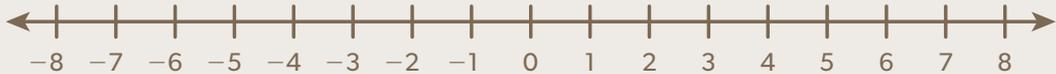
PRACTICE

Find the opposite of the number shown on the number line.

1

−5 −4 −3 −2 −1 0 1 2 3 4 5
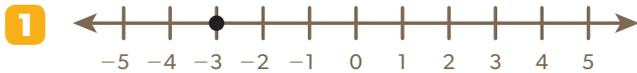
The opposite of −3 is _____.

2

−5 −4 −3 −2 −1 0 1 2 3 4 5

The opposite of 2 is _____.

Plot the number on the number line. Then, find its opposite and plot it on the number line.

3 −8   The opposite of −8 is _____.

−10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10

4 6   The opposite of 6 is _____.

−10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10
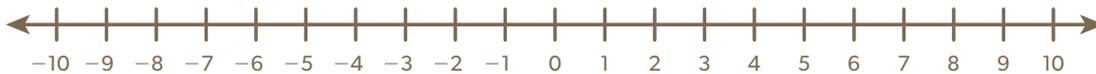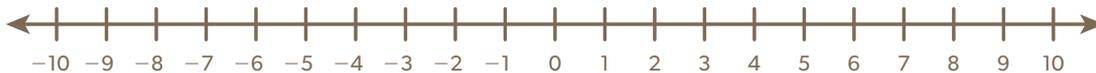
Use the number line to find the opposite of the opposite of the given number.

5 The opposite of the opposite of 12 is _____.

−15 −14 −13 −12 −11 −10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
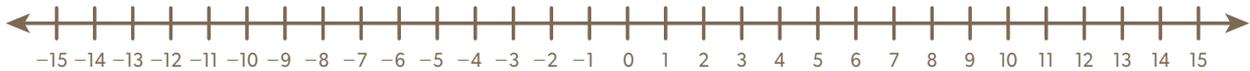
You can find the absolute values of all **rational numbers**, which include integers.

The numbers you work with in the real world are often rational numbers.

You can use absolute value to find and compare distances from a reference point.

The elevation 35.5 feet is 35.5 feet above sea level.

The elevation −35.5 feet is 35.5 feet below sea level.

The reference point is 0 feet, or sea level.

You can use the absolute value of a number to describe its size, or its distance from a reference point.

35.5 feet and −35.5 feet are both 35.5 feet from sea level, but in opposite directions.

> The absolute value of a rational number is its distance from 0!

> I get it! I can use the absolute value of a real-world quantity to describe it in real terms.

Words to Know

rational number

a number that can be written as a ratio of two integers

$0.75, -15, 0, 7\frac{1}{2}, -2.5, \frac{7}{9}$

DISCUSS Describe the temperature −4°F, using its absolute value. What is the reference point in this case?

LESSON LINK

PLUG IN

A number line can help you find the absolute value of a number.

$$|-2| = 2$$

POWER UP

A number line can help you find opposite numbers.

−2 and 2 are opposites.

GO!

> I see! I can use absolute value to describe positive and negative rational numbers in real-world situations!

The absolute value of the negative balance describes the size of her debt!

WORK TOGETHER

You can describe a real-world situation using absolute value.

- A balance of −$35.23 means negative 35 dollars and 23 cents.

- The absolute value of −35.23 is 35.23.

- The reference point is a balance of 0, where Jeanne would have no money in her account and not owe the bank any money, either.

- Jeanne has a debt of $35.23.

Jeanne spent more money than she had in her bank account, and her balance is now −$35.23. How much does Jeanne owe the bank?

$$|-35.23| = 35.23$$

A negative balance means money owed. The balance of −$35.23 means that Jeanne owes the bank $35.23.

A Use absolute value to describe the situation.

DO A treasure chest is buried at −25 feet. How many feet below the ground is the treasure chest?

1 Determine the reference point.

The reference point is _____.

2 Find the distance from the reference point.

The distance from the reference point is the absolute value of −25.

3 Describe the situation.

$$|-25| = \underline{\quad\quad}$$

The treasure chest is _____.

B Write a positive or negative number for the situation described.

DO Bjorn wrote a check for $45.85 to the electric company. Write a number to represent the change in Bjorn's checking account.

1 Determine the reference point.

The reference point is $_____, which would represent no change to Bjorn's account.

2 Determine the distance from the reference point.

The distance from the reference point is _____.

3 Determine whether the distance is in a positive or negative direction.

The amount on the check will be taken from Bjorn's checking account and given to the electric company. So, Bjorn's account is losing the money. The number should be _____.

4 Write a number.

The number to describe the situation is _____.

DISCUSS When dealing with a bank account, a credit is money added to the account and a debit is money taken out. For the terms *credit* and *debit*, which would be described by a positive number and which would be described by a negative number?

PRACTICE

Find the absolute value of the number represented by the point on the number line.

1

The absolute value is _____.

2

The absolute value is _____.

Find the absolute value of the number.

3 $|45.2| = $ _____

4 $\left|-124\frac{1}{2}\right| = $ _____

> **REMEMBER**
> The absolute value of a number is always positive.

Determine the reference point. Use absolute value to describe the situation.

5 A kite flies up 30 feet. How far is the kite from the ground?

The reference point is _____.

$|30| = $ _____

The kite is _____ feet from the ground.

> **HINT**
> The distance is the absolute value of the number.

6 A giant squid swims at -800 feet. How far is the squid from the surface of the ocean?

The reference point is _____.

$|-800| = $ _____

The squid is _____ feet from the surface.

Determine the reference point. Describe the situation.

7 Hafid agrees to pay his neighbor $25 for mowing his lawn.

The reference point is _____.

_____

8 Janna bakes a cake in an oven that is 350°F.

The reference point is _____.

_____

Write a positive or negative number for the situation described.

9 The temperature is 12°F below zero.

The temperature is _____°F.

10 A hot-air balloon is 150 feet in the air.

The hot-air balloon's elevation is _____ feet.

Write a positive or negative number to describe each person's account balance.

11 Cole owes the bank $21.15. _____

12 Dominic opened a bank account by depositing a check for $250. _____

> I know! A deposit means putting money into the bank.

Use absolute value to represent each situation. Then solve.

13 Gail's checking account shows a balance of −65.34. How much debt does Gail show in her checking account? _____

14 The depth of a lake was written as $-28\frac{1}{2}$ feet. How many feet below the surface is the bottom of the lake? _____

DISCUSS   **Putting It Together**

A hiker and a scuba diver both start at sea level. After an hour, the hiker is at an elevation of 67.5 feet, and the scuba diver is at an elevation of −88.1 feet. How can you use absolute value to explain whether the hiker or diver is farther from sea level?

PROBLEM SOLVING

DEBIT OR CREDIT?

READ

Tamila had $75.80 in her bank account. The bank credited her account $35.45 and then debited the account $40. Does her account have less than or more than $75.80 after these transactions?

PLAN

• What is the problem asking you to find?

If Tamila's account has _____ than or _____ than $_____ now

• What do you need to know to solve this problem?

The reference point is _____.

A credit is a _____ number and a debit is a _____ number.

If the |credit| is more than the |debit|, then the account has more than the reference point. If the |credit| is less than the |debit|, then the account has less than the reference point.

• How can you solve this problem?

Compare the absolute values of the _____ and _____.

SOLVE

The credit can be described by the number _____.

The debit can be described by the number _____.

Find the absolute values.

$|35.45| =$ _____ $|-40| =$ _____

Compare the absolute values.

The |credit| is _____ than the |debit|.

Tamila's account has _____ than the reference point now.

CHECK

Check the problem by using addition and subtraction.

$75.80 + $35.45 =$ _____

_____ $- $40 =$ _____.

Does Tamila's account have more than or less than $75.80? _____

> If I compare the absolute values of the credit and debit, I can solve the problem with mental math!

PRACTICE

Use the problem-solving steps to help you.

1   The ground floor of a building is floor 0. Jeremy got into the elevator and pushed the button marked 3. Alana went down one flight of stairs to the basement. Write a number to describe each person's position in the building, relative to the ground floor.

Jeremy's position can be described by the number _____.

Alana's position can be described by the number _____.

CHECKLIST
- [ ] READ
- [ ] PLAN
- [ ] SOLVE
- [ ] CHECK

2   Talia and Robert opened accounts at the same bank on the same day. After the first week, Talia's balance was $55.67 and Robert's balance was −$2.17. Use absolute value to describe each person's account balance.

CHECKLIST
- [ ] READ
- [ ] PLAN
- [ ] SOLVE
- [ ] CHECK

3   A football coach uses negative numbers for yards away from the other team's goal line. He uses positive numbers for yards closer to the other team's goal line. After the first play, the coach says that the ball's position is positive 12. What does that mean?

CHECKLIST
- [ ] READ
- [ ] PLAN
- [ ] SOLVE
- [ ] CHECK