

# Absolute Value

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Score: \_\_\_\_\_ / 18

Here is a simple but powerful idea: **absolute value** measures how far a number is from zero on the number line—not which side of zero it is on. That is why  $|-7|$  and  $|7|$  both equal 7; each sits exactly 7 units from zero. Because distance is never negative, an absolute value is always zero or positive. One common trap to watch for: if there is a minus sign *outside* the absolute-value bars, find the absolute value first, then apply the sign. Mastering this concept now will pay off every time you work with integer operations, distance, and real-world contexts like temperature change.

## Key Concepts & Quick Review

**Definition:**  $|n| =$  distance from  $n$  to 0 on the number line  $\Rightarrow |n| \geq 0$  always.

**Rule:**  $|n| = n$  if  $n \geq 0$ ;  $|n| = -n$  if  $n < 0$   
absolute value)

**Key fact:**  $|-n| = |n|$  (opposites have the same absolute value)



## Examples

① Evaluate  $-|-9|$ .

**Think It Through:** Work from the inside out. First find the absolute value:  $|-9| = 9$  because  $-9$  is 9 units from zero. Then look at the negative sign outside the bars and apply it after the absolute value is finished. That gives  $-(9) = -9$ . A negative sign outside absolute value bars does not disappear.

**Answer:**  $-9$

② Two hikers leave camp (position 0 on a trail). Hiker A walks 11 *mi* east (+11) and Hiker B walks 11 *mi* west ( $-11$ ). Use absolute value to compare the distances each hiker traveled. Then find  $|+11| - |-11|$ .

**Think It Through:** Absolute value tells distance from zero, so direction does not matter here. Hiker A traveled  $|+11| = 11$  *mi* and Hiker B traveled  $|-11| = 11$  *mi*. That means they are the same distance from camp even though they walked in opposite directions. Subtracting the two distances gives  $11 - 11 = 0$ .

**Answer:** 0; both hikers traveled equal distances



**Practice Problems**

Evaluate each expression.

- |               |       |                           |       |
|---------------|-------|---------------------------|-------|
| 1. $ -8  =$   | _____ | 9. $ -45  =$              | _____ |
| 2. $ 15  =$   | _____ | 10. $ 7  -  -7  =$        | _____ |
| 3. $- -7  =$  | _____ | 11. $ -13  +  -8  =$      | _____ |
| 4. $ -34  =$  | _____ | 12. $ -6  \cdot  -4  =$   | _____ |
| 5. $- 12  =$  | _____ | 13. $ -3 ^2 =$            | _____ |
| 6. $ 0  =$    | _____ | 14. $ 8 - 15  =$          | _____ |
| 7. $ -23  =$  | _____ | 15. $ -100  \div  -25  =$ | _____ |
| 8. $- -20  =$ | _____ |                           |       |

**Study Tips**

- 👉 Absolute value is **always**  $\geq 0$ . It measures distance, and distance is never negative.
- 👉 A negative sign *outside* the bars is applied **after** taking the absolute value:  $-|-5| = -(5) = -5$ .
- 👉 Work from the inside out: simplify what is inside  $| \cdot |$  first, then evaluate the absolute value, then apply any outside operations.

**Word Problems**

16. Two submarines depart from a dock at sea level (depth = 0). Submarine A dives to a depth of  $-340$  feet and Submarine B dives to a depth of  $-180$  feet. Use absolute value to determine which submarine is *closer* to the surface, and by exactly how many feet closer it is than the other submarine. \_\_\_\_\_
17. Alena's bank account balance was \$0 on Sunday. By Monday evening her balance had dropped to  $-\$47$ . By Tuesday evening it had dropped further to  $-\$62$ . Use absolute value to state her Tuesday balance as a positive amount owed. Then determine by how many dollars her balance changed between Monday evening and Tuesday evening, and express that change as an absolute value. \_\_\_\_\_
18. Three points  $P, Q, R$  are marked on the number line shown here. Find  $|P|, |Q|$ , and  $|R|$ . Then determine which point is *farthest* from zero, and compute  $|P| + |R|$  (the total distance from zero of the two outer points). \_\_\_\_\_



## Answer Keys

- |                                                                                                        |                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1) 8<br/>2) 15<br/>3) -7<br/>4) 34<br/>5) -12<br/>6) 0<br/>7) 23<br/>8) -20<br/>9) 45<br/>10) 0</p> | <p>11) 21<br/>12) 24<br/>13) 9<br/>14) 7<br/>15) 4<br/>16) Sub B is closer; it is 160 <i>ft</i> closer.<br/>17) Owes \$62; <math> -62 - (-47)  = \\$15</math> change.<br/>18) <math>P = -7</math>; <math>Q = -2</math>; <math>R = 5</math>; farthest from 0: <math>P</math>;<br/><math> P  +  R  = 12</math></p> |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Step-by-Step Explanations

**Strategy:** For Absolute Value, treat absolute value as distance from zero; first make the value inside the bars nonnegative, then handle any operation outside the bars. A correct solution should make clear whether the bars changed the sign or only measured distance.

**Practice 1:**  $|-8| =$  **Answer:** 8

In the opening example, evaluate absolute-value bars as distance from zero before doing any remaining operation.

**Practice 15:**  $|-100| \div |-25| =$  **Answer:** 4

For the end-of-set item, evaluate absolute-value bars as distance from zero before doing any remaining operation.

**Word-problem notes:**

**16. Answer:** Sub B is closer; it is 160 *ft* closer.

Use absolute value to compare how far each submarine is below the surface. Submarine A is  $|-340| = 340$  feet below, and Submarine B is  $|-180| = 180$  feet below. Since 180 is smaller, Submarine B is closer to the surface. The difference is  $340 - 180 = 160$  feet.

**17. Answer:** Owes \$62;  $|-62 - (-47)| = \$15$  change.

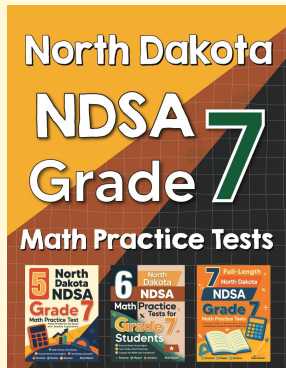
A balance of  $-\$62$  means Alena owes \$62, so the positive amount owed is \$62. To find the change from Monday to Tuesday, subtract:  $-62 - (-47) = -62 + 47 = -15$ . The negative sign shows the balance went down by 15 dollars. The size of the change is  $|-15| = \$15$ .

**18. Answer:**  $P = -7$ , so  $|P| = 7$ ;  $Q = -2$ , so  $|Q| = 2$ ;  $R = 5$ , so  $|R| = 5$ ;  $P$  is farthest from 0;  $|P| + |R| = 12$ . Read the points off the number line:  $P$  is at  $-7$ ,  $Q$  is at  $-2$ , and  $R$  is at 5. Absolute value gives the distance from zero, so  $|P| = 7$ ,  $|Q| = 2$ , and  $|R| = 5$ . The largest absolute value is 7, so  $P$  is farthest from zero. Adding the outer distances gives  $|P| + |R| = 7 + 5 = 12$ .



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