

So far, you have made connections between integer expressions and movement on a number line. Today you will use your understanding to compare expressions, to determine the values of signed numbers, and to find out which frog is farther from the starting place in a jumping contest even if the frogs hop in different directions. As you work today, keep these target questions in mind:

What does it mean for a number to be greater?

What are the ways in which I can compare two numbers?

How can I determine the distance jumped?

3-111.

Predict whether each answer below will be positive, negative, or zero. It may be helpful to visualize a number line. After you have made each prediction, find the answer to check your prediction.

a. $5-10$

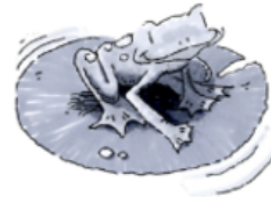
b. $-(-8)-2$

c. $-5+5$

d. $-4+15$

Prediction	Answer
-	-5
+	6
0	0
+	11

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↓ 3-112

3-112.

Lorena's bank will loan money to customers if they overdraw their accounts by less than \$100. (To overdraw an account means to have the account balance fall below zero.) Lorena started out with a balance of \$13.00 and made a withdrawal from her account of \$81.50.

- a. In the context of this story, what does a positive number mean? A negative number? Zero?

- b. Lorena's final balance is $-\$68.50$. Will the bank loan her this amount? Write a numerical inequality to show why or why not.

3-113.

Dr. Frog and Bumble Frog were in a jumping competition. Both frogs started at zero on a number line, but they had trouble jumping in the same direction consistently. Dr. Frog hopped 8 feet to the right and then 3 feet to the left. Bumble Frog hopped 9 feet to the left and then 1 foot to the right.

- a. Write expressions to represent the jumps for each frog.

$$- \text{Dr. F.} = 0 + 8 - 3$$

$$\text{B.F.} = 0 - 9 + 1$$

- b. Which frog is ahead? (That is another way of asking which frog is sitting on a larger number on the number line.) Explain.

$$\text{Dr. F.: } 8 - 3 = 5$$

$$\text{B.F.: } -9 + 1 = -8$$

- c. Imagine now that the winner of the frog-jumping contest is the frog that lands farthest from zero and that the direction the frog jumps does not matter. In this case, which frog would win? Explain. —

3-114.

When you compare jumping frogs, sometimes you want to compare the *values* of where they land. Other times, you want to compare the *distances* between the ending spots and the starting spots. In the case of the frog problems, the distance between the ending and starting spots is the distance from zero.

The numerical value of a number without regard to its sign is called the **absolute value**. Absolute value can represent the distance on a number line between a number and zero. Whether a frog is 3 feet to the left of zero on a number line (-3), or if a frog is 3 feet to the right of zero on the number line (+3), either way, the frog is still just 3 feet away from zero! This is the idea of absolute value.

Straight vertical bars around the expression or number are used to indicate the distance or absolute value of an expression or number. For example, to show that a frog's location is 3 feet right of zero, you would write $|3|=3$. To show that a frog's location is 3 feet left of zero, you would write $|-3|=3$.

- a. Mr. Wizzard started at 0 and jumped left 7 feet. Auntie Long Legs started at 0 and jumped right 5 feet. Which frog was ahead? Write an inequality statement (using $<$ or $>$) to compare the values of their landing points.

W: -7 ALL: 5 -7 < 5

- b. For each frog in part (a), write an absolute value statement that shows the distance that each frog ended up from zero. Which frog was farther from zero?

W: $|-7|=7$ ALL: $|5|=5$

$\rightarrow |-7| > |5|$

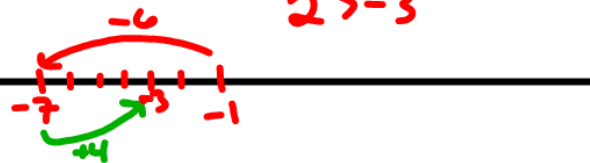
Mr. Wizzard is further from zero

- c. To find the absolute value of an expression, you put the expression into the absolute value bars. For example, in problem 3-113 you could have written $|8-3|=|5|=5$ and $|-9+1|=|-8|=8$. For the two jumping contests described in parts (i) and (ii) below:

- Find the landing point of each frog. Then compare the value of the two landing points with an inequality statement.
- Write mathematical sentences using absolute value for the distance each frog landed from zero.
- Which frog was farther from zero? Write another inequality statement.

- i. Hopping Hannover: $7-5 = 2$
GG: $-1-6+4 = -3$

$2 > -3$



- ii. Bea Major: $3-6= -3$
Dee Minor: $7-3= 4$