

Teacher Guide: Number Line Frog Hop



Learning Objectives

Students will...

- Add numbers using a number line.
- Subtract numbers using a number line.
- Decompose a two-digit number into tens and ones.
- Mentally add/subtract by first adding/subtracting the tens and then the ones.



Vocabulary

add, difference, equation, subtract, sum

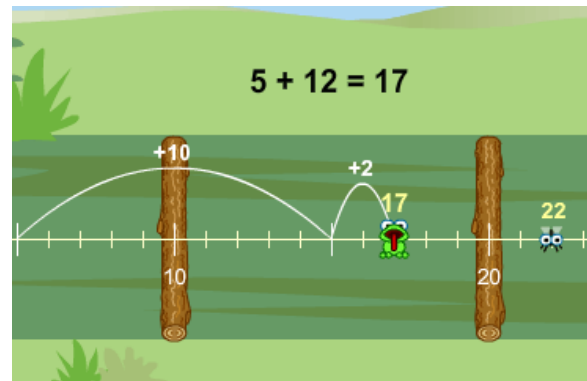


Lesson Overview

The *Number Line Frog Hop Gizmo*™ helps students explore addition and subtraction on a number line. Students control a frog who hops along the number line in a quest to catch flies.

The Student Exploration sheet contains three activities:

- Activity A – Students catch flies by moving the frog with addition and subtraction.
- Activity B – Students move a given distance along the number line by decomposing it into tens and ones.
- Activity C – Students play a game with the number line and learn a trick for mentally adding or subtracting a two-digit number.



Suggested Lesson Sequence

1. **Pre-Gizmo activity** (🕒 10 – 15 minutes)

Draw a line on the chalkboard. Explain that the line represents a path from one place to another. The length of the path is 12 miles. Ask, “If we want to make the trip in two days, how far would we go each day?” Have students come up with several possibilities. Then change the trip so that it lasts three days. Have students list possible distances for each day. Have them share their answers by drawing them as jumps on the chalkboard.

Then challenge your class by asking, “At the end of the trip, you realize that you left your sweater back where you stopped on Day 1. How far back do you need to go to get it?”

2. **Prior to using the Gizmo** (🕒 10 – 15 minutes)

Before students are at the computers, pass out the Student Exploration sheets and ask students to complete the Prior Knowledge Questions. Discuss student answers as a class. After discussing the Prior Knowledge Questions, use a projector (if possible) to introduce the Gizmo and demonstrate its basic operations.

3. **Gizmo activity** (🕒 15 – 20 minutes per activity)
Assign students to computers. Students can work individually or in small groups. Have students work part of the Student Exploration sheet using the Gizmo. Alternatively, you can use a projector and do the Exploration as a teacher-led activity.

It may be overwhelming for students to do all of the activities in the Student Exploration in one sitting. We recommend starting with the first page of the Student Exploration sheet (Prior Knowledge Questions and Gizmo Warm-up) plus one of the three activities. Extend the lesson if you want using the extensions below. Return to the Gizmo and the unused activities in future class periods to reinforce the concepts.

4. **Extending the Gizmo** (🕒 15 – 20 minutes)
Here are some suggestions for extending the activities in the Student Exploration sheet:

Activity A Extension – Have students use the Gizmo to do some skip counting. Have them position the frog somewhere near the left edge of the number line (e.g., 4). Then have them enter a jump size (e.g., 5). Direct them to place flies on the number line so that the frog will catch them if it keeps jumping the same distance. Then have students repeatedly click **Add** to check their answers (e.g., 9, 14, 19, 24, 29). This can also be done with repeated subtraction.

Activity B Extension – Have students turn off **Show positions** and **Show Number line**. Then have them add flies and try to catch them. Without being able to see the positions or the number line ticks, students will have to estimate the distances. The logs (placed at every ten units) should help them. After students have practiced estimating for a few minutes, have them share their strategies with the class.

Activity C Extension – Pair up students and have them play a fly-catching game. Have students click **Add fly** six times to place six flies in random locations. Each student then takes a turn entering a jump amount and moving the frog. The student who catches the most flies wins.

Another way to extend students' work with the Gizmo is class discussion. After students are done with their activity, discuss the following questions:

- If the frog is at 13 and it jumps a distance of 7, do you know exactly where it landed? Why or why not? [No, because we don't know which direction it jumped. It could have landed at 20 ($13 + 7$) or 6 ($13 - 7$).]
- Explain how you could add $18 + 41$ mentally. [Instead of adding 41 all at once, you would first add 40 and then add 1. So $18 + 40 = 58$, and then $58 + 1 = 59$.]
- Explain which of these equations represents the largest jump and why: $3 + 15 = 18$ or $29 + 1 = 30$. [Students might erroneously think that $29 + 1 = 30$ represents the largest jump because the numbers in that equation are larger. But $3 + 15$ means the frog starts at 3 and jumps 15, whereas $29 + 1$ means the frog starts at 29 and jumps 1.]

5. **Follow-up activity: A frog's life** (🕒 45 – 60 minutes)
Have students work alone or in pairs. Their job is to write a short story that describes one day in the life of a frog. (Rabbits and kangaroos work just as well as frogs.) The story would describe how the animal protagonist jumps along a number line path to find

food, visit friends, get exercise, run errands, and so on. Students should illustrate the story with a drawing that represents each jump on the number line. They should also label each drawing with the appropriate equation. To ensure that students include subtraction as well as addition, you could include a requirement that the animal return home at the end of the day. Students don't need to use the same number line that the Gizmo does. You could challenge more advanced students to use a number line with larger numbers. (For example, one goes from 230 to 280, with the frog starting out at 250.)



Mathematical Background

A common misconception to watch for is counting the ticks instead of the intervals. (Counting the ticks gives an incorrect answer because the tick at the frog's current position doesn't count as a jump – it's his initial position – but every tick mark after that does.)

For example, a student might view the $2 + 5 = 7$ jump seen to the right as $2 + 6$ because they count six tick marks (including the one where the frog was originally positioned).



One familiar real-world connection (used in the Prior Knowledge Questions) is board games. A good starting point for dispelling the tick/interval misconception would be to ask students what number they would need to roll to move the ant game piece to A. Then you can make a connection between the movement on a game board and movement on a number line.



Another good real-world connection is the time line. You can have students make timelines for their own lives and then use them to answer simple questions. For example, a student born in 2000 will see that they are eight years old in 2008 because of the eight intervals between the dots, not the nine dots themselves:



Working with number lines has many benefits: it improves student understanding of measurement (the tick/interval misconception also rears its head when reading rulers) and provides as strong foundation for graphing coordinates. Experience with whole-number number lines also prepares students for working with number lines that use negative numbers, fractions, and decimals.



Selected Web Resources

Generate your own number lines: <http://theworksheetsonline.com/numline.html>

Make your own timeline: <http://www.enchantedlearning.com/crafts/memory/timeline/>

Background on number lines: <http://www.learningwave.com/chapters/integers/numline.html>

Find numbers on a number line: <http://www.webmath.com/k8numlineuse.html>