

KIBO Number Line – 1 hour

Solving problems with algorithms (Computational Thinking)

Overview: In this lesson, students will use algorithms and moving robots to model mathematical concepts. KIBO will travel along a physical number line to model counting, addition, and subtraction. Students will create algorithms (optionally including repeat loops) to solve problems, just as programmers do at work!



Learning Goals: Students will:

- **Model** mathematical operations of addition and subtraction.
- Create an **algorithm** to solve a problem.

Materials/Resources:

- One KIBO 10 kit or higher per 2-4 students
- Masking tape
- **Optional:** Addition and subtraction flashcards
- **Optional:** KIBO Says Game cards



New to KIBO? Watch the Videos!

If this is your first time using KIBO, we encourage you to check out our short tutorial videos at kinderlabrobotics.com/getting-started.

Lesson Plan



Inspire: Review – or introduce – the concept of a number line with children at circle. Provide some traditional examples with a drawing or standard classroom number line chart, and demonstrate counting, addition, and subtraction.

“Today we will teach KIBO to count, add, and subtract by moving along a KIBO number line! As KIBO moves forward and backward, it will help us solve math problems. KIBO’s movements **model** the operations we do when we add and subtract.”

This activity would be a great opportunity to collaborate with a math specialist!



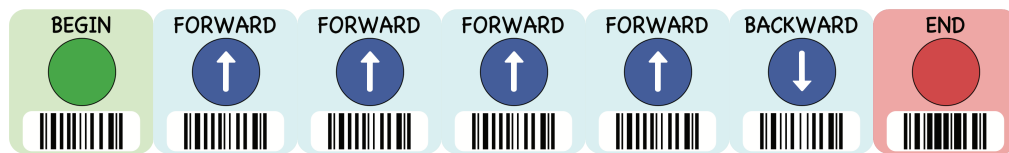
Connect: A Human Number Line. Let students experience the idea of a number line with a physical activity, where the students move forward and backward themselves. For example, ask them to take 3 steps forward, then 2 more steps forward. how many steps have they taken? Optionally, use **KIBO Says Game** cards as prompts for this activity.



Small-Group Work: Solve Math Problems with KIBO. In this activity, students will explore adding and subtracting by sending a KIBO forward and backward along a number line. Students will solve addition and subtraction problems with their “counting KIBO.” For example, four FORWARDS followed by one BACKWARD represents the subtraction operation “4 minus 1”: the KIBO will end up at “3” on the number line.

First engage students in collaborative work to create KIBO number lines together. To set up the number line, create a simple program with one forward movement (BEGIN — FORWARD — END). Position the KIBO at the start of the area and mark that spot as “0” (zero). Then run the program repeatedly, marking and numbering where KIBO stops after each movement. After 8 FORWARDS, you’ll have marked off an 8-KIBO-step number line.

Then demonstrate how KIBO can solve math problems by moving forward and backward along the number line. Starting the KIBO at zero on the number line, run this program:



KIBO will move to the 4 on the number line, then move backward to 3. This represents KIBO “solving” the problem 4 minus 1. *If limited to one set of blocks, students can scan the same FORWARD or BACKWARD block multiple times. Optionally, students with more KIBO experience can use a REPEAT loop in this program.*

Present math problems as prompts for the students to solve with KIBO. These should be addition and subtraction problems where each term is between 1 and 4 (and the answer is between 0 and 8). Math flashcards would work well for this.

The following exploration prompts can keep students on track:

- How far does KIBO move with a single FORWARD block? What about two FORWARDS?
- What happens if you change the order of your blocks?
- What is the biggest number on the line that KIBO can reach? What program would you write to get there?

To simplify this activity for younger children, you can just focus on counting. How far along the number line does KIBO go with one, two, or three FORWARD commands?



Reflect: What Symbols Did You Create? Ask students to share one of their math programs. What was particularly challenging about this activity? Did students discover interesting connections between KIBO’s movement and addition and subtraction problems?

Standards Addressed

Common Core Math: CCSS.MATH.CONTENT.1.OA.C.5, CCSS.MATH.CONTENT.2.MD.B.6
CSTA K-12 Computer Science Standards: 1A-AP-09, 1A-AP-10, 1A-DA-06, 1A-DA-07