Integer Beaded Number Line Set

Instructions and Sample Activities

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What is the Integer Beaded Number Line?

The **Integer Beaded Number Line** is a concrete representation of the number line. The Math Standards have integrated the number line directly into their language to highlight the value and importance of this tool in developing student understanding. Number lines themselves are representational, not concrete, and research tells us that we should first build comprehension of concepts through concrete exploration.

The **Integer Beaded Number Line** is a tool for developing conceptual understanding of integers, their values, and how operations work in a way that students can see, touch and manipulate. It provides students with a tactile learning experience while supporting sense-making, rather than giving students a set of given "rules", which as we know, are often forgotten. Using the **Integer Beaded Number Line** allows students to uncover and discover the "rules" of integer operations as patterns they can see through their own exploration.

Understanding the Integer Beaded Number Line

Working with the **Integer Beaded Number Line** is intended to be a prerequisite to the work students do with a traditional number line. The

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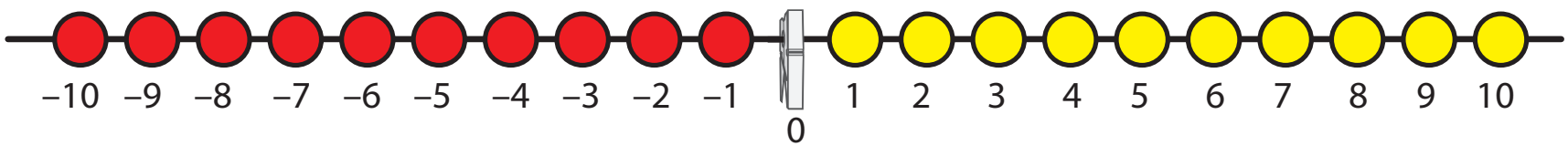
structure of the **Integer Beaded Number Line** is designed to complement integer work that may be done with red and yellow counters, with red counters representing negative values and yellow counters representing positive values. Zero is marked with a small removable clip on the **Integer Beaded Number Line.** The string clearly illustrates that as you move to the right, the value increases, and as you move to the left, the value decreases.



How to Use the Integer Beaded Number Line

First and foremost, it is important to remember that integers should be presented as opposites. This can be clearly demonstrated using the **Integer Beaded Number Line**. For example, the opposite of 6, or –6, is represented by 6 red beads, since 6 yellow beads represent 6 or +6. Students should also learn/discover that when given the same quantity of opposites, their sum is zero. These are known as "zero pairs." **Examples:** –2 + 2 = 0, 5 + (–5) = 0, and so on.

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Absolute value, the distance from a number (point) on the number line to 0, is also easily modeled using this tool.

The concept of opposites is critical to understanding both values and operations. It is important to separate operations from opposites. Let's explore this in Addition and Subtraction:

–4 + 6	**–4 – 6**	**4 + (–6)**	**4 – (–6)**	**–4 + (–6)**
The opposite of 4 plus 6	The opposite of 4 minus 6	4 plus the opposite of 6	4 minus the opposite of 6	The opposite of 4 plus the opposite of 6

Other Key Ideas

- When adding, we move to the RIGHT.
- When subtracting, we move to the LEFT.
- When we have a negative (opposite) after an operation, we CHANGE DIRECTIONS (essentially doing the opposite).

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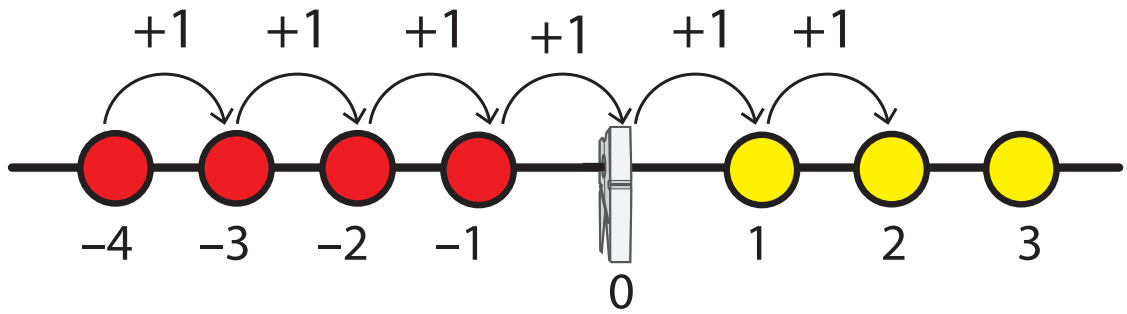
–4 + 6	–4 – 6	4 + (–6)	4 – (–6)	–4 + (–6)
Move to the RIGHT	Move to the LEFT	Move to the LEFT (add = right, but opposite = change direction)	Move to the RIGHT (subtract = left, but opposite = change direction)	Move to the LEFT (add = right, but opposite = change direction)

See the illustrated examples below.

Addition and Subtraction

When adding, students must remember that they are jumping from their start number to the next bead, not including their start number in the count. This is a common error with number line work in general. For example:

–4 + 6 = 2



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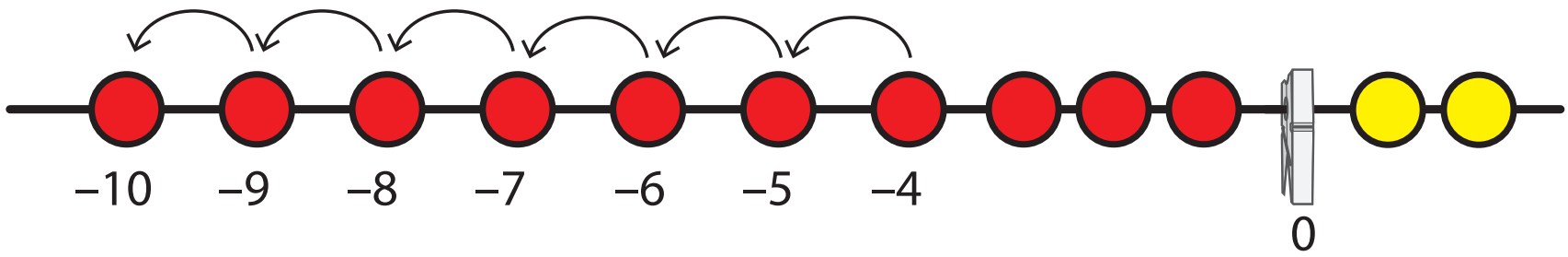
–4 –6 = –10



Instructional Tip: Subtraction may also be thought of as missing addend. In the example above, think –4 + ____ = –10. Students can use the **Integer Beaded Number Line** to find the missing addend.

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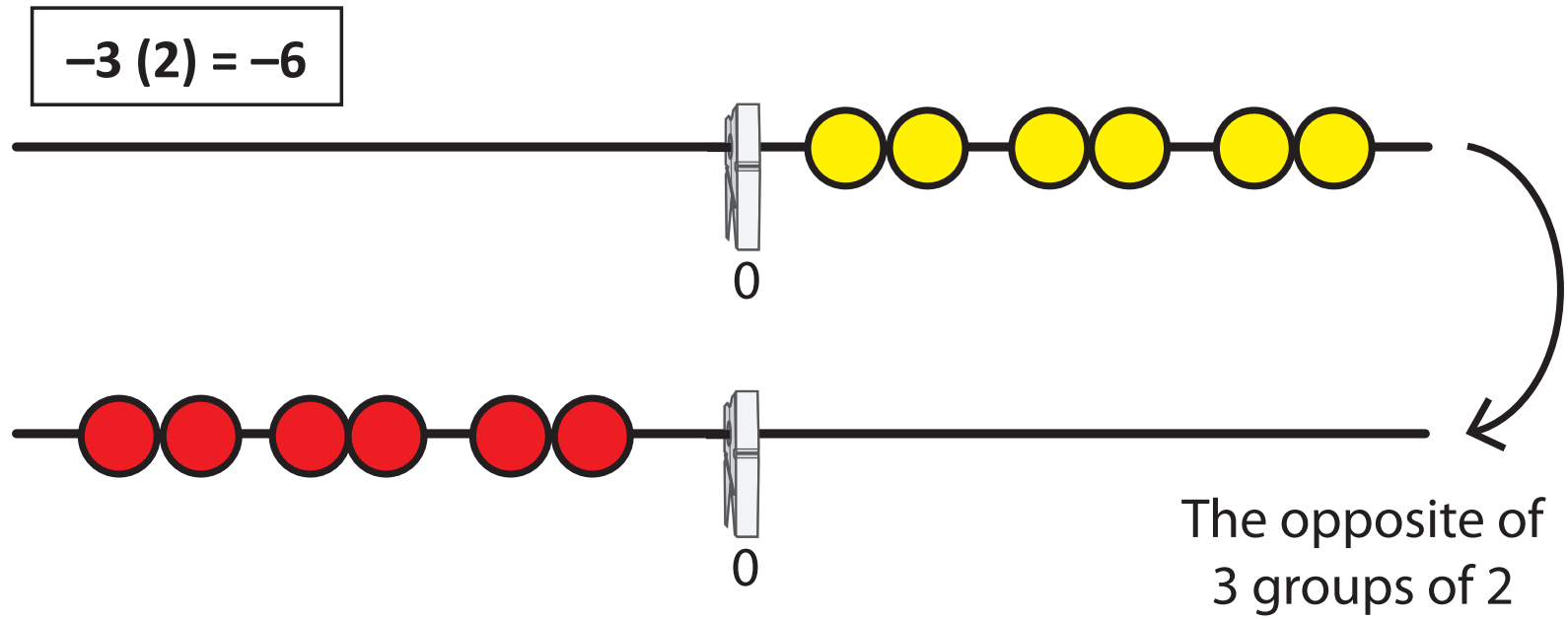
Multiplication and Division

–3(2) = –6	–3(–2) = 6	3(–2) = –6	–6 ÷ 2 = –3	–6 ÷ (–2) = 3	6 ÷ (–2) = –3
The opposite of 3 groups of 2	The opposite of 3 groups of negative 2	3 groups of negative 2 (or the opposite of 2)	The opposite of 6 divided by 2	Negative 6 divided by the opposite of 2	6 divided by the opposite of 2



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Using the Integer Beaded Number Line in the Classroom

Whole-Class Activities

When introducing integers, integer comparisons, operations, and problems involving integers, it is helpful to model thinking in the whole group using the **Integer Beaded Number Line**. Pose questions and have students model solutions using this tool.

Here are some examples to get you started:

1. What is the opposite of 4?	**2.** What is the absolute value of –3?
3. What is greater, –7 or –2? How do you know?	**4.** What is the sum of –3 and –4?
5. What is 3 – 5?	**6.** What is –2 – 4?
7. What is –4(2)?	**8.** If the temperature changed from –6 to 9, how many degrees did it rise?

*Note: The **Integer Beaded Number Line** may also be used vertically.

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Small-Group Instruction

The **Integer Beaded Number Line** is ideal for small-group instruction. As problems are posed, students use the Integer BNL to solve while the teacher observes in real time. This allows teachers to see how the student is approaching the problem and to catch misconceptions immediately. Using this tool in small groups also helps the teacher to make informed assessments of student progress in understanding integers and operations, and to determine when the student is ready to transition from the **Integer Beaded Number Line** to a traditional number line (moving from concrete to representational).

Independent Activities/Math Stations

Whenever students work independently, whether in math stations or on individual practice, the **Integer Beaded Number Line** should be available as a scaffold to support their reasoning. By providing access to the Integer BNL, teachers allow students to decide if and when they need it. Students are also more likely to discover mathematical "rules" through their hands-on exploration. Further, they have a way to check the accuracy of their computations.

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Sample Activities

Activity 1: All About My Integer (small group/independent)

Materials: Integer Beaded Number Line, Integer Cards*, notebook or recording sheet

1. Students draw a card and use the **Integer Beaded Number Line** to complete the following:

My number	Absolute Value	Opposite	My number plus 10 ___ + 10 =	My number minus 10 ___ – 10 =

2. Repeat with other integers, as needed, using the Integer BNL as a scaffold.

***Integer Cards are commercially available or can be made out of index cards:**

1	2	3	4	5	6	7	8	9	10
–1	–2	–3	–4	–5	–6	–7	–8	–9	–10

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Activity 2: What's the Balance? (small group)

Materials: Integer Beaded Number Line, notebook or dry-erase board

Overview: The teacher presents a scenario and students use their **Integer Beaded Number Line** to follow along and keep track of the balance. Example:

> Amy loves to use her debit card but isn't always good at tracking her balance. Let's see how she did last weekend and if she has any money left in her account.
>
> Friday night Amy earned $18 dollars babysitting. (Begin at 18 on the BNL). Saturday morning she went to breakfast and spent $9 on a bagel and coffee. (Move down to 9.) After that, she went to the mall and saw some earrings she wanted, but she didn't have enough money to buy them. Luckily her Mom Venmo'd her $10 so she could get them. (Back up to $19.) They cost $13. (Back down to $6.) How is Amy doing? Does she have enough to go to the movies with her friends on Saturday night? The ticket costs $12.
>
> **Extension:** If Amy's friend says she can give her what she needs to get the movie ticket, how much debt will she be in? Show this on your BNL. How do you represent this as an integer?

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Activity 3: Name that Equation! (small group/independent)

Materials: Integer Beaded Number Line, notebook or dry-erase board

Overview: Students build understanding of operations by writing equations to match scenarios. **Examples:**

1. Ty owed me $5 and just borrowed $10 more. How much does he owe me now? [–5 + (–10) = –15]

2. The temperature yesterday was 2 below zero. Thank goodness it is 15 degrees warmer today! What is the temperature today? [–2 + 15 = 13]

3. I only had $3 in my bank account, but then my sister paid me back the $9 she owed me. How much money is in my account after she paid me back? [3 – (–9) = 12]*

   *Note that you are subtracting her debt and students may find this confusing.

4. The builder thought we had to dig down two feet to pour the foundation, but it turns out that we need to dig down 4 times as deep. How many feet down do we need to dig? [–2(4) = –8]

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Activity 4: Hit the Target (partner game)

Materials: Integer Beaded Number Line, Integer Cards (–10 to +10), Operator Cards*, notebook or recording sheet

Overview: Partners take turns building and solving equations. The goal is to get as close to a target solution as possible (for example, 20) with each equation without going over.

1. Player 1 selects two Integer Cards and two Operation Cards and arranges them as an equation.
2. Player 2 selects two Integer Cards and two Operation Cards and arranges them as an equation. Player 2 uses the bead string to solve the equation/check the solution and then records the total.
3. Players compare solutions and the player closest to the target solution without going over wins the round.
4. Players play 9 rounds. The player with the most winning rounds wins the game.

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Operation Cards can be made out of index cards:

+	+	+	+	+	–	–	–	–	–

Activity 5: Can You Solve It? (small group)

Materials: **Integer Beaded Number Line**, paper to record problems/ solutions

Overview: Students use their **Integer Beaded Number Line** to write and solve story problems involving integers. Students should be encouraged to observe their environment and utilize authentic contexts for their problems. When students are finished curating the problem(s), they exchange them with a classmate to solve.

1. Student(s) create authentic word problems involving integers.
2. Students solve the problem using the **Integer Beaded Number Line** and create an answer key.
3. Students exchange problems with a partner, solve using the **Integer Beaded Number Line**, and then check for accuracy by referring to the answer key.

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Activity 6: Up and Down the Elevator (partners or small group)

Materials: 2 **Integer Beaded Number Lines** (one for each student), playing cards (with face cards removed), notebook or recording sheet

Overview: Students take turns drawing playing cards to see whose elevator lands on the highest floor. **Note:** for this activity, the **Integer Beaded Number Line** is turned so that it is vertical. The top "floor" is 20 and the bottom "floor" is –20 . . . deep in the basement!

The game can be played with 2–4 students, but each needs their own **Integer Beaded Number Line**.

1. All players begin at zero in the "lobby."
2. Player 1 selects a card from the deck. If it is black (positive), the player moves up the elevator and stops at the appropriate "floor." Example: Player draws the 5 of Clubs and moves up the number line to the 5th bead.
3. Player 1 records the equation: 0 + 5 = 5.
4. All players follow and repeat Steps 2 and 3 in turn.

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5. When everyone has had a turn, Player 1 draws again. If the player draws a black card (positive), he/she again moves up as many "floors" as the card indicates. If the player draws a red card (negative), he/she moves down that number of floors. **Example:** The player is at 5 and draws an 8 of diamonds. The player moves down to –3. The player records the equation as 5 – 8 = –3.
6. Players continue taking turns for 5 rounds or until the first player reaches the 20th floor.

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