Number Line Shortcuts

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Summary	The students will use a number line to see how two addends or subtrahends are equivalent to one single change once combined.
Goals	1. To develop notation for changes or actions on the number lines. 2. To understand how two changes are equivalent to a single change; that is, to explore the fact that two addends (or addend and subtrahend) can be combined into a single addend. 3. To understand that the order of the changes does not affect the end result.
Materials	A previously assembled "number line" (Going from −10 to +20 fixed onto a wall or hanging across the classroom), Overheads, Handouts
Keywords	Contextualized Situations Full Class Discussion Hands-On Activity Negative Numbers Number Lines Production of Algebraic Expressions Small Group Work
Foci	The use of the number line to represent different contexts. How displacements on the number line relate to number sentences and verbal problems.

Introduction:

A number line is stretched against the wall or across the classroom going from about —10 to +20. The children themselves become numbers on the line and perform different "line dances" and, by doing so, they further explore additive operations and begin to explore negative numbers. Students perform addition and subtraction operations by moving up and down the number line and represent these actions as vectors on a written number line or as number sentences. They begin to think about "shortcuts", multiple addends that can be shorted to a single addend.

The students will move to more schematized diagrams, with vectors representing amounts and operations on those amounts.

Activity Plan:

Number Line Dances

1. Operating on the number line and representing the changes [Whole Class]

Ask two new volunteers to stand this time at the numbers 10 and 15. We're going to pretend that where they're standing is the temperature. Do you think it's hot or cold? What happens if it gets 5 degrees warmer? Now it gets really cold, and drops 20 degrees. Where do you think they'll end up? This time, one student will drop down to zero, while the other student drops to –5. Some may say that it stops at zero, while others will say it keeps going down. Have the students count up as they travel along the number line to keep track of the 20 degrees. Ask the students, what would happen if the temperature kept dropping? The idea is to provoke a discussion about the continuous nature of negative numbers. Continue with: The temperature doesn't drop, it actually gets 10 degrees warmer. Where do you think they should go?

Introduce the overhead on page 1 and ask for a volunteer to go from 0 to 3 on the number line stretched across the classroom and stand behind it. Once the students agree that this is where 3 is represented on the line, propose:

Let's pretend that Joshua won 3 dollars. What happens if he earns one more dollar? Where should he go? What if he earns 2 more dollars? What if now he spends 3 dollars?

After this introduction, ask the children to help you show on a first written number line what has happened. Write arrows and the number sentence to show 0 + 3 + 1 + 2 - 3.

Ask another volunteer to start at 0 and then pretend that he/she earned 6 dollars and then spent 3. Represent this on the second number line on the overhead and discuss:

How come they both ended up at the same place?

2. Changes and shortcuts [Group Work]

Distribute the handout on page 1 and ask the children to complete the table. The starting value is kept constant in the first items. Since each of the change pairs has the same effect, the result will be the same in each case. This allows the students to conclude that there is the same invariant underlying the diverse operations.

After the first eight examples, the students are asked to reduce the two changes to a single change. This can be referred to as a shortcut, a direct route. But the word *change* is important to use.

The final row concerns making a generalization for the effect on *N*, whatever *N* might stand for.

3. Discussing children's work [Whole Class]

Ask a few volunteers to act out the tasks for each row.

Why do the results always come out the same?

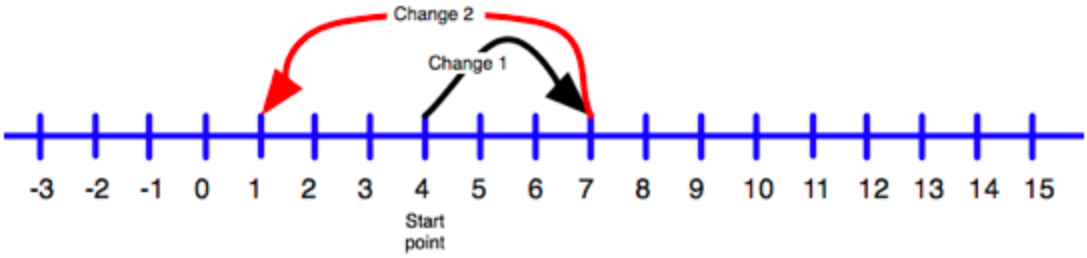
4. Present the Homework problem (Page 2)

The problem is very similar to the handout. It should need little explanation.

Overhead and Handout: Calculating on the Number Line **(Page 1)**

Name: _____ Date: _____

Start at the "start point". Make two changes. Show where you end.



Start point	Change	Change	End		Number sentence, Numerical expression
4	+3	-6			4 + 3 - 6 =
4	+4	-7			4 + 4 - 7 =
4	+5	-8			=
4	+6	-9			=
4	-9	+6			=
4	-8	+5			=
4	-7	+4			=
4	-6	+3			=

In each row above there are <u>two changes</u>.

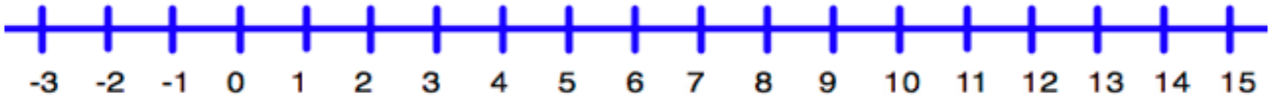
In each row, making the **two changes** is the same as making what **single change**? _____ . [Fill in the number.]

Start point	Change	Change	End		Number sentence, Numerical expression
N	**-7**	**+4**			

Overhead and Homework: Calculating on the Number Line (Page 2)

Name: _____ Date: _____

Start at the "start point". Make two changes. Show where you end.



Start point	Change	Change	End		Number sentence, Numerical expression
7	-5	+4			7 – 5 + 4 =
7	-7	+6			7 – 7 + 6 =
7	-8	+7			=
7	-10	+9			=
7	-1	+0			
7	+0	-1			
In each row above there are <u>two changes</u>. The two changes are the same as changing by _____ . [Fill in the number.]					
7	+39	-40			7 + 39 – 40 =
7	-40	+39			
	-40	+39	5		
	-40	+39	3		
	-40	+39	-1		
N	-5	+4			