## Arrow Cards

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| In this lesson, students explore addition by using a strategy based on place value using arrow cards as a tool.  |

**NC Mathematics Standard(s):**

**Number and Operations in Base Ten**

**NC.3.NBT.2** Add and subtract whole numbers up to and including 1,000.

* Use estimation strategies to assess reasonableness of answers.
* Model and explain how the relationship between addition and subtraction can be applied to solve addition and subtraction problems.
* Use expanded form to decompose numbers and then find sums and differences.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.

**Student Outcomes:**

* I can add within 1000 with ease by using a strategy based on place value (collecting hundreds, collecting the tens, and collecting the ones, and when necessary, composing ten ones to make a ten or composing ten tens to make a hundred).
* I can use arrow cards as a tool to help me add using place value strategies.
* I can use a number line to add within 1000.

**Math Language:**

**What words or phrases do I expect students to talk about during this lesson?**

* **Number line**
* **Place value**
* **Strategy**
* **Compose**

**Materials:**

* Arrow Cards (One set per partner on card stock if preferred)
* Zip plastic bag to store cards
* Paper to draw a number line
* Paper to chart a problem to be displayed
* Large paper or a way to display a number line

**Advance Preparation**:

* There is a growing body of research to suggest the importance of the number line as a tool for helping children develop greater flexibility in mental arithmetic as they construct mathematical meaning, develop number sense, come to understand number relationships, and develop powerful strategies for addition and subtraction. The number line can do much more than simply help children count to 100. The number line can be used as a tool to help children function well with the various operations. The number line is a powerful visual tool for adding and subtracting.
* Arrow cards will need to be copied, cut and stored in bags prior to beginning this task. This can be time consuming, but the value of these cards and the flexibility of their use is worth the time spent in preparation.
* Students may have had opportunities to use these cards in previous grades and may understand how to line the arrows up to show the value. If not, the teacher will need to spend time “playing” with these materials prior to instruction.

**Launch:**

1. Introduction to Arrow Cards (10 minutes)
* Arrow cards are distributed to students and a quick warm up is done to make sure students understand how to use the cards. For the warm up, ask students to show you 53 and review the hidden 50 in 53, Ask students to show you 438 and review the hidden 400 and 30 in 438. Have students show 85 and 58. What is the difference in these two numbers? Which is larger? How do you know?
* Depending upon the students’ prior knowledge and work with arrow cards, the teacher may need to spend more time working with place value understanding and composing and decomposing numbers before moving to using place value strategies for addition and subtraction. See the second grade lesson on arrow cards if needed to build understanding of place value before using this lesson.

**Questions to Pose**:

* Can you show me how to make 325, 457, 289, 58, 399, etc. with the arrow cards?
* What does the hidden zero represent?
* Explain why the zero is important.

**Explore:**

1. Exploring Addition with Arrow Cards (30 minutes)
* Present pairs of students with the problem 457 + 246= . Ask students to use the arrow cards to solve this problem. Allow students to struggle with the problem as the teacher circulates and poses additional questions to the students. When students begin to finish have them share their solution with another set of partners and then compare solution strategies. After lots of small group discussion, pull students together and discuss how they solved the problem. Using some type of projection device, walk through the strategies used to solve the problem. Share the following solution strategy with the students. 457 is the same as 400 + 50 + 7 and 246 is the same as 200 + 40 + 6 when the numbers are decomposed. Be sure students see the visual model of this by separating their arrow cards, have students then combine the hundreds, tens, and ones so that they are seeing 400 + 200, 50 + 40, and 7 + 6. Exchange the hundreds for the total of 600, exchange the tens for a total of 90, and exchange the ones for a total of 13. Now put these cards together so that we have 600 + 90 + 13. When students put these cards together it will look like this:

|  |  |  |
| --- | --- | --- |
| 6 | 0 | 0 |
|  | 9 | 0 |
|  | 1 | 3 |
|  |  |  |

Now as students begin to total the problem they will see that the 90 and 10 will need to be composed into a hundred. When this happens a hundred is added to the hundreds place so the cards will now look like this:

|  |  |  |
| --- | --- | --- |
| 7 | 0 | 0 |
|  | 0 | 0 |
|  | 0 | 3 |

and the sum total becomes 703.

* If the teacher feels that students need more guidance in walking through the next problem, it can be done as a whole group. If students were successful in completing the first problem in partners then continue to allow the students to persevere in solving the next problem.
* Give students the problem 586 + 346 = . Students **MUST** use the arrow cards to solve the problem. Some students will know how to use the traditional algorithm to solve this problem and will want to quickly use their abstract understanding to solve the problem. Encourage (even require) the students to use the arrow cards so they begin to understand what is happening with the algorithm.
* Repeat the process of sharing the strategies partners used and be sure the place value strategy of composing number is modeled as shown:

|  |  |  |
| --- | --- | --- |
| 8 | 0 | 0 |
| 1 | 2 | 0 |
|  | 1 | 2 |

When cards are totaled:

|  |  |  |
| --- | --- | --- |
| 9 | 0 | 0 |
|  | 2 | 0 |
|  | 1 | 2 |

for a sum total of 932.

* Continue this process with several problems and continue to require the use of arrow cards.

**Questions to Pose**:

* How can you use your arrow cards to help you solve this problem?
* Is there more than one way to represent that number?
* Can you show me another way to make that number?
* Does our number line have to start at 1?
* Does a number line have to have every number marked on it?
* What could we begin with to solve this problem?
* What are the increments we could use to jump on the number line? What have we already learned that can help us with the number line? How is understanding place value going to help you solve this problem?

**Discuss:**

1. Connecting to the Number Line (20 minutes)
* Using the problem we began with of 457 + 246= ask students how it could be modeled on a number line. This should generate lots of discussion and again will depend on the prior experience students have had with number lines. Some good questions to lead this discussion would include, “Does our number line have to start at 1?” “Does a number line have to have every number marked on it?” “What could we begin with to solve this problem?” “What are the increments we could use to jump on the number line?” The teacher should model and “try” the suggestions the students give for ways to solve the problem. One efficient way to solve it problem would be:



After solving this problem, have students go back to the problems they solved earlier and create a number line to represent their solution strategy. Discuss the place value understandings used in both of these methods.

* Ask pairs of students to come up with a problem they would like to solve, this problem would need to be approved by the teacher and may depend on the understanding of the students. It would need to be a problem that could be solved by using the arrow cards and could be represented on a number line. This would limit students in using a number over 1000 (because of the arrow cards). Have pairs of students chart their problem and solution in a way that could be displayed in the classroom. Ask students to display the solution with the arrow cards and the number line on the walls and have students do a “Gallery Walk” to look at each other’s problems. Encourage students to make their solutions very clear and to include pictures, models, and words so that a second grader could understand how they solved the problem.

**Questions to Pose**:

* What strategy did you find most helpful in solving the problems?
* How are the arrow cards and the number line alike as a strategy?
* What would you say to a second grader if you were trying to teach them how to add using arrow cards?
* What would you say to a second grader if you were trying to teach them to add using a number line?

Evaluation of Student Understanding

Informal Evaluation:

Observations and anecdotal notes of how students are engaging with the work of the lesson.

Formal Evaluation/Exit Ticket:

Give students a problem to solve on the number line.

**Meeting the Needs of the Range of Learners**

**Intervention:** Give students smaller numbers to work with.

**Extension:** Give students larger numbers or have them find and explain other strategies for addition.

**Possible Misconceptions/Suggestions:**

|  |  |
| --- | --- |
| **Possible Misconceptions** | **Suggestions** |
| Students may not have a conceptual understanding of place value so that they would think 234 is 2+3+4 rather than 200+30+4 and may not see the relevance of the zeros. | Have students build numbers with base ten blocks and compare those numbers to the arrow cards so that the students can see why the zero is important. This may take several conversations and a variety of models until students begin to understand. |
| Students with limited or no experience with an empty number line may want to put each number on the number line. Students may not know how to space the numbers on the number line so that they represent the quantity of the number correctly. | Begin with smaller numbers for these students so they can see the actual space between numbers on a number line that is marked with appropriate spacing. Refer to the second grade lesson titled “The Human Number Line.” |

**Special Notes:**

This task is very involved and may take several days depending on the prior experiences and the place value understandings of the students. This lesson only involves addition but the standard also addresses subtraction.







