**Sorting Problem Types**

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| In this lesson, students use their understanding of word problems to sort problems based on type. The focus for students in this lesson shifts from solving word problems to analyzing word problem structures in order to group like problems. The purpose is to help students understand and visualize problems so they will know how to write equations that match and know what operation is needed to solve. This lesson focuses on sorting addition and subtraction word problems with a specific focus on Take Apart and Put Together types. The lesson, however, can be adjusted to use with any problem types you notice students need more experience with. You could also adjust the number size in the problems to use this lesson at different times in the year. |

**NC Mathematics Standard:**

**Represent and solve problems**

**NC.1.OA.1** Represent and solve addition and subtraction word problems, within 20, with unknowns, by using objects, drawings, and equations with a symbol for the unknown number to represent the problem when solving:

* Add to / Take from – Change unknown
* Put together / Take apart – Addend unknown
* Compare – Difference unknown

**Standards for Mathematical Practice:**

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

7. Look for and make use of structure.

**Student Outcomes:**

* I can sort word problems by determining whether situations involve taking apart or putting together groups.
* I can write equations to match word problem situations.
* I can analyze and sort word problems that involve change unknown situations.
* I can solve word problems.

**Math Language:**

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

equation, word problems, add to, put together, take from, take apart, sort, unknown, solution

**Materials:**

* book, *Elevator Magic* by Stuart J. Murphy
* word problem cards for students to sort
* white boards or student math notebooks
* copies of Exit Ticket
* manipulatives to model problems to determine problem type

**Advance Preparation**:

* Make copies of word problem cards (Activity Sheets) and cut apart, unless students will cut apart during the lesson.
* Read aloud the book *Elevator Magic* by Stuart J. Murphy (or similar text). This could occur up to a few days prior to this lesson or earlier in the same day you plan to teach this lesson. As you read, ask students to act out the subtraction situations through models or drawings. Briefly discuss the different situations with students throughout your reading of the text.

**Launch:**

1. Introduce the task (5 minutes)

Remind students of all the work they have been doing and continue to do with solving problems, using the context of *Elevator Magic* or similar story as an example. Say: *As we have learned, there are many different situations or stories that show things being put together, taken apart, added to, or taken from other things.* Tell students they will work with more of these stories or word problems today. Instead of solving the problem as they normally do, students will analyze the problems and sort them into groups by thinking about the type of problem or situation.

Give students the first set of word problem cards (Activity Sheet 1). Read aloud the problem on each word problem card, asking students to follow along as you read.

\*Note: You may choose to only use four word problem cards instead of all six. Just be sure both types are represented, and that all children receive the same word problem cards.

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| There were 15 fish in a fish tank. 8 of the fish were orange and the rest were white. How many fish were white? | 8 black cows and 7 brown cows are in a field together. How many cows are in the field? | There are 15 cupcakes. The first grade students ate 7 of the cupcakes. How many cupcakes are left? |
| I have a bag of candy. There are 8 chocolate candies and 7 lemon candies. How many pieces of candy are in the bag? | We found 7 ladybugs and 8 crickets in the backyard. How many bugs did we find? | My dad bought 15 balloons for the party. 7 of the balloons are yellow. The rest of the balloons are blue. How many blue balloons did my dad buy? |

**Explore:**

1. Sorting Word Problems (10-12 minutes)

Ask students to work in groups of 2 or 3 to sort the word problem cards as they deem appropriate based on their own criteria. For example, some students may say “I know the whole group [total] in this problem” and then sort the rest based on that criteria (whether the total is known or unknown). Remind students they will need to explain their thinking and justify why they sorted the problems as they did. Be available to read problems aloud to students again as needed.

As students are working, refrain from suggesting how students could sort. If groups are struggling, ask questions to help them explore and to spark their thinking (e.g. *Do you notice any similarities in these two problems?*). Also encourage students to discuss their thinking while sorting and their rationales with each other.

You can use questions such as:

* *What are you thinking about this problem? What makes you think that?*
* *Do you agree? Why? Why not?*
* *How did you decide to sort the problems?*
* *Can you explain what he/she just said?*
* *Why did you decide to put this problem in this group?*
* *What can you do since you do not agree on how to sort this problem?*
* *What do you think of his/her reasoning?*

Students may not be able to distinguish action and operation without modeling the problem. Provide students with manipulatives to directly model the problem, but do not make finding the solution a focus of your questioning or instruction. Move among the groups as children are working and discussing the problems. Observe their methods for sorting and notice the groups they create. Most likely, students will sort into two groups: situations that show adding and situations that show subtracting. However, notice if any students or groups have a different way of thinking, even if it seems incorrect or inefficient. This may be something you will need to address during the class discussion. Also notice meaningful conversation between students or groups as they talk about the problems that you would like to highlight during the whole class discussion.

**Discuss:**

1. Explanation of Sorted Groups (15-20 minutes)

Before you have students move together as a large group, collect some of the word problem cards and keep them in the groups students placed them in when they sorted.

Bring the class together to talk through how students sorted the word problems. During this time of discussion, you will want to ask student groups to share their thinking for sorting but keep the conversation open to allow students not in that particular group to ask questions and agree or disagree with what is being shared. Remember to showcase the thinking and discussion you observed during the Explore activity by asking those students to share their experiences. Since all students sorted the same word problems but possibly in different ways, facilitate the discussion to allow for one train of thought followed by another so at the end of the discussion the whole class will have sorted all problems and have agreed upon the criteria for sorting.

The end result should be word problem cards sorted into two groups: Take Apart problems and Put Together problems. To assist students as they interpret and analyze the problems, suggest writing equations to match the problems. Working together as a class, ask students to write and explain equations that match the situation of the problems. Specifically be aware of the take apart problems. It is possible students will see these as an addition situation with a missing addend. Help them to see the situation as having a whole and taking that whole apart to make two groups, thus using subtraction to take away the known quantity to find the unknown group (e.g. the fish tank problem).

**Additional Activities (if needed)**

1. Sorting & Solving Problems including Change Unknown Problems (15-20 minutes)

Allow students opportunity to extend their thinking by repeating the process of analyzing and sorting word problems, this time including other problem types. Giving students opportunity to analyze problems and recognize different types will allow them to better understand the problems, link them to accurate equations, and solve with increased consistency.

Give students the second set of word problem cards (Activity Sheet 2). Read aloud the problem on each word problem card, asking students to follow along as you read.

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| Maria saw three yellow butterflies. She also saw eight orange butterflies. How many butterflies did Maria see? | Annya has 8 pennies. She found more pennies on the sidewalk. Now she has 11. How many pennies did Annya find? | Jose had 11 lollipops. He gave a lollipop to each of his 8 friends. How many lollipops does Jose have now? | Bill had 11 toy cars. He lost some, but he still has 3 toy cars. How many toy cars did Bill lose? |

Two of the problems are subtraction and two of them are addition but the set does include a couple of change unknown problems as well. Listen in to conversations as children work together to sort these four problems into groups. There is again opportunity for students to sort in various ways, including change unknown vs. result unknown or by operation (e.g. subtraction vs. addition). Notice the elements of the problems students recognize easily and what they struggle to comprehend then make notes for future instruction.

For an additional challenge, you may ask students to find solutions to the word problems on the cards. You could give students specific word problems you would like them to solve or you can allow students to choose two or three of the cards they have been working with and solve the problems on those cards.

Students can pair up with a partner to check each other’s work and discuss strategies for finding solutions to the problems.

**Evaluation of Student Understanding**

Informal Evaluation:

Observe students as they discuss the problems and sort. Make note of obstacles and/or misconceptions students face so they may be addressed in later lessons or small group meetings. Question students to uncover their thinking, especially since they are not producing an actual product. Have conversations with students to encourage oral explanation and use of academic language.

Formal Evaluation/Exit Ticket:

Pose the following task for students to complete.

***The answer to a word problem is 5 monsters. What could the problem be? Write a word problem with a question that can be answered by the solution “5 monsters.”***

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

**Intervention:**

* Reduce the number of word problem cards to sort for partners or small groups who have difficulty getting started or are struggling with the task.
* Encourage children to model the problem with manipulatives in order for them to more clearly see the situation and determine the action.

**Extension:**

* Students could select a word problem from each sorted group and write the equation that matches the problem situation.
* Ask students to collaboratively write one more word problems that would match the type for each sorted group. Challenge them to use the same numbers or fact family as the given problems.

**Possible Misconceptions/Suggestions:**

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| **Possible Misconceptions** | **Suggestions** |
| Students sort the word problems simply by looking at the numbers used in the problem. | Select first a word problem card with noticeable  action. Read the problem aloud again asking  students to visualize what is happening, like  making a movie in their mind. Have them act out  the situation with cubes or counters. Repeat with a  second problem then ask students to decide if the  problems have the same kind of action or not.  Assist students in putting the two problems  together (if same action) or in separate groups (if  not the same action). |
| Students do not distinguish the difference between the word problems; they sort all problems into the same group. | Ask students to draw a representation of two of the  problems, using one of each type. Do not ask  them to solve, but just to represent the information  in the problem. Likely, students will notice the  difference as they draw. If not, point out that you noticed how students approached the problems differently when drawing. |

**Special Notes:**

* Remember not to instruct children to look for “key words” in word problems. Key words often do not apply to all situations and it will further confuse children when the operation they choose based on a key word does not yield correct results. Instead, encourage children to think about the situation and visualize what is happening in the situation. The goal is for children to comprehend the context of the problem, not to simply hunt for words to dictate how to compute an answer.

**Possible Solutions:**

Solution to sort for Activity Sheet 1:

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| **Take Apart Problems** | **Put Together Problems** |
| There were 15 fish in a fish tank. 8 of the fish were orange and the rest were white. How many fish were white? | 8 black cows and 7 brown cows are in a field together. How many cows are in the field? |
| There are 15 cupcakes. The first grade students ate 7 of the cupcakes. How many cupcakes are left? | I have a bag of candy. There are 8 chocolate candies and 7 lemon candies. How many pieces of candy are in the bag? |
| My dad bought 15 balloons for the party. 7 of the balloons are yellow. The rest of the balloons are blue. How many blue balloons did my dad buy? | We found 7 ladybugs and 8 crickets in the backyard. How many bugs did we find? |

Solutions to sort for Activity Sheet 2:

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| **Change Unknown Problems** | **Result Unknown Problems** |
| Annya has 8 pennies. She found more pennies on the sidewalk. Now she has 11. How many pennies did Annya find? | Maria saw three yellow butterflies. She also saw eight orange butterflies. How many butterflies did Maria see? |
| Bill had 11 toy cars. He lost some, but he still has 3 toy cars. How many toy cars did Bill lose? | Jose had 11 lollipops. He gave a lollipop to each of his 8 friends. How many lollipops does Jose have now? |

OR

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| **Subtraction Problems** | **Addition Problems** |
| Annya has 8 pennies. She found more pennies on the sidewalk. Now she has 11. How many pennies did Annya find? | Bill had 11 toy cars. He lost some, but he still has 3 toy cars. How many toy cars did Bill lose? |
| Maria saw three yellow butterflies. She also saw eight orange butterflies. How many butterflies did Maria see? | Jose had 11 lollipops. He gave a lollipop to each of his 8 friends. How many lollipops does Jose have now? |

*Parts of this lesson adapted from* Hunovice, L., OConnell, S., & SanGiovanni, J. (2016). *MATH IN PRACTICE Teaching first-grade math*. Portsmouth, NH: Heinemann.

**Activity Sheet 1**

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| I have a bag of candy. There are 8 chocolate candies and 7 lemon candies. How many pieces of candy are in the bag? | My dad bought 15 balloons for the party. 7 of the balloons are yellow. The rest of the balloons are blue. How many blue balloons did my dad buy? |
| There are 15 cupcakes. The first grade students ate 7 of the cupcakes. How many cupcakes are left? | There were 15 fish in a fish tank. 8 of the fish were orange and the rest were white. How many fish were white? |
| We found 7 ladybugs and 8 crickets in the backyard. How many bugs did we find? | 8 black cows and 7 brown cows are in a field together. How many cows are in the field? |

**Activity Sheet 2**

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| Annya has 8 pennies. She found more pennies on the sidewalk. Now she has 11. How many pennies did Annya find? | Jose had 11 lollipops. He gave a lollipop to each of his 8 friends. How many lollipops does Jose have now? |
| Maria saw three yellow butterflies. She also saw eight orange butterflies. How many butterflies did Maria see? | Bill had 11 toy cars. He lost some, but he still has 8 toy cars. How many toy cars did Bill lose? |

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**Exit Ticket**

**The answer to a word problem is 5 monsters. What could the problem be? Write a word problem with a question that can be answered by the solution “5 monsters.”**

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