Mathematics Lesson: Addition & Subtraction Collection Problems
Grade 4   Quarter 1   Adding & Subtracting Whole Numbers: Lesson 8

State Standard(s)
4.NBT.4 Fluently add and subtract multi-digit whole numbers using the standard algorithm.
4.OA.3 Solve multi-step word problems posed with whole group numbers and having whole number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Standards for Mathematical Practice
Standard 1: Make sense of problems and persevere
     in solving them
Standard 2: Reason abstractly and quantitatively
Standard 4: Model with mathematics
Standard 6: Attend to precision.
Standard 7: Look for and make use of structure

Essential Vocabulary
Problem structure (type), collection, addition, subtraction, addend (part), total(whole), unknown, equation, situation equation, solution equation

Evidence of Student Learning
Informal observations and
Anecdotal notes

Materials
- Whiteboards/markers
- Blackline Masters, *"Addition & Subtraction Collection Problems", "Solving Addition and Subtraction Problems"*

Essential Question(s)
How does the formal algorithm generalize and align to previously learned strategies for addition and subtraction?

Homework
Blackline Master, *"Collection Problems Homework"*

Mathematics Lesson
Addition and Subtraction Collection Problems

Activity 1: Reviewing Change Problem Structure **Engage and Explore 10 min)**
1. Ask students to turn and talk in a small group about what good mathematicians do when solving word problems. Ask students to share how they know a word problem has a change structures
    - think about the type (structure) of problem - (*with change problem structures they always involve an action*)
    - read and retell the problem carefully
    - underline important vocabulary
    - circle and label quantities
    - model the problem with a picture or organizer
    - write an equation to represent the situation
    - solve the problem accurately
    - uses estimation to check if answers make sense
2. The homework from *Adding & Subtracting Whole Numbers: Lesson 7* as a warm up review with change problem structure. Invite students to share and compare their word problems with a partner. Select up to 6 student leaders (preferably to model/solve each unknown equation) to share a word problem they wrote on their whiteboard.   Discuss the action that occurred and the missing unknown quantity in each change problem.

Activity 2: Learning about Collection Problem Structures   **(Explain and Elaborate 30 min)**
1. Tell students just like there are many different text structures in reading; there are many different problem structures in math. Today we will discuss another structure, the **"collection" problem**. Collection problems do not involve an action; it simply is joining or separating sets. (Modeling with manipulatives allows students to see how the sets are joined and separated).

Lesson Continued on Next Page

Source: *Teacher Created*

<u>**Mathematics Lesson**</u>
<u>**Addition and Subtraction Collection Problems**</u>
<u>**Continued**</u>

There are two types of collection situations: Collection Total (whole) Unknown and Collection Addend (part) unknown. The collection total unknown is when a problem has two addends that need to be "put together" to find the total. The collection addend unknown is when a problem requires the total to be "taken apart" to find the missing addend. Once we realize what type of problem structure and the unknown quantity, we can estimate to check if our solutions will be reasonable.

1. Display Blackline Master, "*Addition and Subtraction Collection Problems*". Ask students how these word problems are alike and different before solving them. Pay attention to the unknown in the question.
   Do not insert quantities in each blank until students can see the structure of the problem and identify if the unknown is an addend unknown or total unknown. This way they will focus on the situation being represented rather than trying to solve the problem. Choose three multi-digit numbers that are related. For example: 1,525, 2,475, 4000 are related numbers because if the two addends are put together it will equal the total; if the total is separated and one addend is subtracted, the other addend is found.
2. Work through the two word problems from the blackline master and write the correct situation equations that represents the unknowns. The example below uses the three related numbers above. Differentiate the magnitude of numbers for your class depending on the need. The big idea is to focus on understanding the structure of collection problems here.

   Problem 1 is a collection total unknown. Situation equation $1,525 + 2,475 = l$
   Problem 2 is a collection addend unknown. Situation equation $4,000 + \quad l \quad = 1,525$
   *A possible solution equation for problem 2 would be $4,000 - 1,525 = l$

3. Practice modeling and solving for the unknowns in each equation after students see how the problems are related. Be sure that students understand the difference between a situation equation and a solution equation. ****Situation equations show the action or the relationship in the problem.** It is important that students learn to represent the problem's situation algebraically. This way students can set the problem up correctly and then manipulate the equation to solve for the unknown. When students write equations to solve the problem, these are known as solution equations. It shows the operation performed to solve the problem and often times there is more than one way to generate a solution equation for solving.
4. Ask students to practice telling a math partner a new collection word problem. Remind students to use three related numbers. Have partners identify if the addend is unknown or total unknown. After students have practiced telling the word problem, have them write it on their whiteboards. If time allows, invite a few students to share their word problems and have the remaining students identify the unknowns.
5. Ask students these questions in a turn and talk to make conjectures.
   - *What if we changed the numbers to make them larger or smaller, does it change the structure of the problem? Why or why not?* No, the structure remains the same, because it still involves joining or separating sets. There is no action or comparison of quantities.
   - *What if we added another addend(part) to the word problem, does it change the structure of the problem? Why or why not?* No, the structure remains the same there's just another addend to add into the problem.

Promote more math talk in a whole group discussion by asking other questions to connect and clarify ideas such as: *What did ____just say? Can you tell me more? Who can repeat what _____just said? Does anyone want to add on to what ____said? Do you agree or disagree with _____'s idea? Is this what you said? Can you prove it? What do you think will happen if _____? What makes you say that?*

Activity 3: Writing and Solving Collection Word Problems (Extend and Evaluate 20 min)
1. Distribute Blackline Master, "*Solving Addition and Subtraction Collection Problems*". Have students work with a partner to talk through each problem as they discuss the structure and the situation equation. Partners must choose three related multi-digit numbers and insert them into each word problem. Some problems may require more than one step. Remind students to use a letter to represent the unknown for each situation equation. If time allows, have student leaders share their solution equations and strategies for solving each problem.
2. Assign, Blackline Master, "*Writing Collection Problems"* to each student for independent practice as homework. Answers will vary.

Addition and Subtraction Collection Problems
How are these word problems alike/ different?

Collection with Total (whole) Unknown:

At the park there are _____ red leaves and _____yellow leaves on the ground. *How many leaves are there altogether?*

Collection with Addend (part) Unknown

There are _____leaves on the ground at the park. _____are red and the rest are yellow leaves. *How many leaves are yellow?*

Practice telling your math partner a different word problem that has a collection structure used. Remember to choose three related numbers. After you share your word problem, have your partner identify if the unknowns is a missing addend or missing total.

Name:_____Date:_____

Solving Addition and Subtraction Collection Problems

<u>*Directions*</u>*: Read each problem carefully. Then choose related multi-digit numbers for each blank. Find the situation equation and represent the unknown with a letter. Write your solution with a label. Show your work on the back if needed.*

1. At the park there were _____ boys and _____girls. There were also _____ adults. How many people were there altogether?

   Situation equation: _____

2. The play had _____ people in the audience. _____were children and the rest were adults.   How many adults were there at the play?

   Situation equation: _____

3. There were _____ red flowers, _____ yellow flowers, and _____ purple flowers. There were also ـ____ bushes. How many plants were in all?

   Situation equation: _____

4. At the basketball game, there was a total of _____ people in the arena. _____ people were cheering for Team A. _____ people were cheering for Team B. Some people were not fans of either team. How many people were not cheering for a team?

   Situation equation: _____

Solving Addition and Subtraction Collection Problems
(ANSWERS WILL VARY BASED ON NUMBERS USED, BUT SITUAITON EQUATION IS REPRESENTED THE SAME. SOLUTION EQUATIONS WILL BE DIFFERENT.

1. At the park there were _____ boys and _____girls. There were also _____ adults. **How many people were there altogether?**

     Situation equation: _____ + _____ + _____ = ***p (unknown total)***

2. The play had _____ people in the audience. _____were children and the rest were adults.   **How many adults were there at the play?**

     Situation equation: _____ + ***a*** = _____ **(unknown addend)**

3. There were _____ red flowers, _____ yellow flowers, and _____ purple flowers. There were also _____ bushes. **How many plants were in all?**

     Situation equation: _____ + _____ + _____ + _____ = ***p* (unknown total)**

4. At the basketball game, there was a total of _____ people in the arena. _____ people were cheering for Team A. _____ people were cheering for Team B. Some people were not fans of either team. How many people were not fans of Team 1 or Team 2?

     Situation equation: _____ + _____ + ***f*** = _____ ***(unknown addend)***

Name:_____   Date:_____

Collection Problems Homework

Part 1 Directions: Choose multi-digit numbers for each blank. Write the situation equation and represent the unknown with a variable.   Write your solution with a label. Show your work on the back if needed.

1. At the Book Fair, there were __736_ children and _319__parents. There were also ___48_____ teachers. How many people were at the Book Fair altogether?

    Situation equation: _____

2. The aquarium has __5,984_ fish. _1,290_are swordtails and the rest are guppies.   How many guppies are in the aquarium?

    Situation equation: _____

Part 2 Directions: Use the 2 equations. Write a collection problem with an addend (part) unknown and a collection problem with a total (result) unknown. Use a letter to represent each situation equation. Model how to solve each problem on the back.

$7,049 + 4,251 = n$ (collection total unknown)	$4,251 + n = 11,300$ (collection addend unknown)

1. Collection with total (result) unknown

    _____

    _____

    _____

2. Collection with addend (part) unknown

    _____

    _____

    _____

3. ****Challenge**: Can you add a change structure into one of the word problems above so that the word problem above requires more than one step in order to solve?

Collection Problems Homework Answer Key

ANSWERS WILL VARY BASED ON NUMBERS USED, BUT SITUAITON EQUATION IS REPRESENTED THE SAME. SOLUTION EQUATIONS WILL BE DIFFERENT.

Part 1 Directions: Choose multi-digit numbers for each blank. Write the situation equation and represent the unknown with a variable.   Write your solution with a label. Show your work on the back if needed.

1. At the Book Fair, there were _____ children and _____parents. There were also _____ teachers. How many people were at the Book Fair altogether?

     Situation equation: _____ + _____ + _____ = **p (unknown total)**

2. The aquarium has _____ fish. _____are swordtails and the rest are guppies.   How many guppies are in the aquarium?

     Situation equation: _____ + **a** = _____ **(unknown addend)**

Part 2 Directions: *Answers will vary*

Wake County Public School System