The Greatest Difference

Overview

Students choose 4 number cards. They use these numbers to write subtraction equations with two 2-digit numbers. They find the equation that produces the greatest possible difference. Students then compare and use both the counting view (single blocks on number lines) and the place value view (packed blocks) to solve each problem.

Objectives

Thinking Skills: Students use strategies to create equations. They look for patterns in the number of possible equations. They also compare and contrast different methods for solving subtraction problems with blocks.

Mastery Skills: Students use single blocks on the number line to subtract. They learn to use packed blocks on the Place mat to subtract. They learn that both methods produce the same mathematical result.

Materials

Each group of students needs:
- 100 single blocks
- 1 block-of-100
- 1 Place mat
- 1 number line (0-100)
- 1 set of number cards (0-9)
- 1 "Two Ways to Subtract" activity sheet

Class Introduction   (20 - 25 minutes)

Place a pile of number cards face down.
- Ask a student to pick four number cards from the pile, for example 5, 3, 1, and 2.
- Explain to students that they will use these four numbers to create subtraction problems. They must use 2 digit cards for each number in the problem. It must be a 2-digit number minus a 2-digit number.

Ask the class to think of ways to arrange the cards to create subtraction problems.
- Record student suggestions.
- Discuss how it is possible to arrange the digits in such a way that the answer is less than zero. Discuss what it means to have an answer less than zero. A real life example to share is temperature; temperatures can drop below freezing. In Celsius, freezing temperatures are "less than zero." Ask students if they have ever experienced "less than zero" temperatures.
- Explain that you are going to save problems with answers less than zero for a different lesson. Have students look at their list and eliminate these equations.

- All possible equations for the example are:

Positive Differences	Differences less than 0
51 – 23	25 – 31
51 – 32	15 – 23
35 – 12	15 – 32
35 – 21	32 – 51
52 – 12	23 – 51
52 – 21	31 – 51
25 – 13	13 – 25
52 – 31	13 – 52
52 – 13	12 – 53
32 - 15	12 – 35
23 – 15	21 – 35
31 – 15	21 - 53

Ask a student to choose an equation. Have the student model how to find the difference using blocks on the number line.

- For example, if the student chose the equation 51 – 23, the student should place 51 single blocks on the number line. Then, the student should remove 23 single blocks from the number line to show 28 single blocks remaining.

Have another student model the problem with packed blocks on the Place mat.

- For example, the student should put 5 blocks-of-10 in the tens place and 1 single block in the ones place on the Place mat. The student should take 2 blocks-of-10 off the mat. In order to take away 3 single blocks, the student should unpack a block-of-10 so that there are 11 single blocks on the mat. Then the student should take 3 single blocks off the mat. The student will have 2 blocks-of-10 and 8 single blocks remaining. (Note: It does not matter which blocks the students remove first, the blocks-of-10 or the single blocks. This issue may be discussed after students choose their own method with the blocks.)

Explain to students that the goal of this activity is to get the greatest possible difference. Have students look at the list or think of a better way to arrange the 4 number cards into an equation with this goal in mind. In the example, the equation that produces the greatest difference is **53 – 12**.

Ask students to solve the problem using both the number line and the Place mat. Have students discuss both methods of solving a subtraction problem.

- Ask, **Did both methods produce the same difference between the numbers? What is the same/different about the two methods? Did you prefer one method to the other?**

Give students the opportunity to challenge the equation that was chosen. If a student or group of students believes that another equation would produce a greater difference, have them test out their prediction.

Small Group Activity   (15 - 20 minutes)

Pass out the materials. Ask one team in each group to use the number line method and the other team to use the Place mat method. Direct students to play as follows:

- Students work in groups of 4, two teams of 2 in the group.
- Each player in the group gets to choose one number card from the pile. Both teams write these 4 numbers on their activity sheets.

- Teams separately and secretly find 2-digit equations for these numbers. They choose the equation that they think will produce the greatest possible difference and write it on their activity sheet.
- Teams use their method to model their equation for the other team (even if they have the same equation written.)
- Teams that chose the correct equation get a point for that round.
- Groups play three rounds and then switch materials and methods of subtraction (number line and Place mat). They play two rounds with the other materials.

Closure (10-15 minutes)

Discuss the responses to the following questions:
- **What strategy did you use to arrange your cards?** (Ask students to describe their strategies in detail.)
- **Are you confident that you always found the equation with the greatest possible difference? If so, why?**
- **Did you and your opposing team usually write the same equation? If so, did you get the same answer with the number line as with the Place mat?**
- **How is using blocks on the number line similar to/different from using blocks on the Place mat?**
- **Did you prefer one method over the other? Why?**
- **If the numbers were in the hundreds, which method do you think you would prefer? Why?**

Have students respond to the questions at the bottom of the second page of the activity sheet. Collect student work. (Note: There will always be 24 (4!) possible equations including positive and negative differences. Some students may discover this. Ask these students to think about and try to explain why there are always 24 possible equations for this scenario.)

Assessment

As the class is working in small groups, observe student behavior.
- Are students working collaboratively?
- Do students choose two 2-digit numbers that will result in the greatest difference between them? Do they have a strategy other than trial and error? Do they readily articulate their strategy?
- Do students model and use the number line method appropriately?
- Do students model and use the Place mat method appropriately?
- Do students understand that the two methods used correctly always produce the same result?
- Do students recognize the number of possible combinations in this situation is always 24?

Extension

❑ Have students repeat the activity, only this time ask students to write equations to produce the least difference.
❑ Have larger groups of students conduct this activity with two 3-digit numbers. Time should be planned accordingly, as it will obviously take a longer period of time to do this activity with the number line method.
❑ Have children try to figure out the number of equations that can be written with six digits (two 3-digit numbers) versus four.