

I Know It's Either 2 More or 2 Less

In Session 1.4, these students are considering the relationship between two subtraction expressions. First they compare $200 - 75$ and $200 - 78$ and then $350 - 300$ and $350 - 298$. Although some students may use such relationships to make it easier to solve certain subtraction problems (e.g., thinking of $350 - 298$ as $350 - 300 + 2$), the primary purpose of this discussion is not to help students use this method for subtraction. Rather, by considering these pairs of subtraction expressions, students have to think hard about how the operation of subtraction works and what each number means.

The class is considering this story problem.

Deondra had two boxes of paper clips and used 75 of them to make a wire sculpture. Arthur had two boxes of paper clips and used 78 of them to make a wire sculpture. Who had more paper clips left?

Teacher: First, what expression can we write for Deondra's paper clips? What about for Arthur's paper clips?

The teacher takes students' suggestions and writes the two expressions on the board.

Deondra's paper clips: $200 - 75$
Arthur's paper clips: $200 - 78$

Teacher: So after Deondra uses 75 and Arthur uses 78 clips, who has more left, and how do you know?

Kim: Deondra does, because they had the same amount to begin with, and Deondra didn't use up as many.

Gil: Arthur used up 3 extra. I thought about it like this—they both used 75 at first, so then they would have the same left. But then Arthur used up 3 more, but Deondra didn't use any more.

Teacher: Will this always be true? What if I used different numbers? Let's say that they both start with 350 paper clips. This time, Deondra uses up 300 and Arthur uses 298.

Deondra's paper clips: $350 - 300$
Arthur's paper clips: $350 - 298$

Teacher: I know that you know right away how many paper clips Deondra has left. Can you use that answer to help you figure out how many Arthur has left?

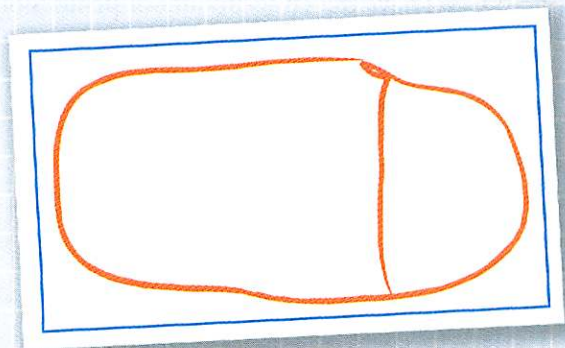
Elena: It would just be 2 different because Deondra has 50 left and Arthur will have, wait . . . I know it's either 2 more or 2 less . . .

Denzel: It has to be 2 more because if you have money in your pocket and you spend more, then you'll have less left.

Keith: If you take away less, you end up with more. It has to be. Can I show you what I mean?

Teacher: Did you have a picture of some kind in mind? [Keith nods yes.] So you have an idea about a picture and Denzel came up with a story about money. Before you share your picture, I'd like everyone to make a picture or think of a story context that helps explain whether Arthur ends up with more or less and why.

After students work for a few minutes in pairs and individually, several students share their ideas. Keith draws this on the board:



Sample Student Work

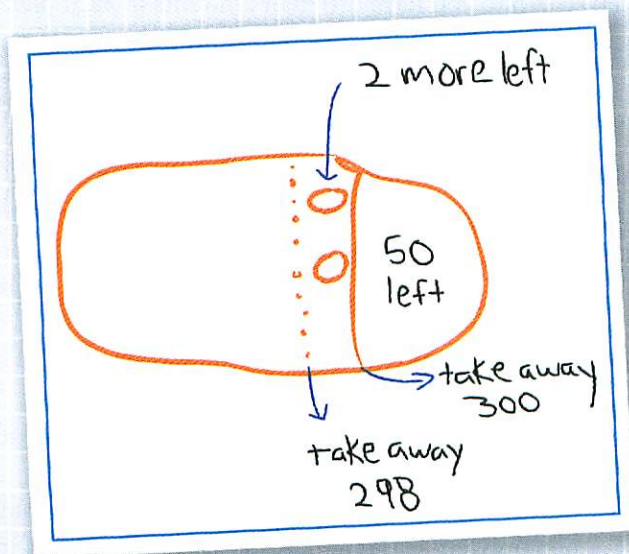
Keith: It's like here's a pile of paper clips. You take some away and have some left.

Teacher: Where's the part that you take away, and where's the part that is left?

Keith explains that the larger section represents the 300 clips Deondra uses; the smaller section represents the 50 clips that are left.

Keith: But if you only take away 298, it's over here.

Keith draws a second line, shown by the dotted line below.



Sample Student Work

Nancy: Yeah, it's like you have this big hunk of bread and you can take a tiny bite or a bigger bite. If you take away smaller you end up with bigger.

Teacher: Did anyone have another way of thinking about it? It was confusing at first. Everyone knew that there was something about a 2, but a lot of people weren't sure if Arthur ends up with 2 more or 2 less. Did anyone come up with another picture or story that helped them think about this?

Ines: I used to think it was 48, but I heard everyone saying it's 52, but I didn't get why. But then when Denzel said about money, me and Kenji thought about 3 dollars and 50 cents. If you spent 3 dollars, you have that 50 cents left, but if you only spent \$2.98, you have an extra 2 cents. You'd get 2 cents change from the 3 dollars and you still have 50 cents, so that's 52, not 48.

Even though several students gave clear responses at the beginning of this discussion, the teacher knew that other students needed time to think out and represent these ideas for themselves. By representing their ideas with pictures or by putting them in a context, they are able to think about the meaning of the operation and how the numbers in a subtraction expression are related to each other and to the difference. Underlying what these students are doing are connections between algebra and arithmetic (see **Algebra Connections in This Unit**, page 16).