

## Finding Perimeter and Area

In Sessions 2.5 and 2.6, students have been finding the perimeter and area of their own footprints. The teacher has been watching and interacting with students, asking what strategies they are using to find perimeter and area, and if they are making certain to include all of the perimeter, or all of the area. In this discussion, the teacher focuses on how students found the perimeter and area.

**Teacher:** Let's start by talking about perimeter. Who will describe how they found the perimeter of their footprint?

**Edwin:** I measured the squares.

**Teacher:** Hmm, Edwin how did you use the squares to find perimeter?

**Edwin:** I just counted all the squares and that was it.

**Teacher:** What do the rest of you think?

**Pilar:** I think that works, but I thought squares were area.

**Edwin:** Oh! That's right, that's how I found the area, not the perimeter!

**Teacher:** OK, but let's talk about perimeter. Who wants to explain what they did?

**Cameron:** I just put yarn around my footprint. Then I measured the yarn.

**Dwayne:** I did perimeter and I used the handle of the marker container thing and half of my foot was nine inches and the other half was  $9\frac{1}{2}$  inches.

**Teacher:** Any questions for Cameron or Dwayne?

**Keisha:** Yes, I want to know how Dwayne figured out the whole perimeter.

**Dwayne:** Nine and nine is 18 inches and then 18 inches plus a  $\frac{1}{2}$  inch is  $18\frac{1}{2}$  inches.

**Teacher:** How about the part that goes around your heel or toes?

**Dwayne:** I got that. It was part of the half.

**Teacher:** So it sounds like one of the challenging things with perimeter was figuring out how to make a straight line so you could measure it. How about the area? Who wants to explain how they found the area of their foot?

**Gina:** I tried to find the column and rows but some aren't full. I wasn't sure what to do.

**Nancy:** First I copied my foot onto grid paper. Then I counted all the whole squares, then the halves. I got 22 square units.

**Teacher:** Nancy, why did you use grid paper?

**Nancy:** Well, at first I just did it because I saw Chiang doing it, but then I figured out I needed to have squares on the paper so I could count them!

**Nicholas:** I did that too, but then I saw like a rectangle in my footprint, so I drew the lines on it. There were four in each row, and six rows, so I got 24 squares, then added on the others.

**Teacher:** So it sounds like the challenging part of the area is how to count those partial squares. How did people count the partial squares?

**Deondra:** I judged them with my eyes and I'd think [points to different partial squares on her footprint] this one and this one make about a whole, and this one and this one. Like that. [A number of students nod in agreement.]

**Adam:** I didn't even count them. I just counted the whole squares.

**Keisha:** You can't do that! You have to count them!

**Adam:** Why?

**Keisha:** You just have to! [pauses] Hmm. It's just like when we did the tetrominoes. You have to cover everything; you can't have any gaps. So you have to count everything on the foot.

**Teacher:** Good. We have to count everything. I noticed just about everyone ended up tracing their footprints on grid paper. Here's my last question. Was doing that helpful for finding area or perimeter?

**Oscar:** Area, because it would work just as easily on a plain piece of paper for perimeter because you're just finding the outside of it. It doesn't matter if there are squares or not. But for area, you need some kind of square units to count.

During the course of this discussion, the teacher wants students to focus on some important ideas about perimeter and area and how they are measured—that perimeter is a one-dimensional or linear measure (even if the border is curved) and that area is two-dimensional and measured in square units. Since many students confuse perimeter and area, the teacher highlights the difference between the two measures. The teacher does not focus on the exactness of students' measurements (such as not worrying about how much the yarn stretches out, or if each partial square that students count as  $\frac{1}{2}$  a square unit is actually  $\frac{1}{2}$ , etc.). His goal in this discussion is for students to understand that “everything” has to be measured. Therefore, he asks Dwayne about accounting for the heel and the toes in finding perimeter, and highlights for the whole class Keisha's explanation about having to count the partial squares.