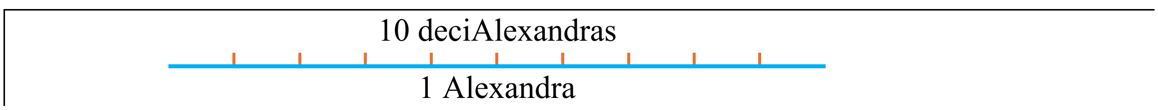
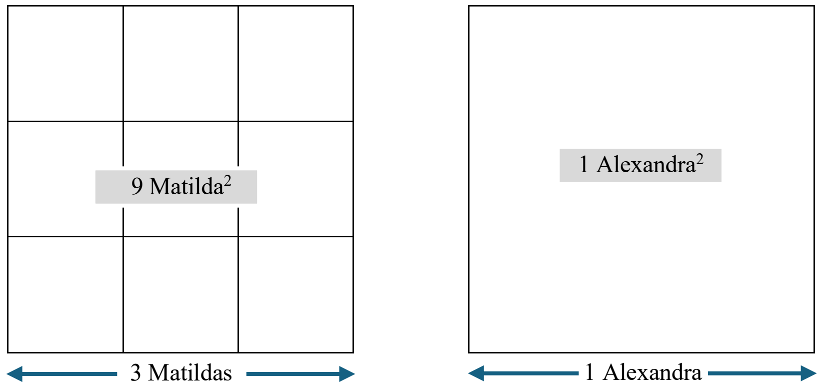
Teacher Notes

- Distribute the Personal Unit handout and a page of centimeter graph paper.
- Ask students to make their personal unit and answer the first two questions. This activity is better when people are answering the questions for congruent objects (e.g., everyone has a matching desk or table). If that is not the case, you can pick some other matching objects that will enable comparison.
- Ask students to share their results for the first question and put them on the board. “The desk is: 7.5 Julias, 9 Juans, 3 Biffs, etc.”
- Ask students to write down which unit they think is the longest and ask them why.
- Discuss why the longest units have the smallest associated value/count. Ask about which unit is the shortest.
- What else can we learn from the measurements on the board? Can you identify two of your classmates’ units where one is approximately twice as long as another (without looking at their unit sheets, but based on the measurements)? Are any 50% longer than another (ratio = 1.5). Is one a third of another? Get several examples of the ratios between different units and predict how their second measurements will compare and then ask what those second measurements were from those students to see how well the ratio from one measurement matched the next.
- Review some basic metric prefixes (centi, deci, kilo) and ask what a deciAlexandra is. Have them mark the deci- markings off on their personal unit (see orange tick marks below).




- Have them rewrite their lengths in terms of a whole number of deci-*their_names* (7.5 Julias should become 75 deciJulias).
- Continue onto question 4) from the handout. If possible, distribute scissors and have students cut out one or more copies of their unit square (or have them fold a version). As students work, help them think about how to measure and keep track of fractional portions of their square.
- When students share out their results, note that even though a desk may be 36 ¼ Alexandra$^2$, that does not mean 36 whole squares can fit on it without dissection. For example, a rectangle 0.5m by 10m has an area of 5m$^2$, but no whole square meter fits in it.
- Have students share their desk areas in their personal square units and record the information on the board. Ask for observations. Ask whose area unit is the biggest and smallest (the answers should be the same as before for lengths). If it is not noted that the ratios are not the same as they were for the linear units, ask whose area unit is approximately twice as large as another’s. It will not be the same students whose lengths units were approximately in a ratio of 2:1. Have two students whose area ratios are close to 2:1 based on the measurements hold them up and show the whol class. Is one twice as wide as the other? Twice as high? What is going on? What about the two students whose linear units were 2:1. What is the ratio of their desk area measurements? It should be around 4:1. Why?

- These inquiries should help students see that while one-dimensional measurements are proportional to their units, two-dimensional measurements are in two directions and so the ratio is the square of the linear ratio. If your linear measurement is 3 times my linear measurement (because your unit is $^1/_3$ as long), your area measurement will be 9 times mine (3 times in one direction * 3 times in the other).




This activity links linear to area measurements and, as you introduce volume, can be extended to 3-dimensional measurements, in which 1 $\text{Alexandra}^3$ equals 27 $\text{Matilda}^3$ and 1 $ft^3$ = 1728 $in^3$. It shows that each new dimensional unit can be built up from the previous dimension's unit, which is a key concept in the rest of the area and volume activities in this lesson sequence.
The customary system of measurement that the United States (and only a handful of other countries) uses makes teaching measurement time-consuming and less informative. While $ft^2$ and $ft^3$ are units of area and volume, most people do not work with $ft^3$, but instead deal with units such as tablespoons, quarts, and gallons, each with different ratios between them. While citizens in countries that still use non-metric units need some familiarity with the units in use, math classes should focus on metric measure, both for its base ten simplicity (every unit is in a power of ten ratio with the other units because they are all based on the same metric prefixes) and because all science classes should work in metric universally. The more students experience these units in hands-on practical ways, the more familiar and comfortable they will be with them.

Students can get more practice and challenge thinking about units conceptually with the Arbitrary Trimetric Unit handouts.