Picturing Cookies—Part I

By graphing relationships, we can turn symbolic relationships into geometric ones. Because geometric relationships are visual, they are often easier to think about than algebraic statements.

One of the constraints in *How Many of Each Kind?* is that the Woos can make at most 140 dozen cookies altogether (because of oven-space limitations). You can represent this constraint symbolically by the inequality

$$P + I \leq 140$$

where P is the number of dozens of plain cookies and I is the number of dozens of iced cookies.

Choose one color to use for combinations of plain and iced cookies that satisfy the constraint—that is, combinations that total 140 dozen cookies or fewer. Choose a different color for combinations that do not satisfy the constraint—that is, combinations that total more than 140 dozen cookies.

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Some Examples

For instance, what color should you use for the point (20, 50)? In other words, does the combination of 20 dozen plain cookies and 50 dozen iced cookies fit the constraint or not? You can check by substituting 20 for P and 50 for I in the inequality $P + I \leq 140$. Because $20 + 50 \leq 140$ is a true statement, the first color should be used for the point (20, 50).

What about 90 dozen plain cookies and 120 dozen iced cookies? This does not satisfy the constraint, because the statement $90 + 120 \leq 140$ is not true. Therefore, the second color should be used for the point (90, 120).

Your Task

Your task is to plot both types of points and then to describe the graph of the inequality itself. (The graph of the inequality consists of all points that fit the constraint, that is, all points of the first color.)

Steps 1 through 3 in Question 1 give details on what you need to do. Do your final diagram on a sheet of grid chart paper. If you have time, do Question 2, dealing with other constraints.

1. Go through these steps for the oven-space inequality.

   Step 1: Have each group member try many pairs of numbers for the variables, testing whether each pair satisfies the constraint. *On one shared set of coordinate axes,* group members should plot their number pairs using the appropriate color.

   Step 2: Make sure that your group has many points of both colors. After some experimentation, you may need to change the scale on your axes so that you can show both types of points. If necessary, redraw your axes with a new scale and replot the points you have already found.

   Step 3: Continue with Steps 1 and 2, adding points of each type in the appropriate color. Keep going until you get the "big picture," that is, until you are sure what the overall diagram looks like. Include with your final diagram a statement describing the graph of the inequality itself (the points of the first color) and explaining why you think your description is correct.

2. Graph each of the remaining constraints on its own set of axes. Either follow the process described in steps 1 through 3 of Question 1 or use what you learned in Question 1 about the "big picture."