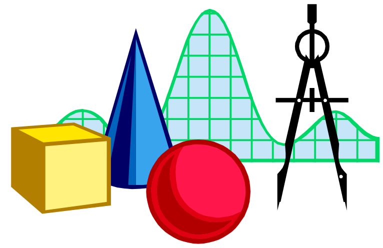
TAKE IT TO THE MAT

A NEWSLETTER ADDRESSING THE FINER POINTS OF MATHEMATICS INSTRUCTION



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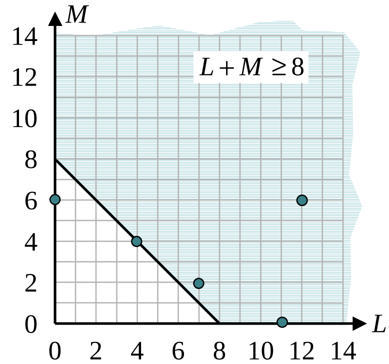
Latex	*Mylar*	*Total* (≥8)
4	4	8
12	6	18
11	0	11
0	6	6
7	2	9



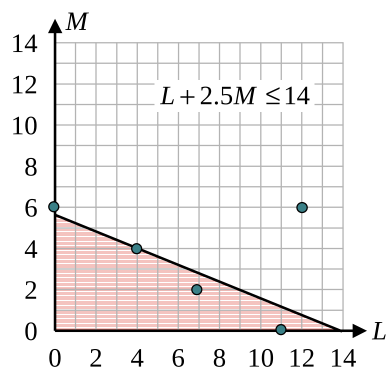
After students learn to graph lines on the coordinate plane using various forms of linear equations—general, slope-intercept, point-slope—we often move on to linear inequalities. Kids usually see linear inequalities as the graphing of a line followed by shading, but don't often see its purpose. In fact, linear inequalities is a highly applicable topic. In this issue of *Take It to the MAT*, we'll look at linear inequalities and what they are good for.

Let's say we are going to throw a party and would like to have some nice balloons to make the scene festive. Our decorator thinks that we should have **at least** 8 balloons, the more the better. The party shop has two types of balloons: latex and Mylar. How many of each will we buy? Four latex and four Mylar? Twelve latex and six Mylar? Eleven latex and zero Mylar? No latex and six Mylar—that won't work. But, the possibilities that do work *are* endless.

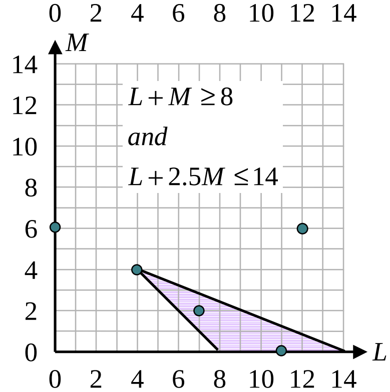
We can write an inequality to represent how many balloons we can possibly buy: *Number of Latex Balloons* + *Number of Mylar Balloons* ≥ 8. There are an infinite number of solutions to this inequality. A partial table of solutions might look like the one at the top of the column of figures at right, and we can graph the inequality as shown in the second figure. The points from our table are shown on the graph. (Shaded table cells indicate non-solutions.)

Latex	*Mylar*	*Total* (≥ 8)	*Cost* (≤ $14)
4	4	8	$14
12	6	18	$27
11	0	11	$11
0	6	6	$15
7	2	9	$12

The diagonal line represents the points where $L + M$ exactly equals 8, the shaded area where $L + M$ is greater than 8. The solution set—line plus shaded area—is all of the ordered pairs (L, M) that make the inequality $L + M \geq 8$ true. However, we are only graphing in the first quadrant, as negative values for the number of balloons is nonsensical. Also, students must realize in this situation that not every place on the line and shaded region is a solution, only those where L and M are whole numbers. (We can't buy partial balloons.)



Well then, why not 1000 balloons? Because we have a budget. We can't afford to spend more than $14. Latex balloons cost $1.00 and Mylar balloons cost $2.50. Now how many balloons can we buy? Let's look at our original table, adding a cost column. A few of our previous ordered pairs (L, M) work: (4, 4), (11, 0), and (7, 2). All of the possibilities can be written as another inequality: *Number of Latex Balloons* + 2.5 · *Number of Mylar Balloons* ≤ 14. This is shown on the second graph along with its shading. The meanings of the line, shaded area, 1st quadrant, and whole number values are equivalent to those described in the previous paragraph.



In the end, our choices for L and M must satisfy both inequalities simultaneously. That is, all ordered pairs (L, M) must make both inequalities true statements. Only three points in our table do, but what of all the possibilities? This is shown in the third graph, where the shaded area is the overlap of the previous two graphs. Only those points (L, M) in the shaded regions or on the boundary lines work in both inequalities. There are only a few possibilities, 19 to be precise.

So long as we choose one of the points in the overlapping shaded region, or on its boundary, we will satisfy both our decorator and our accountant.