Students may well consider the behavior of the parabola $y^2 = x$ and the other conics $2x^2 + y^2 = 1$, $x^2 + 2y^2 = 1$ and $x^2 - y^2 = 1$ relative to L_∞.

Homogeneous coordinates are used in the study of the more general projective geometry in which one does not have affine, similarity or euclidean properties. The above discussion refers to figures which are valid in affine geometry at least although one need not think of that as he introduces these concepts to students.

DON'T FORGET BASE-TWELVE

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Many mathematics textbooks present the idea of counting in number systems besides the standard system of base-ten. Unfortunately, these discussions usually concern bases less than ten and rarely cover bases over ten. As a result, the base-twelve system is often ignored. This is an extreme oversight since the base-twelve system can be very enlightening to elementary aged students' study of number systems.

The reasons for teaching a system based on twelve are obvious. We have a name for a group of twelve objects: a dozen. Children know that they can buy a dozen eggs, a dozen oranges, or a dozen doughnuts. They have an experiential understanding that a dozen represents a group of twelve objects. Likewise, we also have a name for a group of twelve-twelves: a gross. Since these terms are familiar to students, it is only natural and logical to build on this familiarity.

However, before you begin an exploration of base-twelve, a minor obstacle must be overcome. In the base-ten system of numeration there are just ten numerals (0,1,2,3,4,5,6,7,8,9). To be able to work in base-twelve, two more numerals are needed to represent ten and eleven. (The fact that we do not have such single digit numerals could be one of the reasons that textbooks do not present number systems above base-ten.)

This obstacle can be turned into an activity by allowing students to invent these new numerals. Most books that present base-twelve use a T to represent ten and an E to represent eleven. While that is all right, T and E are popular letters and do not seem "numeral" enough.

There are many other possibilities. Doughnuts are bought by the dozen so a possible numeral could relate to the shape of a doughnut  . Another idea would be to use the Roman numeral X for ten. Eleven could then be some variation of the Roman numeral XI such as  ,  ,  or  . (You would not want to use XI because it would not fit in with the other single digits.) Combinations are possible such as the doughnut shape and Roman notation  . It is obvious that there are many choices. For this discussion,  will be used for ten and  for eleven.

Our base-twelve system will then have the numerals 0,1,2,3, 4,5,6,7,8,9,  ,  . The number twelve would be represented as 10_{twelve} meaning 1 group of twelve and 0 ones. Another way to describe 10_{twelve} would be to say it represents 1 dozen and 0 ones. Similarly, 23_{twelve} would represent 2 dozens and 3 ones and 5_{twelve} would represent ten dozens and 5 ones.

The next step would be to name the group of twelve-twelves. As mentioned previously, we already call this quantity a gross. Therefore, by using this term, 343_{twelve} would represent 3 gross, 4 dozens, and 3 ones.

Most classroom discussions of the base-twelve system would end after an exploration of the values of the first three places. But if your class has the interest or desire, you can go further.

The next place to the left in the base-twelve system represents groups of 12 x 144 or 1,728. Here we do not have a name for such a quantity. However, in the base-ten system we sometimes combine terms when describing the values of certain places (ten-thousand's place or hundred-thousand's place). We could do this in our base-twelve system and call the next place the dozen-gross' place.

As you can see, this exploration with the base-twelve system could go on and on. Most classes will probably only want to explore the dozen's place and gross' place. But remember, whenever you are teaching bases...Don't Forget Base-Twelve.

REFERENCES

Luce, Maurice, illus. Steveson, Charles. Ten-why is it important? Minneapolis: Lerner Publications, 1969.

Adler, Ruth and Irving. Numerals: New Dresses for Old Numbers. New York: John Day and Company, 1964.

THE UPS AND DOWNS OF PROBABILITY

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As probability becomes a part of more and more high school curricula across the country, we need to look about for honest examples of probability usage in everyday life. Dealing bridge hands, rolling dice and flipping coins are all right for an introduction, but it seems contrived, artificial, and of little practical use. To see how probability theory is used every day, let's take a look at a modern convenience that everyone takes for granted--the automatic elevator. How are these designed for efficiency in modern buildings?