The **other** type of hyperbola

When you are trying to massage an equation into the standard equation of a hyperbola of the form $(x-c)(y-d)=E$, one way to do it is as follows:

1. Before you get started, the warning sign that you will need to do this is that there is a cross term xy, perhaps with a coefficient.
2. Divide the entire equation by the coefficient of xy (if it exists), and move the constant term to the other side of the equation.
3. Determine c and d. We want our equation to look like $(x-c)(y-d)=E$. If we were to expand this product, we would have an equation of the form $xy-dx-cy+cd=E$. So the coefficients of x and y are actually d and c, respectively. (Not the other way around!)
4. Add cd to both sides of the equation, and then factor the $xy-dx-cy+cd$ as $(x-c)(y-d)$.
5. The center of the graph is at (c,d), with horizontal and vertical asymptotes eminating from the center. If E is positive, the curves are in the upper-right and lower-left quadrants. Otherwise, the curves are in the upper-left and lower-right quadrant.

Here is an example:

1. Determine the standard form of the following equation: (Note the xy cross term.)

$$5xy+10x-25y+30=0$$

2. Divide by 5.

$$xy+2x-5y+6=0$$

   Then move the 6 to the other side of the equation.

$$xy+2x-5y=-6$$

3. Since the coefficient of x is 2 and the coefficient of y is -5, then $d=2$ and $c=-5$.
4. So, add $cd=-10$ to both sides of the equation, and factor.

$$xy+2x-5y-10=-6-10$$

$$(x-5)(y+2)=-16$$

5. The center is at $(5,-2)$, and the curves are on the upper-left and lower-right sections defined by the asymptotes.