MA 323 **2/17/05**

Combinatorial Geometry
All Hail! Problem Set Four

Instructions: Again, do any two of these problems, but one of them MUST be problem (1). They're due in a week (Feb 24). Feel free to use Geometer's Sketchpad to write these up.

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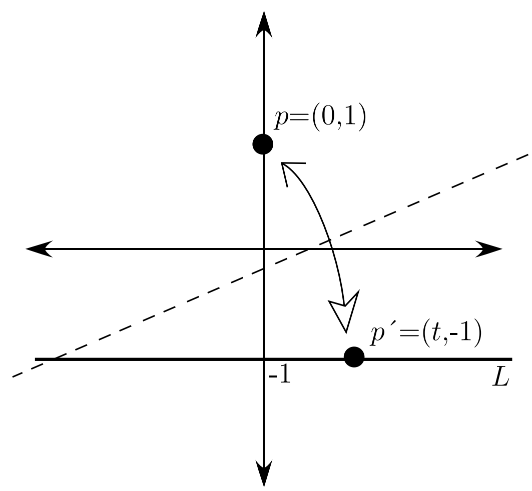
(1) In class we did that parabola folding activity on paper and on Geometer's Sketchpad. Let's define where things lie on the xy-plane. Let the point $p = (0, 1)$ and let L be the line $y = -1$. Now suppose that we fold p to an arbitrary point $p' = (t, -1)$ on the line L, where t can be any number.

Find an equation for the crease line we get when we fold p onto p'.
(Write it in terms of x and y, although it will have the t variable in it as well.)



(2) Use your answer to problem (1) to find an equation of the parabola that our crease line is tangent to.

(3) Prove that the "ellipse activity" really works. That is, prove that if we're given a circle C (with center point O) and a point p inside the circle, then when we fold p to an arbitrary point p' on the circle, the crease line we make will be tangent to the ellipse whose two foci are O and p and whose "constant" will be the radius of the circle. (That is, for any point x on the ellipse, the distance $\overline{Ox}$ plus the distance $\overline{xp}$ will always equal the radius of the circle.)

(4) How would you fold a regular hexagon inside a square piece of paper? Hint: you can use what we learned about folding an equilateral triangle to help.