



DoubleCross Education Conic Sections - A Dynamic Approach

Teacher Notes

Conic Sections are brought to life through the use of GeoGebra Dynamic Mathematics software (www.geogebra.org). The “Dynamic Worksheets” that are linked to the site are html documents (i.e. web pages) that are fully functional using basic web browsers like Internet Explorer, Firefox or Safari. This means that the GeoGebra software does not need to be installed in order to explore the dynamic features that are in the sketches.

The instructions for teaching the parabola are detailed below but the other conics can be taught using this basic plan.

The parabola is usually the first of the conics that are explored. Students generally have some experience with the parabola in the context of the graph of a quadratic function. They usually do not have knowledge of the basic focus/directrix definition of the parabola. This is difficult to demonstrate through teacher-created diagrams but using the sketches titled *Parabola Definition 1* (vertical axis) and *Parabola Definition 2* (horizontal axis) the properties are far more evident. These dynamic worksheets can be shown in a classroom demonstration mode and the distance properties discussed. Then the basic equation of the parabola in the form

$y = \frac{1}{4p}x^2$ and $x = \frac{1}{4p}y^2$ are introduced and the importance of parameter p are demonstrated.

Next the translations and reflections of the parabola is explored using dynamic worksheets *Parabola 1* and *Parabola 2*. The student worksheet (pdf file) *Parabola Worksheet 1* is designed for students to accompany the *Parabola 1* dynamic worksheet. This student exploration can be done in a computer lab, in a classroom computer activity center or as a homework assignment. It is designed for students to discover how changing the parameters of the equation

$y - k = \frac{1}{4p}(x - h)^2$ effect changes in the graph. After exploring a number of examples,

students are asked to generalize the changes that occur when h , k and p are altered. Students are then asked to graph using the GeoGebra Dynamic Worksheet and then graph parabolas without using the software. Next they examine graphs and are prompted to write equations from the graph which helps to solidify their understanding of the parabola.

This basic plan serves as the outline for the ellipse and hyperbola. These GeoGebra Dynamic Worksheets and the student worksheets that accompany them are intended to provide a solid introduction but not a complete exploration of the conics. For example, plotting the foci of the ellipse and hyperbola are not part of the worksheets. Teachers are urged to use these resources to supplement traditional teaching methods.