SAMPLE ACTIVITY FOR:

TI-83 PLUS
SILVER EDITION

Investigating Geometry Using Cabri®

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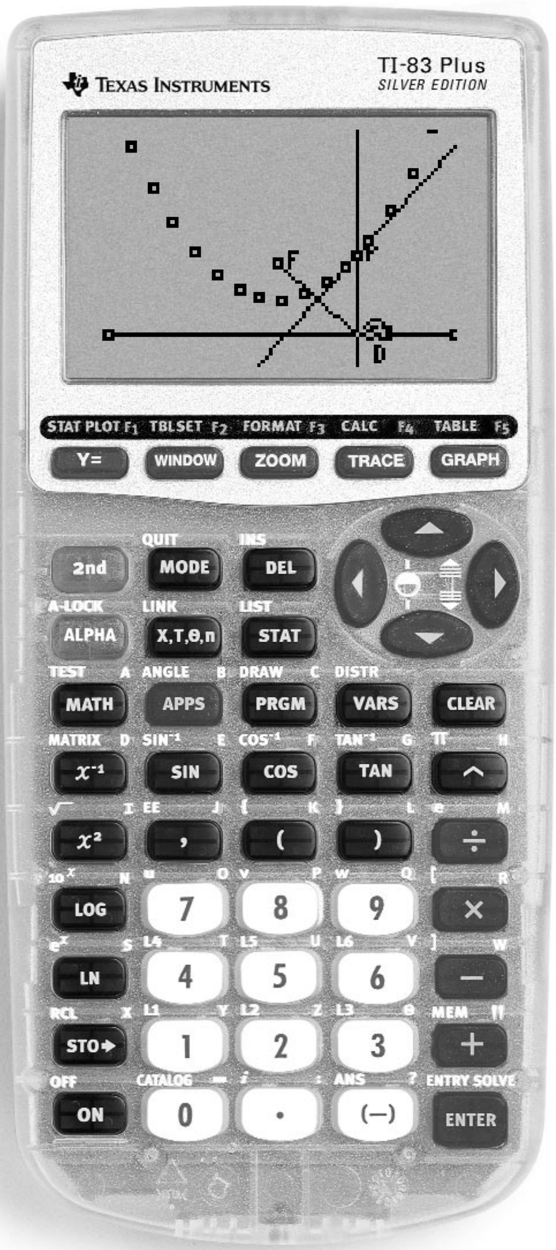
EXPLORATIONS™



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Investigating Geometry Using Cabri Jr.

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Analytic Geometry (Geometry in the Coordinate Plane)

*Instructor Notes --
Similar Triangles and Proportions

Exploration 1

1. Students should see that:

$$\frac{AD}{AB} = \frac{AE}{AC}$$

- It is this interactive portion of this geometry package that makes it such a powerful tool for investigations.
- Students can now investigate an infinite number of examples.
- When dragging measurements, note that the labels of the measurements move independent of the measurements.
- Students should be able to explain that the ratios are equal from the fact that ΔADE and ΔABC are similar by the Angle-Angle Similarity Theorem.
- This is true because parallel lines form congruent corresponding angles. See Figure 1.

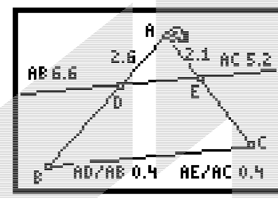

Figure 1

Exploration 2

. Students should see that

$$\frac{AD}{AB} = \frac{DE}{BC}$$

- Students should be able to explain that the ratios are equal from the fact that ΔADE and ΔABC are similar by AA.
- This is true from the fact that the parallel lines form congruent corresponding angles. See Figure 2.

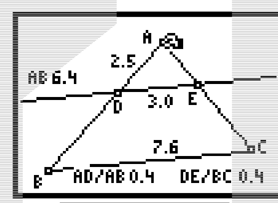

Figure 2

Exploration 3

. Students should see that (Figure 3)

$$\frac{AD}{DB} = \frac{AE}{EC}$$

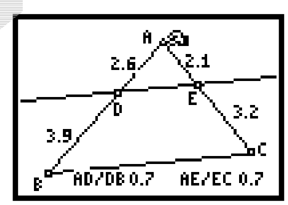

Figure 3

Similar Triangles and Proportions

Math Concepts

- Parallel Lines
- Equivalent Ratios

Materials

- TI-83 Plus
- CabriJr™ Application

Overview

This activity is designed to allow students to interactively investigate ratios. This allows hundreds of examples to be done in a short amount of time. From the evidence, students are expected to induce the generalizations about ratios. Triangle similarity is a natural extension of the equivalent ratio explorations.

Exploration 1

1. Draw ΔABC triangle using the Triangle tool from the F2 menu. Then draw a point (D) on a side of the triangle using the Point Point on tool in the F2 menu. See Figure 1.
2. From the F3 menu, select the Parallel tool to draw a line parallel to one side that intersects the other two sides of the triangle. To execute the Parallel tool select the side to which the parallel line is to be drawn and then select the point placed on the side of the triangle, point D. See Figure 2.
   - Use the Point Intersection tool from the F2 menu to draw the point of intersection of the parallel line and the other side of the triangle. Point E in Figure 2
   - From the F5 menu use the Alph-Num tool to label the vertices of the triangle A, B, C and the points of intersection D and E.
   - From the F5 menu, use the Measure D.&Length tool to measure the distances AD, AB, AE, and AC. See Figure 3.
   - Drag the point D. Notice that the values of the lengths of AD and AE change.
   - The question to be investigated is whether they are changing at the same rate with respect to the sides AB and AC.
   - Use the Calculate tool in the F5 menu to perform the division operation to find the ratios.

Figure 1

Figure 2

Figure 3

3. What is true about the ratios **AD/AB** and **AE/AC**?

- Would this be true for any triangle?
- Explain why these ratios are the same.

Exploration 2

4. Repeat the process developed in Exploration 1 to check the ratios AD/AB and DE/BC. See Figure 4.

- It may be necessary to delete some measures to get new measures on the screen.
- Explain the result of your investigation.

Figure 4

Exploration 3

5. Repeat the process developed in Exploration 1 to check the ratios AD/DB and AE/EC. See Figure 5.

- It may be necessary to delete some measures to get new measures on the screen.
- Explain the result of your investigation using properties of ratios.

Figure 5

*Instructor Notes --

Parabolas -- Locus of Points Equidistant from a Point and a Line

Exploration

1. Measuring the distance from the point of intersection to the focus and the point of intersection to the directrix will show that the definition of a parabola is satisfied.
   - As point D moves along the directrix, △PDF is always isosceles because of the properties of the perpendicular bisector of its base.
   - This means that PF = PD, or that point P is equidistant from both a point and a line at the same time.
   - This is the geometric definition of a parabola.
2. An alternate geometric definition of a parabola is demonstrated when a circle is drawn centered at point P with radius PD.
   - The parabola is defined to be the locus of the center of the circles passing through a fixed point (the foci) and tangent to a fixed line (the directrix).
   - The lines drawn to construct point P, the center of the circle, locate the center of the circle by bisecting a chord of the circle and drawing a line perpendicular to a tangent line to the circle at a point of tangency.
3. Students should see that as the focus **F** is closer to the directrix, the parabola appears narrower.
   - This is the same graphical effect seen when the value of a in the function $y = ax^2$ is made larger causing a vertical stretch.
   - When the foci is farther away from the directrix, the parabola appears wider as when the value of a in $y = ax^2$ is made smaller causing a vertical shrink in the graph. Figures 1 and 2 show these changes.

Figure 1

Figure 2

Parabolas -- Locus of Points Equidistant from a Point and a Line

Math Concepts

- Parabola
- Focus
- Directrix
- Isosceles Triangles

Materials

- TI-83 Plus
- CabriJr™ Application

Overview

This activity explores the a parabola constructed by definition as the locus of points equidistant from a point and a line. This may be students first introduction to the conic concepts of a focus and directrix. If students have studied parabola as functions, this approach provides an important alternate approach and a connection to conic sections in general.

Exploration

1. The tools needed for the following construction are located in the F2 and F3 menu.
2. Draw a horizontal Segment and a point F not on the segment. See Figure 1.
    - This point is called the focus and the line is the directrix.
    - Draw a Segment from the focus F to a point D on the directrix. It is not necessary to draw the point on the segment first, simply place the pencil on the segment when drawing the second endpoint.
    - Draw the Perpendicular Bisector of segment FD.
    - Through point D on the directrix, draw a line perpendicular to the directrix.
    - Use the Point Intersection tool in F2 to draw point P at the intersection of the perpendicular line through D and the perpendicular bisector of FD.
    - Drag point D along the directrix and observe the path of point P.
3. Point P is equidistant from the focus F and the directrix.
    - To show this, Draw a Circle centered at point P passing through point D and observe where point F is located. See Figure 2.
    - Or, complete ΔPDF by drawing segment FP.

Figure 1

Figure 2

- Explain what type of triangle this is and why this demonstrated the same property as the circle.

3. To visualize the path of the point of Hide (F5 menu) the circle and the triangle if drawn.
   - Execute the Locus tool in F2 by first selecting the point P (the trace point) and the point D (the point on a path).
   - The points can be connected using the Segment tool if desired.
   - Explain what happens when the focus is moved further from or closer to the directrix.
   - To visualize the envelope of the perpendicular bisector Locus the perpendicular bisector as the point D moves on the segment (Figure 4).

Figure 3

Figure 4

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