

CONICS

PROBLEM 2: GEOLOGY AND EARTHQUAKES

When an earthquake occurs, energy waves radiate in concentric circles from the epicenter, or the point above which the earthquake occurred. Stations with seismographs record the level of that energy and how long the energy took to reach the station.

- A. Suppose one station determines that the epicenter of an earthquake is about 100 miles from the station. Find an equation for the possible location of the epicenter.
- B. A second station, 120 miles east and 160 miles south of the first station, shows the epicenter to be about 135 miles away. Find an equation for the possible location of the epicenter.
- C. Using the information from parts A and B, find the possible locations of the epicenter.

REFERENCE: *Advanced Algebra*, Holt, Rinehart and Winston, 1997.

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ONE SOLUTION TO PROBLEM 2: GEOLOGY AND EARTHQUAKES

- A. Suppose one station determines that the epicenter of an earthquake is about 100 miles from the station. Find an equation for the possible location of the epicenter.**

Assume that the location of the station is at $(0, 0)$ on a coordinate grid. The epicenter could be any place on a circle which has its center at $(0, 0)$ and a radius of 100. Our equation is $x^2 + y^2 = 100^2$.

- B. A second station, 120 miles east and 160 miles south of the first station, shows the epicenter to be about 135 miles away. Find an equation for the possible location of the epicenter.**

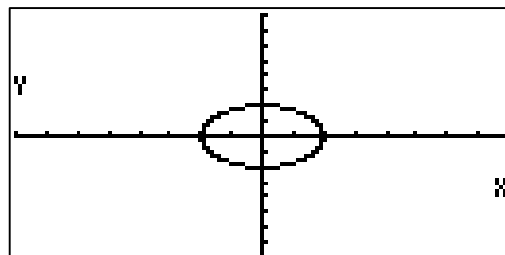
An equation to locate the epicenter would be a circle, with center $(120, -160)$ and radius 135. Its equation is $(x - 120)^2 + (y + 160)^2 = 135^2$.

- C. Using the information from parts A and B, find the possible locations of the epicenter.**

We will use a graphing solution to find the possible locations of the epicenter. From the MAIN MENU, choose "Conics."

- x Down arrow to highlight the circle and press **EXE**.
- x Press **SHIFT** **F3** to set the viewing window. A reasonable window is shown below left. Remember to press **EXE** after entering each value. Press **EXIT** when finished.
- x Type in 0 for H, 0 for K, and 100 for R to draw the first circle. Press **EXE** after each entry and then **F6** to draw the circle. See below right.

```
View Window
Xmin  : -400
max   : 400
scale: 50
Ymin  : -400
max   : 400
scale: 50
INIT | TRIG | STO | RCL
```



The circle appears as an ellipse because of the window we have chosen.

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We want to have a second circle drawn. What we need to do is save the graph of this first circle as a picture that we will use as background. With circle showing,

- x Press **OPTN** and then **F1** for “Picture.”
- x Press **F1** to store the picture and **F1** again for picture memory 1. (Use a different picture memory location if desired.)

Our next step is to use this picture as background.

- x Press **SHIFT** **MENU** for the SET UP.
- x Move the down arrow to highlight Background.
- x Press **F2** for “Picture” and **F1** for picture 1. Press **EXIT** .

- x We’re now ready to add our second circle. From the circle screen, type in 120 for H, -160 for K, and 135 for R, pressing **EXE** after each entry.
- x Press **F6** to draw the circle. The first circle should be there too. See below.
- x Press **F1** for “TRACE” and use the right and left arrow keys to move around the second circle. The points of intersection are located approximately at (95, -27) and (-2, -102).

