In this problem you will solve Problem 3.11 on page 58, which asks you to find a specific pair of points. You should read that problem before continuing.

This lab problem shouldn't take too long. It's designed to help you continue to get more accustomed to GeoGebra. It also shows you a few techniques which will seem strange – like defining line segments which are on top of a line – but can be very powerful when you want to label one particular distance in a diagram. You might want to keep the *Installing and Using GeoGebra* document nearby, as a reminder of how to hide the axes, take a screenshot to include in an email, and so on. Recall that these labs are written assuming you're using a desktop version of GeoGebra. On an tablet or phone, things may be slightly different. The Input field may not be at the bottom of the window, for example!

GeoGebra Construction

Make sure you have the latest version of GeoGebra, because you'll name a point X; in earlier version of GeoGebra X was reserved for a variable name.

(1) Open a new GeoGebra window. Hide the axes but turn on the grid.
(2) To create the angle, type `Ray[(0,0),(1,0)]` and `Ray[(0,0),(0,1)]` in the Input field at the bottom of the window. (You could also use the Ray tool and the mouse, but it would create points when you click in the drawing pad, and make the diagram more cluttered.) You need to type those commands exactly as shown; don't change the square brackets or round parentheses.
(3) Type `Y = (2,2)` in the input field to define the point in the interior of the angle.
(4) Click on the Point tool with your mouse and click somewhere on the vertical ray. Rename this point Z to match the problem text. Make sure the point Z is higher than Y or you'll have problems with the next step. (If you made it too low, use the Selection tool to drag Z higher.) Notice that if you drag the point Z with the Move tool, it can only move along the ray. Cool!
(5) Next you'll create the point X on the other ray. This takes a little work because you want to make sure Y is on the segment $\overline{XZ}$. The simplest way to do this is to choose the Line tool and make a line through Z and Y; then use the Intersection tool to mark the intersection of this line with the horizontal ray. Finally, rename this point X to match the problem text.
(6) You want $|\overline{YX}| = 2 \cdot |\overline{YZ}|$. There are lots of ways to have GeoGebra display those distances. Here's one: choose the Segment tool and create the line segments $\overline{YZ}$ and $\overline{YX}$. In the Algebra window on the left it will show the two segments –named i and j for me, when I did this lab, but with an older version of GeoGebra they were d and e – and their lengths.
(7) Now it's time to clean things up a bit. Go to Object Properties, under the Edit menu. First go to your line, and uncheck "Show Object" since we don't need to see the line at all. For your rays (probably named a and b or f and g, depending on your version) uncheck "Show Label," since don't need to see their names. Finally, for your two segments leave "Show Label" checked, but change the label from "Name" to "Value." Now GeoGebra displays the lengths of these segments on your picture.

   > Note: this step might be different on tablet or web versions of GeoGebra, which have different defaults for whether the name and/or value of segments and other objects. So you might not have to change some labels, or you might have to change different labels, etc. Also, on desktop versions of GeoGebra, you can select objects from a list and edit their properties. On tablet or web versions, after opening Object Properties, you might have to tap on an object to edit it.

(8) If you slide Z up and down, you can now gauge when $|\overline{YX}|$ is twice $|\overline{YZ}|$. But eyeballing can be inaccurate. To have GeoGebra show you the exact ratios of these segment lengths, type `ratio = e / d` in the Input field. (Replace i and j with the names of your segments if they're different.) Now you can look over at `ratio` in the Algebra field to see the exact ratio between the lengths as you slide Z up and down using the selection tool.

To receive credit for this assignment, send me an email with **two** screenshots of your drawing pad. The first should show the points X and Z which solve the problem. The second should show the result after moving Z elsewhere, to prove that you made a dynamic construction and didn't just draw a picture of the solution. The email is due by **12:20pm on Wednesday, 9/27/17** and the subject line must be `Math 5335 Lab 1`.