Properties of Tangents Drawn to Circles   Name_____

1)   Go to https://app.geogebra.org/#geometry.

2)   Go to **Options**. Under **Options**, select **Labeling**. Select **All New Objects**. (See figure.)
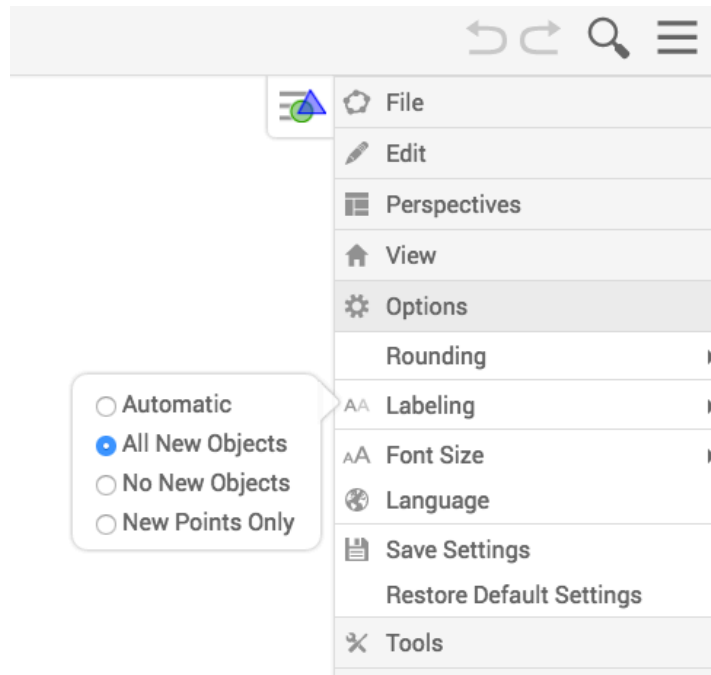
3)   Select the **Circle With Center Through Point** tool to construct a circle.

4)   Use the **Point** tool to plot a point C anywhere outside the circle.
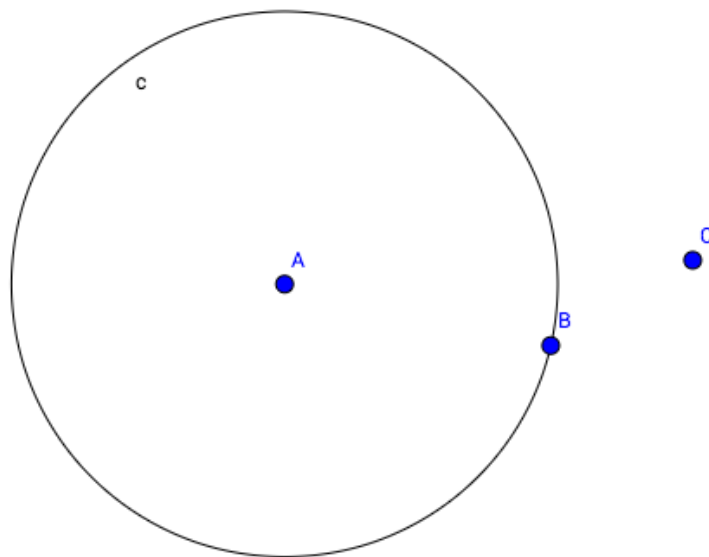
5) Now use the **Tangents** tool to construct two lines that pass through C and are tangent to the circle.

6) Now, use the **Intersect** tool to plot and label the points of intersections of these tangents to the circle. Label these points D and E. (See figure.)
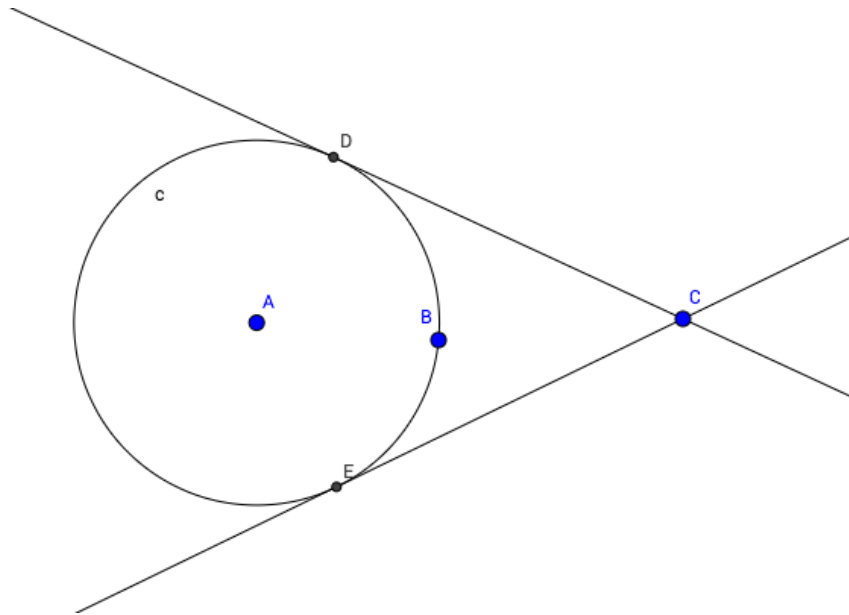
7) Now, right click on one of the two tangent lines. Uncheck the "Show Object" option to hide this tangent line. Do the same for the other tangent line.

8) Use the **Segment** tool to construct segment $\overline{CD}$ and $\overline{CE}$.

9) Use the **Distance** tool to measure and display the lengths CD and CE. What do you initially notice?

10) Now, select the **Move** tool and experiment by moving point C around the screen. (Just make sure C stays *outside* the circle!) What do notice about the lengths CD and CE?

11) Let's generalize now. Fill in the blanks:

_____ **segments drawn to a** _____ **from a**

_____ **outside that** _____ **are** _____ **.**

12) Use the **Segment** tool to construct radii $\overline{AD}$ and $\overline{AE}$.

13) Now use the **Angle** tool to find the measure of $\angle ADC$ and the measure of $\angle CEA$. (When using this tool to measure these angles, be sure to select either the three vertices or the two segments in a *counterclockwise orientation!*)

14) What do you notice about these two angles?

15) Now, use the **Move** tool to move point C around the screen again. Also move points A and B around. What do you always notice to be true about $\angle ADC$ and $\angle CEA$?

16) Use your observations to complete the following statement by filling in the blanks:

If a _____ is drawn to a _____, then a radius

drawn to the _____ of tangency makes a _____ angle with

that _____ segment. We can also say that a _____

drawn to any line _____ to a circle is _____ to

that _____ line.

17) Now go to http://tube.geogebra.org/m/z7QUMhmr. Interact with the applet you see for a few minutes, then answer the questions that you see beneath the applet.