

Going in Circles - Inscribed Angles

Geometry Major Topics: Circles

NCTM Principles and Standards:
Content Standards

Geometry:

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Explore relationships (including congruence and similarity) among classes of two- and three-dimensional geometric objects, make and test conjectures about them, and solve problems involving them.

Establish the validity of geometric conjectures using deduction, prove theorems, and critique arguments made by others.

Objectives: This lesson has students discover properties of inscribed angles in a circle. Using The Geometer's Sketchpad Application for the TI-89 calculator, students construct a circle and an inscribed angle. They will then discover properties of angles inscribed in a circle. This lesson can be used as a teacher directed activity or can be given to the students as a discovery activity. If the students are familiar with The Geometer's Sketchpad Application for the TI-89, this activity should take one 50 minute class period.

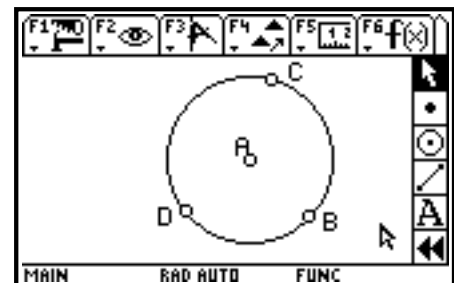
Materials: TI-89 Graphing Calculator, The Geometer's Sketchpad Application

Prerequisites: Students should have a working knowledge of the The Geometer's Sketchpad Application for the TI-89 and know the vocabulary associated with circles and an angle inscribed in a circle.

Procedure:

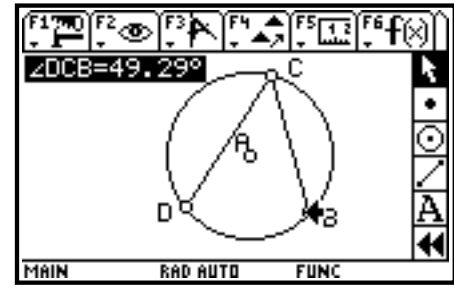
Activity 1: Open The Geometer's Sketchpad Application on the TI-89 by pressing the APPS button and choosing Sketchpad. Press F1 and choose **A:Preferences**. Press F2:Units and set the **Angle Units** to degrees, the **Angle Precision** to **3:1.00**, and the **Other Precision** to **3:1.00**. This will round all angle measures to the nearest hundredth of a degree and any calculations to the same precision.

Press F8 and choose the **compass** tool. Construct a circle with center A. Press F8 and choose the **pointer** tool. Select the "defining" point, the point defining the radius of the circle. Press F2 and choose **1:Hide**. Hide the defining point. Press F8 and choose the **point** tool. Construct points B, C, and D on the circle. Your screen should be similar to the one at the right.

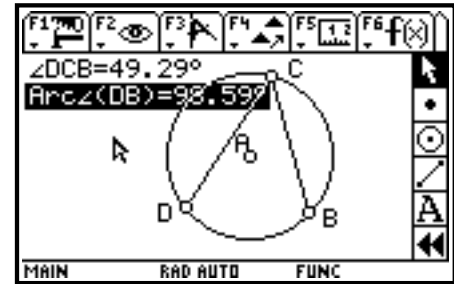


Press F8 and choose the **straightedge** tool. Construct segments

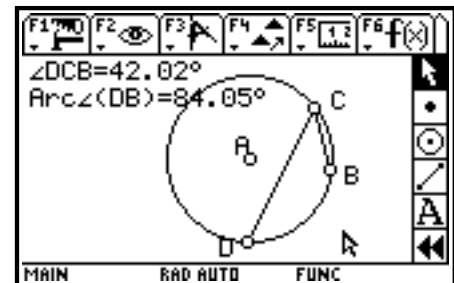
CD and CB. Press F8 and choose the **pointer** tool. To measure angle DCB, select vertices D, C, and B in that order; the second vertex chosen will be the vertex of the angle to be measured. Press F5 and choose **5:Angle**. The measure of angle DCB will be displayed.



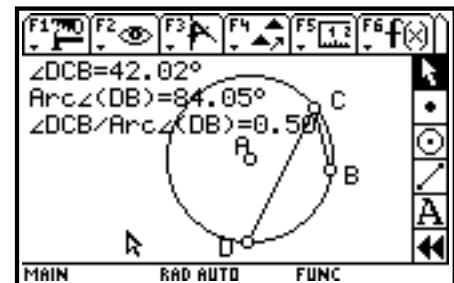
Press F8 and choose the **pointer** tool. Select point D, the circle, and point B. Press F5 and choose **7:Arc Angle**. The measure of arc DB will be displayed. (Note: When the circle and only two points are selected, the software measures the minor arc between the two points. The circle and three points must be selected to measure a major arc.)



Press F8 and choose the **pointer** tool. Drag point D or B to various points on the circle and observe the changes in the angle and arc measurements. Make a conjecture concerning the relationship between the measure of the inscribed angle and the measure of the intercepted arc.

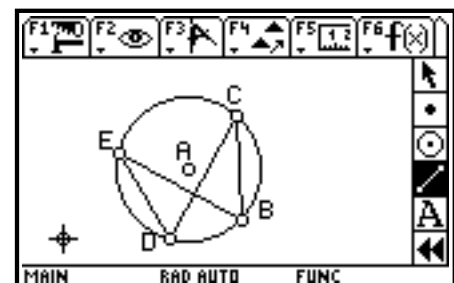


Teacher Note: The conjecture should be "the measure of an inscribed angle is one-half the measure of its intercepted arc". In many cases, the displayed measure of the inscribed angle will not be exactly one-half the measure of the intercepted arc. This discrepancy is due to the precision of our measurement. To confirm the conjecture, press F5 and choose **C:Calculate**. Press F1:Values and calculate the quotient of the angle divided by the arc measure.



Press F8 and drag point D or B to several other locations on the circle to confirm that the ratio remains constant.

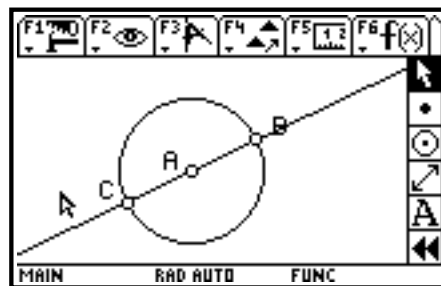
Activity 2: Press F1 and choose **5:Select All**. Press F1 and choose **3:Delete**. This will clear the screen. Press F8 and choose the **compass** tool. Construct a circle with center A. Press F8 and choose the **pointer** tool. Select the "defining" point. Press F2 and choose **1:Hide**. Hide the defining point. Press F8 and choose the **point** tool. Construct points B, C, D, and E on the circle. Press F8 and choose the **straightedge** tool. Construct segments CD, CB, ED, and EB. Your screen should be similar to the one at the right.



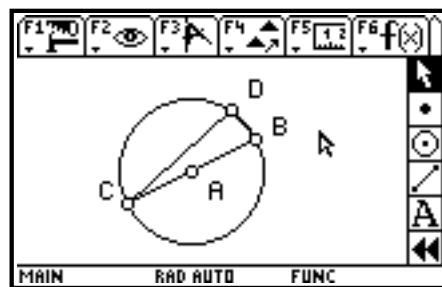
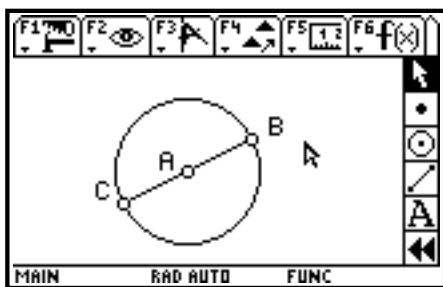
Measure angle DEB and angle DCB. Drag points E and C and make a conjecture as to the measures of these two angles. Justify your conjecture.

Teacher Note: The conjecture should be "the two inscribed angles have the same measure". This can readily be justified by observing that each of the angles intercepts the same arc and thus have a measure of one-half the measure of that arc.

Activity 3: Press F1 and choose **5:Select All**. Press F1 and choose **3:Delete**. This will clear the screen. Press F8 and choose the **compass** tool. Construct a circle with center A. Press F8 and choose the **pointer** tool. Select the "defining" point. Press F2 and choose **1:Hide**. Hide the defining point. Construct point B on the circle. Press F8 and choose the **straightedge** tool. Construct line AB. Press F8 and choose the **pointer** tool. Select the line and the circle. Press F3 and choose **3:Intersection**. This will construct an intersection point; label this intersection point C.

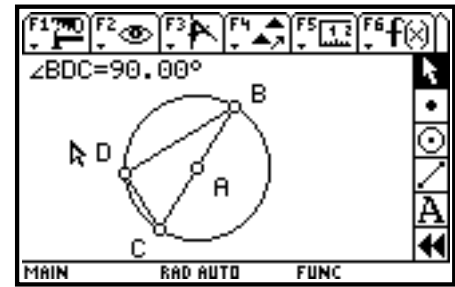


Press F8 and choose the **pointer** tool. Select the line. Press F2 and choose **1:Hide**. This will hide the line. Press F8 and choose the **straightedge** tool. Construct segment CB. This is a diameter of the circle. Press F8 and choose the **point** tool. Construct point D on the circle. Press F8 and choose the **straightedge** tool. Construct segments DC and DB. Your screens should be similar to the ones below.



Angle CDB is an angle inscribed in a semicircle. Measure angle CDB. Press F8 and choose the **pointer** tool. Drag point D to various locations on the semicircle. Make a conjecture and justify this conjecture.

Teacher Note: The conjecture should be "an angle inscribed in a semicircle is a right angle". This can readily be justified, since the arc intercepted by the angle is a semicircle with a measure of 180 degrees. The measure of the inscribed angle is one-half the measure of the intercepted arc, or 90 degrees in this case.



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