Chords and Circles

ID: 9773

Time required
30 minutes

Activity Overview

Students will begin this activity by exploring how the chord in a circle is related to its perpendicular bisector. Investigation will include measuring lengths and distances from the center of the circle. These measurements will then be transferred to a graph to see the locus of the intersection point of the measurements as the endpoint of a chord is moved around the circle. In the extension, students will be asked to find an equation for the ellipse that models the relationship.

Topic: Circles

- *Deduce from the Perpendicular Bisector Theorem the following corollaries:*
  a) *The perpendicular from the center of a circle to a chord bisects the chord.*
  b) *The line joining the center of a circle to the midpoint of a chord is perpendicular to the chord.*
  c) *The center of a circle is at the intersection of the perpendicular bisector of two non-parallel chords.*

Teacher Preparation and Notes

- *This activity is designed to be used in a high school geometry classroom.*
- *This activity is designed to be **student-centered** with the teacher acting as a facilitator while students work cooperatively. Use the following pages as a framework as to how the activity will progress.*
- *Students need to have the application Cabri Jr loaded on the graphing calculator before beginning the activity.*
- *Students should already be familiar with circles, chords of circles, and perpendicular bisectors.*
- *Information for an optional extension is provided at the end of this activity.*
- ***To download the student and worksheet, go to education.ti.com/exchange and enter "9773" in the keyword search box.***

Associated Materials

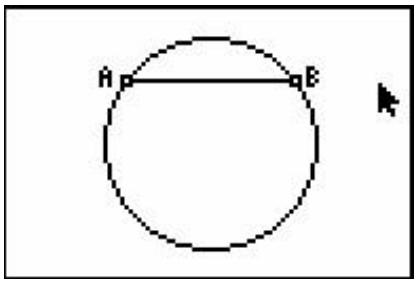
- *ChordsAndCircles_Student.doc*

Introduction

When hikers and skiers go into terrain where there is a risk of avalanches, they take safety equipment including avalanche rescue beacons. An avalanche rescue beacon sends and receives electromagnetic field signals that can travel up to about 30 meters. The search pattern used to locate a beacon buried in the snow is based on the properties of chords and diameters in circles. In this activity, you will use Cabri Jr. to model an avalanche search pattern.

Problem 1 – Relationship between a chord an its perpendicular bisector

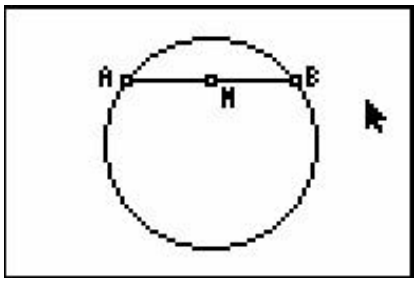
Construct a circle using the **Circle (F2 >Circle)** too in Cabri Jr. to represent the beacon signal.



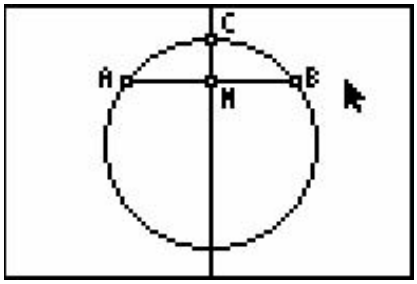
Use the **Hide/Show** to hide its center.

Construct a chord to represent the path of a rescuer as he walks a straight path until the signal disappears. Use the **Segment** tool to draw the chord with endpoints on the circle and label it.

The rescuer walks back to the midpoint of this path. Find the midpoint of *AB* and label it *M*.

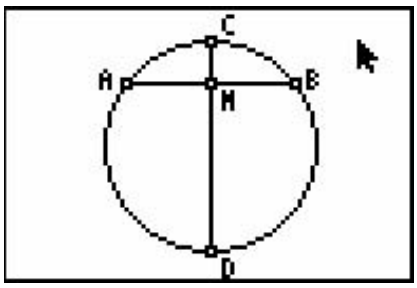


Construct a line perpendicular to *AB* through *M, to* represent the rescuer walking away from the path at a 90° angle until the signal disappears.



Find one intersection point of the perpendicular line and the circle. Label it *C*.

The rescuer turns around and walks in the opposite direction until the signal disappears again. Find the other intersection point of the perpendicular line and the circle. Label it *D*.



Hide the perpendicular line. Construct a segment connecting points *C* and *D*.

The rescuer walks back to the midpoint of this new path.

Find the midpoint of *CD* and label it *X*. This will be the center of the circle formed by the beacon signals. Dig for the missing person!

Confirm that you have located the center of the circle. Measure the distances from *X* to *A*, *B*, *C*, and *D*.

Problem 2 – Extension

Extension 1

Write a proof of the relationship used in the activity. Given a chord of a circle and its perpendicular bisector, prove that the perpendicular bisector passes through the center of the circle.

Extension 2

Use a compass and straightedge to construct a circle and a chord. Construct the perpendicular bisector of the chord and see that it passes through the center of the circle.