Points on a Perpendicular Bisector

ID: 8868

Time required
40 minutes

Activity Overview

In this activity, students will explore the relationship between a line segment and its perpendicular bisector. Once the concept of "a point that is equidistant from two points" is illustrated, extensions including isosceles triangles, kites, and chords in a circle may be explored.

Topic: Triangles and Their Centers

- *Use inductive reasoning to postulate a relationship between a line segment and its perpendicular bisector.*
- *Apply the Perpendicular Bisector Theorem and its converse.*

Teacher Preparation

- *This activity is designed to be used in a high school or middle 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.*
- *The Perpendicular Bisector Theorem states:*
  If a point is on the perpendicular bisector of a segment, then it is equidistant from the endpoints of the segment.
- *In a kite, one diagonal is the perpendicular bisector of the other.*
- *In a circle, the perpendicular bisector of a chord will contain the center (it is a diameter of the circle).*
- ***To download the student TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "8868" in the quick search box.***

Associated Materials

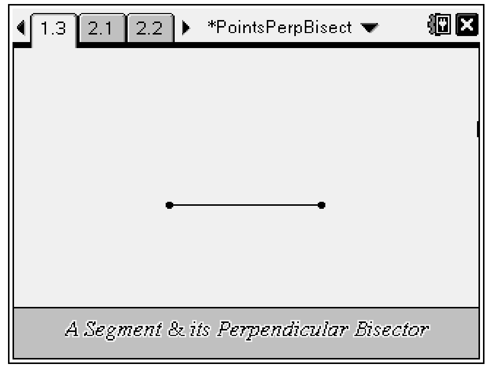
- *VerticalAdjacent.tns*
- *VerticalAdjacent_Student.doc*

Problem 1 – A Segment and its Perpendicular Bisector

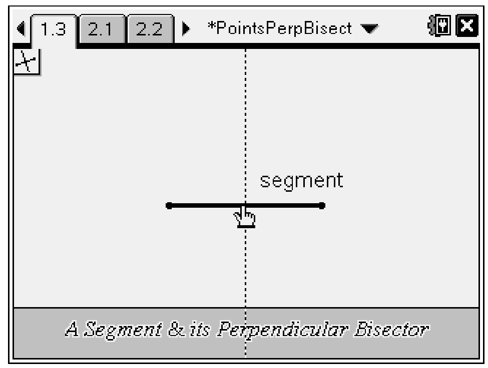
Have students open the file and read the directions on page 1.2.

On page 1.3, students should construct a segment (**MENU > Points & Lines > Segment**) and label the endpoints *A* and *B*.

Note: If the vertices are not labeled as they are created, students may simply use the **Text** tool (**MENU > Action > Text**).

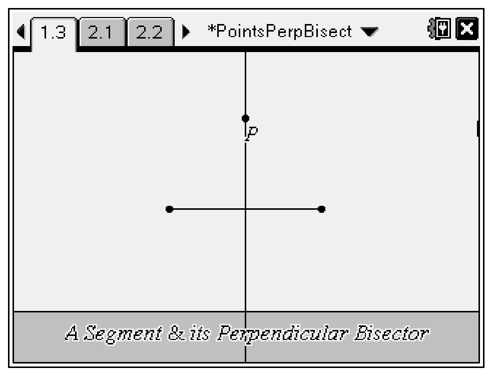


Next, students will construct the perpendicular bisector of $\overline{AB}$ by selecting **MENU > Construction > Perpendicular Bisector**. To use the **Perpendicular Bisector** tool, select the segment by either clicking once on the segment itself or by clicking once on each of its endpoints.



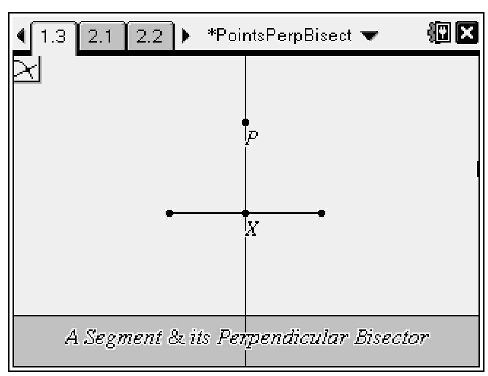
Students should now place a point on the perpendicular bisector using the **Point On** tool (**MENU > Points & Lines > Point On**).

Label this point as point *P*.



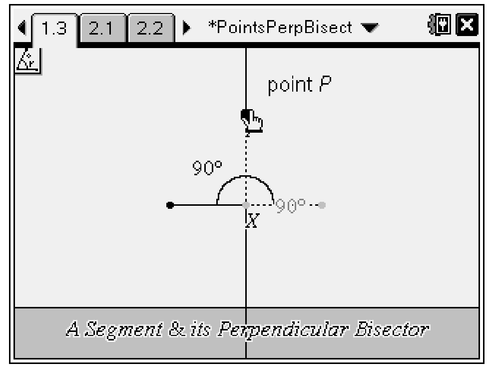
Have students use the **Intersection Point(s)** tool from the Points & Lines menu to mark the intersection of $\overline{AB}$ and its perpendicular bisector.

Label this point as point *X*.



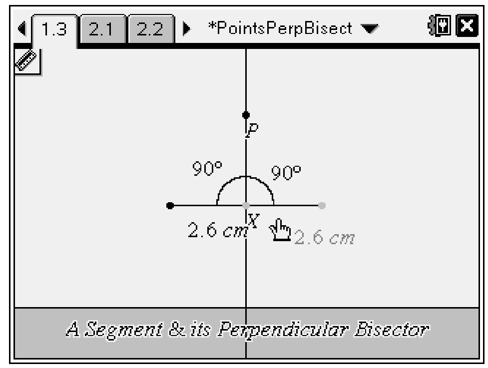
Students can now measure $\angle PXA$ and $\angle PXB$ using the **Angle** tool from the Measurement menu to confirm that the first part of the definition of a perpendicular bisector holds.

(Use the **Angle** tool by clicking on three points that name the angle you want to measure. The vertex of the angle should be the second point chosen.)



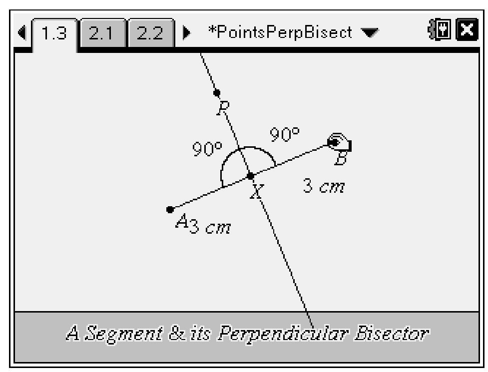
Confirm the second property by measuring the lengths of $\overline{AX}$ and $\overline{BX}$ using the **Length** tool from the Measurement menu.

(Use the **Length** tool by clicking on each endpoint of the segment you want to measure.)



Now have students drag points *A* and *B*.

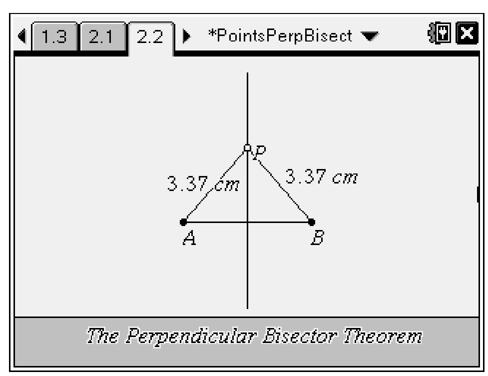
Ask: *Do the new measurements still support the definition of the perpendicular bisector?*



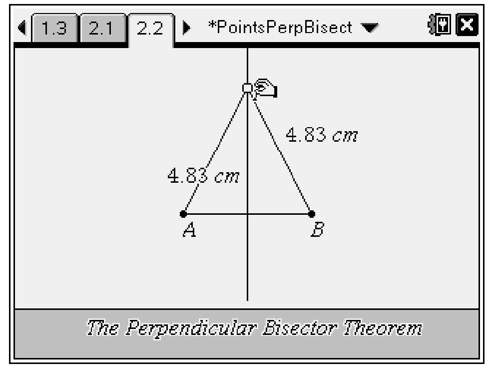
Problem 2 – The Perpendicular Bisector Theorem

After reading the directions on page 2.1, students should advance to page 2.2, where they find a point *P* on the perpendicular bisector of $\overline{AB}$.

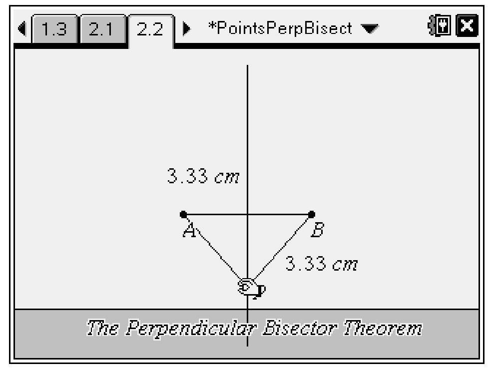
Have students use the **Segment** tool to draw $\overline{AP}$ and $\overline{BP}$, followed by the **Length** tool measure the length of these two segments.



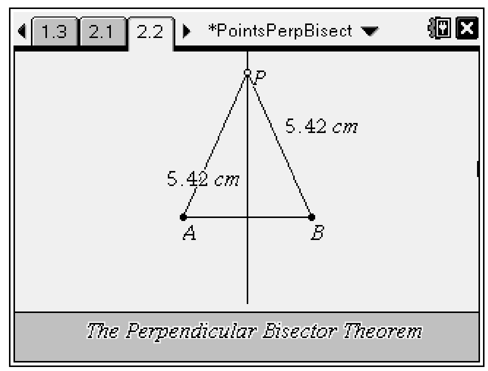
Direct students to drag point *P* to several different locations and observe any changes in the measurements from point *P* to the endpoints of the segment.



Be sure that students test cases in which point *P* is on the *opposite* side of $\overline{AB}$.



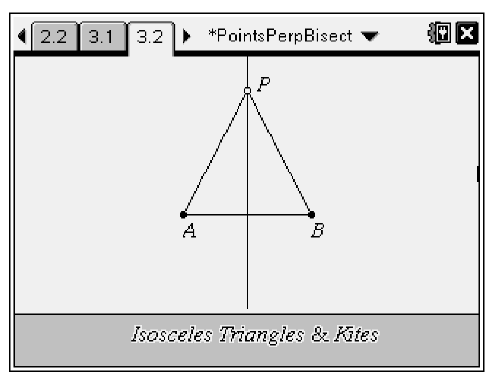
Ask: *What kind of triangle is △ABP? How do you know?*



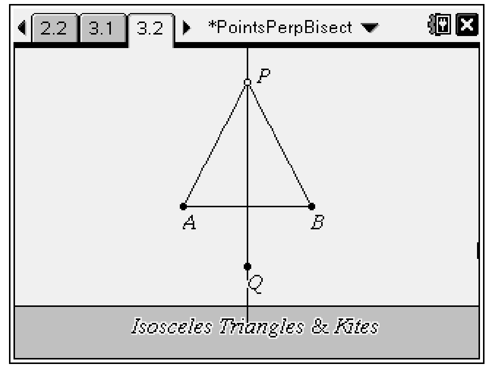
Problem 3 – Isosceles Triangles and Kites

Students should advance to page 3.1 and read the directions.

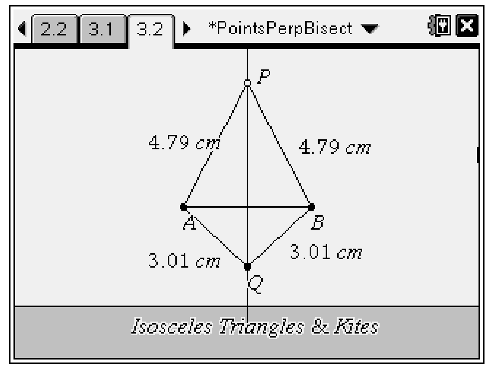
On page 3.2, point *P* is on the perpendicular bisector of $\overline{AB}$, and $\overline{AP}$ and $\overline{BP}$ are shown.



Have students construct a new point *Q* on the perpendicular bisector on the *opposite* side of $\overline{AB}$ as point *P*, like the one shown to the right.



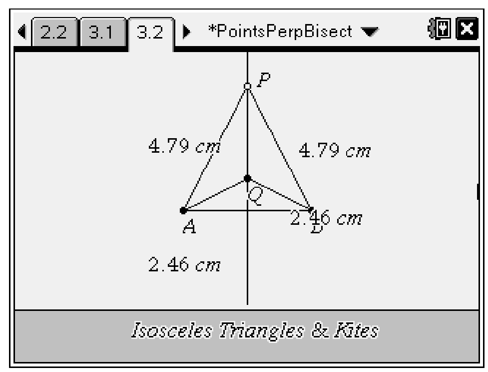
Direct students to use the **Segment** tool to construct $\overline{AQ}$ and $\overline{BQ}$. Then have them measure the lengths of these two segments, as well as the lengths of $\overline{AP}$ and $\overline{BP}$.



Quadrilateral *APBQ* is a kite. Students should drag points *P* and *Q* to investigate the properties of kites.

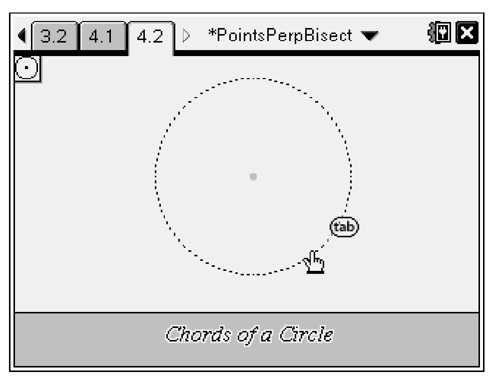
Have them record observations on the worksheet.

Students may also drag points *P* and *Q* to the *same* side of $\overline{AB}$ to investigate concave kites. In a concave kite, one diagonal is *outside* the kite ($\overline{AB}$ in the screenshot to the right).

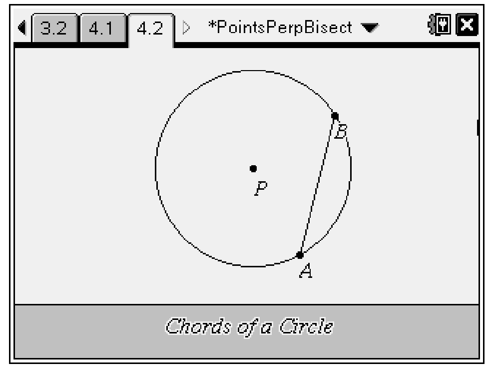


Problem 4 – Chords of a Circle

After reading page 4.1, students should move to page 4.2 where they will use the **Circle** tool from the Shapes menu to draw a circle. Have them label the center of this circle as point *P*.



Next, have students use the **Segment** tool to construct a chord of the circle. Label the endpoints of this segment *A* and *B*.



Direct students to once more use the **Perpendicular Bisector** tool to construct the perpendicular bisector of chord $\overline{AB}$.

Students should then drag points to change the size of the chord and size of the circle, recording their observations on their worksheets.