Name: Date:

**Student Exploration: Segment and Angle Bisectors**

**Vocabulary:** angle bisector, perpendicular bisector

**School**

**Annie**

**Ben**

**Bagel store**

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)

Annie walks from her house to the bagel store on her way to school. Ben leaves his house at the same time and walks the same pace as Annie. They get to the bagel store at the same time.

1. What is true about how far each house is from the bagel store?
2. One day Annie and Ben are late. They skip the bagels and walk straight to school (dashed lines). What can you say about the distance each has to walk?

**Gizmo Warm-up**

In the *Segment and Angle Bisectors* Gizmo, you can trace the motion of a point to discover how the path of the point is related to a segment or an angle.

1. On the **SEGMENT** tab, check that **No constraint on point *C*** is selected. Move point *C* around. Does this have any effect on ?
2. Select **Show ruler** to open the Gizmo rulers. Attach one ruler’s “donuts” the endpoints of , and the other ruler’s “donuts” to the endpoints of . Complete the following sentence to describe the relationship between point *O* and .

Point *O* is the of .

1. Drag point *C* above point *O*. Use the Gizmo rulers to measure  and .
2. Drag point *C* to the left. How do *CA* and *CB* compare?
3. Drag point *C* to the right. How do *CA* and *CB* compare?
4. If *CA* and *CB* are about equal, where is point *C* located?

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| **Activity A:** **Perpendicular bisectors** | Get the Gizmo ready: * Check that **No constraint on point *C***is selected.
* Turn off the Gizmo rulers.
 | 174SE2 |

1. Position point *C* directly above point *O* so that *AC* and *BC* are about equal. Turn on **Trace motion of point *C***. Drag point *C* straight down through point *O*.
2. How do you think the distances from the final position of point *C* to the endpoints of  compare?

Turn on **Show distances from point *C* to endpoints of ** to check.

1. How does the purple path you traced appear to relate to ?

1. Select **Point *C* equidistant from endpoints of **. Check that **Show distances from point *C* to endpoints of ** and **Trace motion of point *C*** are turned on.
2. Drag point *C* up and down. As you do this, how do the distances from point *C* to the endpoints of  compare?
3. Turn on **Show angle measure tool**. Place the “donuts” on points *C*, *O*, and *A*.

What angle does  make with ?

1. What is the relationship between  and ?

Because  is perpendicular to and passes through the midpoint of ,  is the **perpendicular bisector** of .

1. Drag points *A* and *B* to form a variety of segments. In each figure you create, drag point *C*. Fill in the “if-then” statement below to describe what you discover.

If a point is equidistant from the endpoints of a segment, then

**(Activity A continued on next page)**

**Activity A (continued from previous page)**

1. Select **Point *C* on perpendicular bisector of **. Turn off **Show distances from point *C* to endpoints of ** and **Trace motion of point *C***.
2. What two segments are marked congruent?
3. Which angle is marked as a right angle?
4. Turn on **Show distances from point *C* to endpoints of **. Drag point *C*. What is always true about *AC* and *BC*?
5. Drag points *A* and *B* to form a variety of segments. In each figure you create, drag point *C*. Fill in the “if-then” statement below to describe what you discover.

If a point lies on the perpendicular bisector of a segment, then

1. Complete the following “if-and-only-if” statement to summarize your findings in this activity:

A line is a perpendicular bisector of a line segment if and only if every point on the line is

1. Use the figure to the right to answer the following questions. Show your work.

***M***

***N***

***P***

***Q***

***R***

1. If *MN* = 2*x* – 2.5, *PN* = 9.5, and *MR* = *x* – 1, what is *PR*?
2. If *MQ* = 2*x* + 2, *PQ* = 4*x* – 2, and *MN* = 7*x* + 5, what is *PN*?

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| **Activity B:****Angle bisectors** | Get the Gizmo ready: * Select the **ANGLE** tab.
* If necessary, turn off **Show distances from point *C* to  and** .
* Turn on **Trace motion of point *C***.
 | 174SE3 |

1. With **No constraint on point *C*** selected, use the Gizmo protractors to measure ∠*AOC* and ∠*BOC*. Drag point *C* towards point *O* so that the angles stay approximately congruent.
2. What type of figure does point *C* trace when the angles are approximately congruent?
3. How does the measure of each angle (∠*AOC* and ∠*BOC*) relate to the measure of ∠*AOB*?

When  divides ∠*AOB* into two congruent angles,  is the **angle bisector** of ∠*AOB*.

1. Select **Point *C* equidistant from  and **. Turn on **Show distance from point *C* to  and **. Use the Gizmo protractors to measure ∠*DOC* and ∠*EOC*.
2. How are the measures of ∠*DOC* and ∠*EOC* related?

1. How do you think the measures of ∠*DOC* and ∠*DOE* are related?

 Use the Gizmo protractors to check.

1. What is the relationship between and ∠*AOB*?
2. The lengths of  and  represent the shortest distance from point *C* to each side of ∠*DOE*. What is true about *DC* and *EC*?

Drag points *A*, *B*, and *C* around to see if this is always true.

1. Fill in the “if-then” statement below to describe what you have discovered.

If a point is equidistant from the two rays that form an angle, then

**(Activity B continued on next page)**

**Activity B (continued from previous page)**

1. Select **Point *C* on angle bisector of ∠*AOB***. Turn off **Show distances from point *C* to and ** and **Trace motion of point *C***.
2. Which angles are marked as congruent?
3. Turn on **Show distance from point *C* to  and **. Drag point *C*. What is always true about *DC* and *EC*?
4. Drag points *A* and *B* to form a variety of angles. In each figure you create, drag point *C*. Fill in the “if-then” statement below to describe what you discover.

If a point lies on the angle bisector of an angle, then

1. Complete the following “if-and-only-if” statement to summarize your findings in this activity.

A line is an angle bisector if and only if every point on the line is

1. Use the figure to the right to answer the following questions. Show your work.
2. If *HK* = 3*x* + 3 and *JK* = 6*x* – 3, what is *JK*?

***H***

***I***

***J***

***K***

1. If *m*∠*HIK* = (3*x* – 3)° and *m*∠*HIJ* = 5*x*°, what is *m*∠*JIK*?