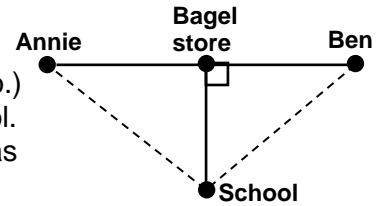Name: _____   Date: _____

Student Exploration: Segment and Angle Bisectors

Vocabulary: angle bisector, perpendicular bisector

**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
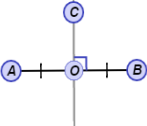to a segment or an angle.
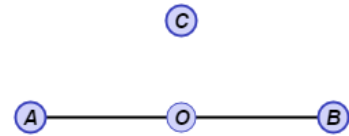
1. On the **SEGMENT** tab, check that **No constraint on point *C*** is selected. Move point *C*

   around. Does this have any effect on $\overline{AB}$? _____

2. Select **Show ruler** to open the Gizmo rulers. Attach one ruler's "donuts" the endpoints of
   $\overline{AO}$, and the other ruler's "donuts" to the endpoints of $\overline{BO}$. Complete the following sentence
   to describe the relationship between point *O* and $\overline{AB}$.

   Point *O* is the _____ of $\overline{AB}$.

3. Drag point *C* above point *O*. Use the Gizmo rulers to measure $\overline{CA}$ and $\overline{CB}$.

   A. Drag point *C* to the left. How do *CA* and *CB* compare? _____

   B. Drag point *C* to the right. How do *CA* and *CB* compare? _____

   C. If *CA* and *CB* are about equal, where is point *C* located? _____

   _____

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

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*.

    A. How do you think the distances from the final position of point *C* to the endpoints of

    $\overline{AB}$ compare? _____

    Turn on **Show distances from point C to endpoints of $\overline{AB}$** to check.

    B. How does the purple path you traced appear to relate to $\overline{AB}$? _____

    _____

2. Select **Point C equidistant from endpoints of $\overline{AB}$**. Check that **Show distances from point C to endpoints of $\overline{AB}$** and **Trace motion of point C** are turned on.

    A. Drag point *C* up and down. As you do this, how do the distances from point *C* to the

    endpoints of $\overline{AB}$ compare? _____

    B. Turn on **Show angle measure tool**. Place the "donuts" on points *C*, *O*, and *A*.

    What angle does $\overline{CO}$ make with $\overline{AB}$? _____

    C. What is the relationship between $\overline{CO}$ and $\overline{AB}$? _____

    _____

    _____

    Because $\overline{CO}$ is perpendicular to and passes through the midpoint of $\overline{AB}$, $\overline{CO}$ is the **perpendicular bisector** of $\overline{AB}$.

    D. 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)

3. Select **Point C on perpendicular bisector of** $\overline{AB}$. Turn off **Show distances from point C to endpoints of** $\overline{AB}$ and **Trace motion of point C**.

    A. What two segments are marked congruent? _____

    B. Which angle is marked as a right angle? _____

    C. Turn on **Show distances from point C to endpoints of** $\overline{AB}$. Drag point C. What is

        always true about *AC* and *BC*? _____

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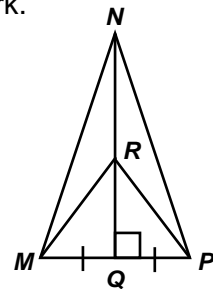
        If a point lies on the perpendicular bisector of a segment, then _____

        _____

4. Complete the following "if-and-only-if" statement to summarize your findings in this activity:
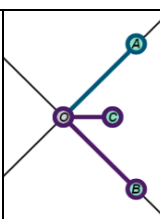
    A line is a perpendicular bisector of a line segment if and only if every point on the line is

    _____

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

    A. If *MN* = 2*x* – 2.5, *PN* = 9.5, and *MR* = *x* – 1, what is *PR*?

    B. If *MQ* = 2*x* + 2, *PQ* = 4*x* – 2, and *MN* = 7*x* + 5, what is *PN*?

	Get the Gizmo ready:
Activity B: **Angle bisectors**	• Select the **ANGLE** tab. • If necessary, turn off **Show distances from point C** **to** $\overrightarrow{OA}$ **and** $\overrightarrow{OB}$. • Turn on **Trace motion of point C**.

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.

    A. What type of figure does point C trace when the angles are approximately

    congruent? _____

    B. How does the measure of each angle (∠AOC and ∠BOC) relate to the measure of

    ∠AOB? _____

    When $\overline{OC}$ divides ∠AOB into two congruent angles, $\overline{OC}$ is the **angle bisector** of ∠AOB.

2. Select **Point C equidistant from** $\overrightarrow{OA}$ **and** $\overrightarrow{OB}$. Turn on **Show distance from point C to** $\overrightarrow{OA}$ **and** $\overrightarrow{OB}$. Use the Gizmo protractors to measure ∠DOC and ∠EOC.

    A. How are the measures of ∠DOC and ∠EOC related? _____

    _____

    B. How do you think the measures of ∠DOC and ∠DOE are related? _____

    _____ Use the Gizmo protractors to check.

    C. What is the relationship between $\overline{OC}$ and ∠AOB? _____

    D. The lengths of $\overline{DC}$ and $\overline{EC}$ 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.

    E. 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)

3. Select **Point C on angle bisector of** ∠*AOB*. Turn off **Show distances from point C to $\overrightarrow{OA}$ and $\overrightarrow{OB}$** and **Trace motion of point C**.

   A. Which angles are marked as congruent? _____

   B. Turn on **Show distance from point C to $\overrightarrow{OA}$ and $\overrightarrow{OB}$**. Drag point C. What is

   always true about *DC* and *EC*? _____

   C. 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 _____

   _____

4. 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 _____

   _____

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

   A. If *HK* = 3*x* + 3 and *JK* = 6*x* – 3, what is *JK*?
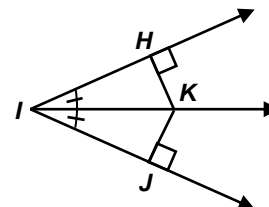
   B. If *m*∠*HIK* = (3*x* – 3)° and *m*∠*HIJ* = 5*x*°, what is *m*∠*JIK*?