

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Student Exploration: Investigating Angle Theorems

**Vocabulary:** complementary angles, linear pair, supplementary angles, vertical angles

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

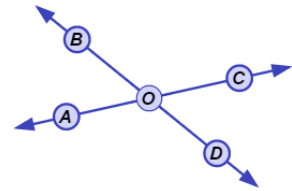
1. Tony has a collection of 200 sports cards. He counts and finds that 40 of them are football cards. What does this tell you about the rest of his collection?

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2. Suppose Tony has only football and baseball cards. Now what can you say about the rest of his collection? \_\_\_\_\_

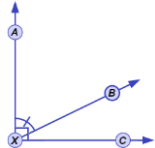
### Gizmo Warm-up

In the *Investigating Angle Theorems* Gizmo™, you can manipulate a dynamic figure to explore the properties of different angles.



1. In the Gizmo, select **Vertical angles** from the **Conditions** menu. You should see two intersecting lines like the ones shown to the right.
  - A. Name the two pairs of angles that do not share a side. (They are nonadjacent.)  
 \_\_\_\_\_ and \_\_\_\_\_    \_\_\_\_\_ and \_\_\_\_\_    Both pairs are **vertical angles**.
  - B. Drag the points to resize the angles. What appears to always be true about the measures of the vertical angles? \_\_\_\_\_  
 Turn on **Show angle measures** and continue to resize to check if this is always true.
2. Select **Form a linear pair** to view a **linear pair** of angles (adjacent angles whose non-common sides form a straight line).
  - A. Name the linear pair by naming the adjacent angles. \_\_\_\_\_
  - B. Adjust the angles by dragging point *B*. What seems to always be true about the measures of a linear pair of angles? \_\_\_\_\_  
 Turn on **Show angle measures**. Drag point *B* to check if this is always the case.



<b>Activity A:</b> <b>Complements and supplements</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>• Under <b>Conditions</b>, select <b>Complementary to congruent angles</b>.</li> <li>• Be sure <b>Adjacent</b> is selected.</li> </ul>	
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1. Both pairs of angles shown ( $\angle AXB$  and  $\angle BXC$ , and  $\angle DYE$  and  $\angle EYF$ ) are **complementary**.

A. Drag points  $B$  and  $E$  to view a variety of complementary angles. What is true about the measures of two complementary angles? \_\_\_\_\_

B. What must be true about  $\angle AXB$  and  $\angle DYE$ ? \_\_\_\_\_

Why? \_\_\_\_\_

\_\_\_\_\_

Turn on **Show angle measures** and drag point  $B$  to verify for a variety of angles.

C. Select **Nonadjacent** and drag the points. Which two angle pairs are complementary?

\_\_\_\_\_ and \_\_\_\_\_      \_\_\_\_\_ and \_\_\_\_\_

D. What must be true about  $\angle CXD$  and  $\angle GZH$ ? \_\_\_\_\_

Turn on **Show angle measures**. Experiment to see if this is always true.

E. What is true of any pair of angles that are complementary to congruent angles?

\_\_\_\_\_

2. Select **Complementary to same angle** and drag points  $A$ ,  $B$ ,  $C$ , and  $D$ .

A. What are the two pairs of complementary angles in this figure?

\_\_\_\_\_ and \_\_\_\_\_      \_\_\_\_\_ and \_\_\_\_\_

B. What must be true about  $\angle AOC$  and  $\angle DOB$ ? \_\_\_\_\_

Why? \_\_\_\_\_

Turn on **Show angle measures** and drag the points to verify this.

C. Select **Nonadjacent** and run a similar test. What is true about angles that are

complementary to the same angle? \_\_\_\_\_

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



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

3. Select **Supplementary to congruent angles**. Both angle pairs shown ( $\angle AXB$  and  $\angle BXC$ , and  $\angle DYE$  and  $\angle EYF$ ) are **supplementary** and form linear pairs.

A. Drag points  $B$  and  $E$  to view a variety of supplementary angles. What can you say about the measures of two supplementary angles? \_\_\_\_\_

B. What must be true about  $\angle AXB$  and  $\angle DYE$ ? \_\_\_\_\_

Why? \_\_\_\_\_

\_\_\_\_\_

C. Select **Nonadjacent** and run a similar test. What is true about angles that are supplementary to congruent angles? \_\_\_\_\_

4. Select **Supplementary to same angle**. Drag the points to view a variety of figures.

A. Name two pairs of supplementary angles that contain  $\angle BOC$ .

\_\_\_\_\_ and \_\_\_\_\_      \_\_\_\_\_ and \_\_\_\_\_

B. What must be true about  $\angle AOB$  and  $\angle COD$ ? \_\_\_\_\_

Why? \_\_\_\_\_

\_\_\_\_\_

Turn on **Show angle measures** and create a variety of figures to verify this.

C. Select **Nonadjacent** and run a similar test. What is true about angles that are supplementary to the same angle? \_\_\_\_\_

5. Select **Vertical angles** and turn on **Show angle measures**. Drag point  $A$  until  $\angle AOB$  is a right angle.

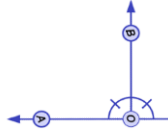
A. What is true about the four angles formed? \_\_\_\_\_

\_\_\_\_\_ Experiment to see if this is always true.

B. Explain why this is always the case. \_\_\_\_\_

\_\_\_\_\_



<b>Activity B:</b> <b>Using angle concepts</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>Select <b>Supplementary and congruent</b> under <b>Conditions</b>.</li> </ul>	
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1. Drag the points to see several pairs of angles that are supplementary and congruent.

A. What is true about the measures of angles that are supplementary and congruent?

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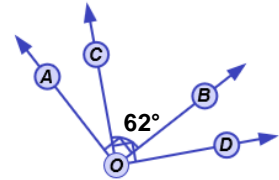
Turn on **Show angle measures** to check. Then, select **Nonadjacent** to check that this also applies to nonadjacent angles.

B. In the space to the right, use algebra to show why both angles must measure  $90^\circ$ .

2. Solve each problem. Show all of your work. Then, if possible, check in the Gizmo.

A. Suppose  $\angle AXB$  and  $\angle BXC$  are complementary and congruent. What are their measures?

C. Find the measures  $\angle AOC$  and  $\angle DOB$ .



B. Suppose  $\angle AXB$  and  $\angle BXC$  form a linear pair. If  $\angle AXB$  is a right angle, what is  $m\angle BXC$ ?

D. Find the values of  $x$  and  $y$ .

