EXPLORATIONS ™

Activity 2

Objective

- To investigate the properties of angles formed by intersecting lines

Cabri® Jr. Tools

Angles Formed by Two Intersecting Lines

Introduction

Intersecting lines are one of the most common figures in geometry. In this exploration, you will investigate the properties of angles formed by intersecting lines. The outcome of the activity will produce two important geometric theorems dealing with vertical and supplementary angles.

This activity makes use of the following definitions:

Adjacent angles — two angles with a common vertex and a common side, but no common interior points.

Supplementary angles — two angles that have measures that sum to 180°.

Vertical angles — two non-adjacent angles formed by two intersecting lines.

Part I: Vertical and Adjacent Angles

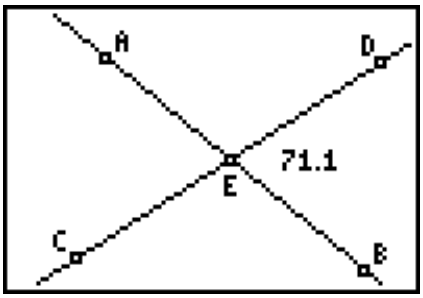
Construction

Draw two intersecting lines and measure the angles formed.

Draw $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ that intersect near the center of the screen.

Construct the intersection of $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$. Label this point *E*.

Find the measure of each of the four angles. Place these measures in the interior of each angle.



Note: *Not all measurements are shown.*

Exploration

Change the size of the angles by:

- dragging one of the defining points of one of the lines.
- dragging one of the lines.

Observe the changes in the measures and note how they are related.

Questions and Conjectures

1. Identify all pairs of vertical angles and make conjectures about their measurements.
2. Identify all pairs of adjacent angles and make conjectures about their measurements.
3. If $m\angle DEB$ is 90°, what would be the measure of the remaining angles? Verify your answer using the construction. Write a conjecture about two lines that intersect at a 90° angle.

Part II: Supplementary Angles

Construction

Draw two adjacent angles that are supplementary.

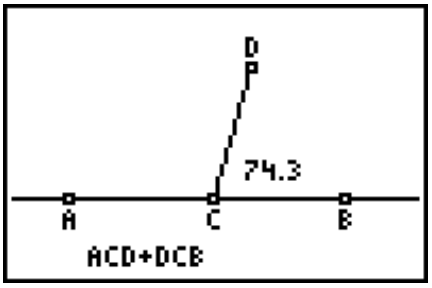
Clear the previous construction.

Draw a horizontal line $\overleftrightarrow{AB}$ near the center of the screen.

Construct $\overline{CD}$ so that point C is on $\overleftrightarrow{AB}$ between A and B, and D is above the line according to the diagram.

Measure $\angle ACD$ and $\angle DCB$. Place these measures in the interior of each angle.

Calculate the sum of $m\angle ACD$ and $m\angle DCB$. Label the calculation and place it near the bottom of the screen.



Note: *Not all measurements are shown.*

Exploration

Change the size of the angle by:

- dragging D to the left and right.
- dragging D to the other side of $\overline{AB}$.

Observe the changes in the measures and note how they are related.

Questions and Conjectures

Consider the following statements and use a construction to determine if they are valid. Be prepared to provide both oral and written arguments for your conclusions.

1. Supplementary angles can be drawn without having vertical angles.
2. Vertical angles can be drawn without having supplementary angles.
3. Two adjacent angles can be drawn that are not supplementary.
4. Any two non-adjacent angles are vertical angles.

Teacher Notes

Activity 2

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Part I: Vertical and Adjacent Angles

Answers to Questions and Conjectures

1. Identify all pairs of vertical angles and make conjectures about their measurements.

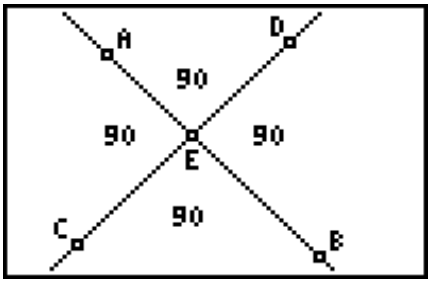
   $\angle DEB$ and $\angle CEA$ are vertical angles. $\angle AED$ and $\angle BEC$ are vertical angles. The measures of the vertical angles are equal.

2. Identify all pairs of adjacent angles and make conjectures about their measurements.

   $\angle AEC$ and $\angle CEB$, $\angle CEB$ and $\angle BED$, $\angle BED$ and $\angle DEA$, $\angle DEA$ and $\angle AEC$ are all pairs of adjacent angles. Adjacent angles formed by intersecting lines are supplementary. The sum of their angle measures equals 180°.

3. If $m\angle DEB$ is 90°, what would be the measure of the remaining angles? Verify your answer using the construction. Write a conjecture about two lines that intersect at a 90° angle.

   Students should conclude that perpendicular lines form right angles, or the converse, and that all right angles are congruent. If one angle measures 90°, its vertical angle is congruent and the measure of the adjacent angle is 180° – 90° = 90°.



Part II: Supplementary Angles

Answers to Questions and Conjectures

Consider the following statements and use a construction to determine if they are valid. Be prepared to provide both oral and written arguments for your conclusions.

1. Supplementary angles can be drawn without having vertical angles.

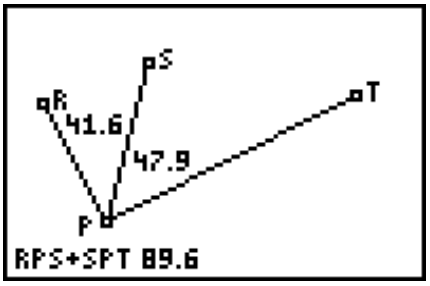
   True. Students can use the construction in Part II as an example.

2. Vertical angles can be drawn without having supplementary angles.

   False. Students can use the construction in Part I as an example.

3. Two adjacent angles can be drawn that are not supplementary.

   True. Students may make a construction similar to the one shown.



4. Any two non-adjacent angles are vertical angles.

   False. Students may make a construction similar to the one shown.