3.4 Proofs with Perpendicular Lines
For use with Exploration 3.4

Essential Question: What conjectures can you make about perpendicular lines?

1 EXPLORATION: Writing Conjectures

Work with a partner. Fold a piece of paper in half twice. Label points on the two creases, as shown.

a. Write a conjecture about $\overline{AB}$ and $\overline{CD}$. Justify your conjecture.

b. Write a conjecture about $\overline{AO}$ and $\overline{OB}$. Justify your conjecture.

2 EXPLORATION: Exploring a Segment Bisector

Work with a partner. Fold and crease a piece of paper, as shown. Label the ends of the crease as $A$ and $B$.

a. Fold the paper again so that point $A$ coincides with point $B$. Crease the paper on that fold.

b. Unfold the paper and examine the four angles formed by the two creases. What can you conclude about the four angles?
3.4 Proofs with Perpendicular Lines (continued)

3 EXPLORATION: Writing a Conjecture

Go to BigIdeasMath.com for an interactive tool to investigate this exploration.

Work with a partner.

a. Draw \( \overline{AB} \), as shown.

b. Draw an arc with center \( A \) on each side of \( \overline{AB} \). Using the same compass setting, draw an arc with center \( B \) on each side of \( \overline{AB} \). Label the intersections of the arcs \( C \) and \( D \).

c. Draw \( \overline{CD} \). Label its intersection with \( \overline{AB} \) as \( O \).

Write a conjecture about the resulting diagram.

Justify your conjecture.

Communicate Your Answer

4. What conjectures can you make about perpendicular lines?

5. In Exploration 3, find \( AO \) and \( OB \) when \( AB = 4 \) units.
In your own words, write the meaning of each vocabulary term.

distance from a point to a line

perpendicular bisector

**Theorems**

**Theorem 3.10  Linear Pair Perpendicular Theorem**

If two lines intersect to form a linear pair of congruent angles, then the lines are perpendicular.

If \( \angle 1 \cong \angle 2 \), then \( g \perp h \).

**Notes:**

**Theorem 3.11  Perpendicular Transversal Theorem**

In a plane, if a transversal is perpendicular to one of two parallel lines, then it is perpendicular to the other line.

If \( h \parallel k \) and \( j \perp h \), then \( j \perp k \).

**Notes:**
3.4 Notetaking with Vocabulary (continued)

**Theorem 3.12  Lines Perpendicular to a Transversal Theorem**

In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.

If \( m \perp p \) and \( n \perp p \), then \( m \parallel n \).

Notes:

**Extra Practice**

In Exercises 1–4, find the distance from point \( A \) to \( BC \).

1.

2.

3.

4.
In Exercises 5–8, determine which lines, if any, must be parallel. Explain your reasoning.

5. 

6. 

7. 

8. 