Name ______________________ Date ______________ Class______________

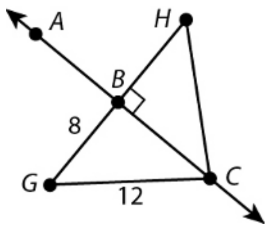
LESSON 4-4

Perpendicular Lines

Practice and Problem Solving: A/B

For Problems 1–2, determine the unknown values.

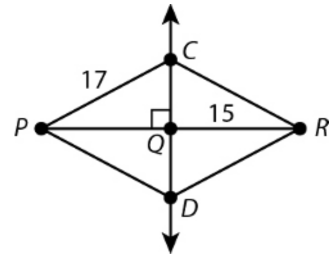
1. Given: $\overleftrightarrow{AC}$ is the perpendicular bisector of $\overline{GH}$.



$GH =$ ______________

$CH =$ ______________

2. Given: $\overleftrightarrow{CD}$ is the perpendicular bisector of $\overline{PR}$.



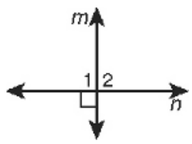
$CR =$ ______________

$PQ =$ ______________

Complete the two-column proof.

3. **Given:** $m \perp n$

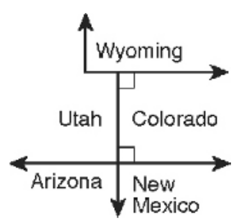
Prove: $\angle 1$ and $\angle 2$ are a linear pair of congruent angles.



Proof:

Statements	Reasons
1. a. ______________	1. Given
2. b. ______________	2. Def. of $\perp$
3. $\angle 1 \cong \angle 2$	3. c. ______________
4. $m\angle 1 + m\angle 2 = 180°$	4. Add. Prop. of $=$
5. d. ______________	5. Def. of linear pair

4. The Four Corners National Monument is at the intersection of the borders of Arizona, Colorado, New Mexico, and Utah. It is called the four corners because the intersecting borders are perpendicular. If you were to lie down on the intersection, you could be in four states at the same time—the only place in the United States where this is possible. The figure shows the Colorado–Utah border extending north in a straight line until it intersects the Wyoming border at a right angle. Explain why the Colorado–Wyoming border must be parallel to the Colorado–New Mexico border.



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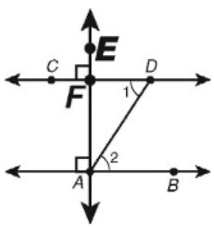
3. m and n are parallel if and only if $m\angle 7 = 90°$.
4. $m \parallel n$; Conv. of Same-Side Int. $\angle$s Thm.
5. m and n are not parallel.
6. $m \parallel n$; Conv. of Corr. $\angle$s Thm.
7. $m \parallel n$; Conv. of Alt Ext. $\angle$s Thm.
8. m and n are not parallel.
9. Possible answer: The given information states that $\angle 1$ and $\angle 3$ are supplementary. $\angle 1$ and $\angle 2$ are also supplementary by the Linear Pair Theorem. Therefore $\angle 3$ and $\angle 2$ must be congruent by the Congruent Supplements Theorem. Since $\angle 3$ and $\angle 2$ are congruent, $\overline{HI}$ and $\overline{JK}$ are parallel by the Converse of the Corresponding Angles Theorem.

Practice and Problem Solving: C

1. $x = 11$; $y = -5$; $m\angle 1 = 57°$; $m\angle 2 = 57°$; $m\angle 3 = 123°$
2. 

   Possible answer: Draw $\overleftrightarrow{AE}$ so it forms a $90°$ angle with $\overleftrightarrow{AB}$ by the Protractor Postulate. The Angle Addition Postulate states that $m\angle FAD$, $m\angle 2 = m\angle FAB$, so by substitution $m\angle FAD + m\angle 2 = 90°$. It is given that $\angle 1 \cong \angle 2$, so $m\angle 1 = m\angle 2$ by the definition of congruent angles. Substituting again reveals that $m\angle FAD + m\angle 1 = 90°$. $\angle FAD$, $\angle 1$, and $\angle AFD$ form a triangle, so by the given information $m\angle FAD + m\angle 1 + m\angle AFD = 180°$. Substitution and the Subtraction Property of Equality show that $m\angle AFD = 90°$. Then by the definition of right angle, $\angle FAB$ and $\angle AFD$ are right angles. $\overleftrightarrow{AE}$ intersects both $\overleftrightarrow{CD}$ and $\overleftrightarrow{AB}$ in right angles, so $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are parallel lines.

3. $x = 61$, $y = -64$, $m\angle 1 = 177°$, $m\angle 2 = 177°$, $m\angle 3 = 3°$

Practice and Problem Solving: Modified

1. Conv. of Corr. $\angle$s Thm.
2. $m\angle 3 = 68°$, $\angle 3 \cong \angle 7$, Conv. of Corr. $\angle$s Thm.
3. parallel
4. transversal; congruent
5. supplementary
6. a. Given
   b. $\angle 2$ and $\angle 3$ are supplementary
   c. $m \parallel n$

Reading Strategies

1. Converse of the Alternate Exterior Angles Theorem
2. Converse of the Same-Side Interior Angles Theorem
3. Converse of the Alternate Interior Angles Theorem
4. Converse of the Corresponding Angles Postulate
5. No; $\angle 1 \neq \angle 5$.
6. $61°$

Success for English Learners

1. The given angles $\angle 2$ and $\angle 6$ are alternate interior angles. The Converse of the Alternative Interior Angles Theorem proves the lines are parallel.
2. The given angles $\angle 8$ and $\angle 4$ are alternate exterior angles. The Converse of the Alternate Exterior Angles Theorem proves the lines are parallel.

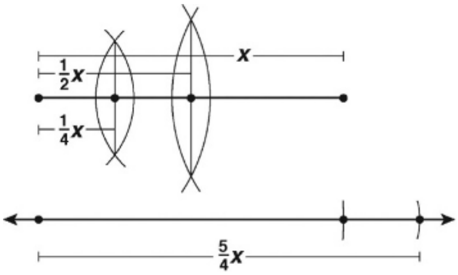
LESSON 4-4

Practice and Problem Solving: A/B

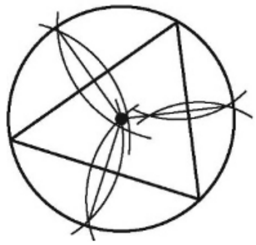
1. $GH = 16$; $CH = 12$
2. $CR = 17$; $PQ = 15$
3. a. $m \perp n$
   b. $m\angle 1 = 90°$; $m\angle 2 = 90°$
   c. Def. of $\cong \angle$s
   d. $\angle 1$ and $\angle 2$ are a linear pair.

4. All of the borders are straight lines, and the Colorado-Utah border is a transversal to the Colorado-Wyoming and the Colorado-New Mexico borders. Because the transversal is perpendicular to both borders, the borders must be parallel.

Practice and Problem Solving: C

1. 

2. Because $\overline{BD}$ must be shorter than $\overline{BE}$, $x < 11$. Therefore $\overline{BC}$ is the shortest segment. If $x = 1$, then $\overline{BD}$ would be the second shortest segment, but if $x = 3$, then $\overline{AB}$ would be the second shortest segment. So there is not enough information given in the figure to say which is the second shortest segment.
3. The distances are equal. Possible answer:



4. $x = 3$, $y = \frac{3}{2}$, $z = -1$

Practice and Problem Solving: Modified

1. $WA = 27$; $AX = 18$; $AB = 36$
2. $FG = 18$; $FD = 9$; $CG = 8$
3. a. Given
   b. 180°
   c. Substi. Prop. of =
   d. $m\angle 1 = 90°$

Reading Strategies

1. 4
2. 5.3
3. 90°
4. 13
5. $\overline{RN}$
6. $(x + 3) < 17$, $x < 14$

Success for English Learners

1. Any point on a perpendicular bisector to a segment is equidistant from the endpoints of the segment.
2. Perpendicular lines form a linear pair containing congruent angles.

LESSON 4-5

Practice and Problem Solving: A/B

1. rise = 4, run = 5, slope = $\frac{4}{5}$
2. rise = –6, run = 3, slope = –2
3. rise = 3, run = 4, slope = $\frac{3}{4}$
4. $y = 9x - 11$
5. $y = 4x - 27$
6. $y = \frac{2}{3}x + 8$
7. $y = -\frac{1}{4}x + 13$
8. $y = -4x + 17$
9. $y = 3x + 14$
10. $y = -\frac{1}{6}x + 9$
11. $y = -\frac{1}{5}x - 2$

Practice and Problem Solving: C

1. $y = -6x + 16$
2. $y = x - 9$
3. $y = \frac{5}{2}x - 8$
4. $y = -5x + 13$
5. $y = -\frac{1}{3}x + 1$
6. $y = -3x - 7$
7. $x = 2$
8. $y = 7$
9. $k = -10$