Warm Up

Solve each inequality.

1. $x - 5 < 8$ $x < 13$

2. $3x + 1 < x$ $x > -\frac{1}{2}$

Solve each equation.

3. $5y = 90$ $y = 18$

4. $5x + 15 = 90$ $x = 15$

Solve the systems of equations.

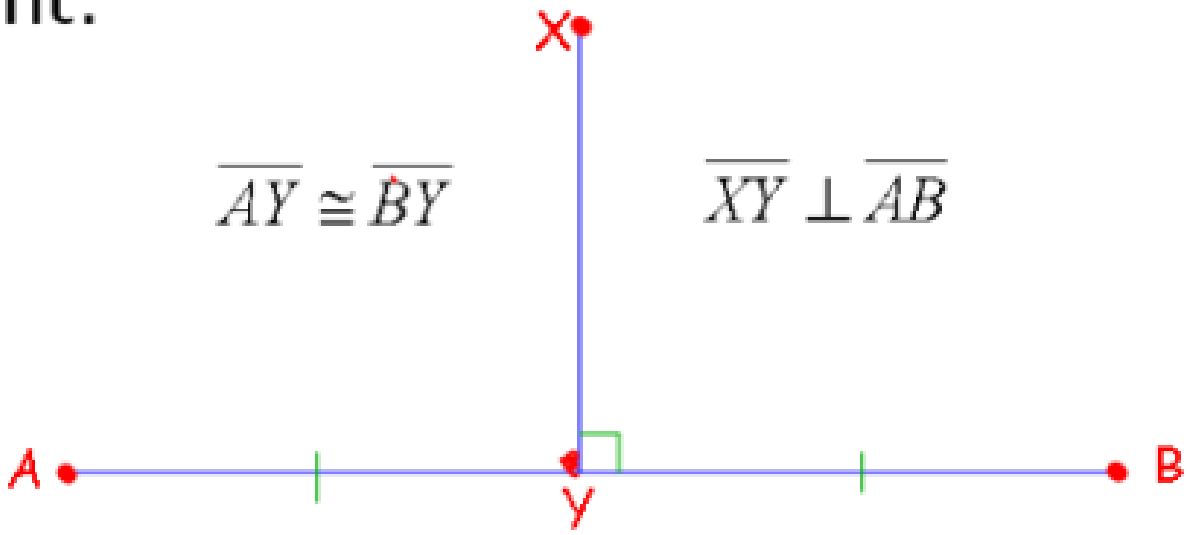
5. $\begin{cases} 6y = 90 \\ 8y - 3x = 90 \end{cases}$ $x = 10, y = 15$

Objective

Prove and apply theorems about perpendicular lines.

3-4 Perpendicular Lines

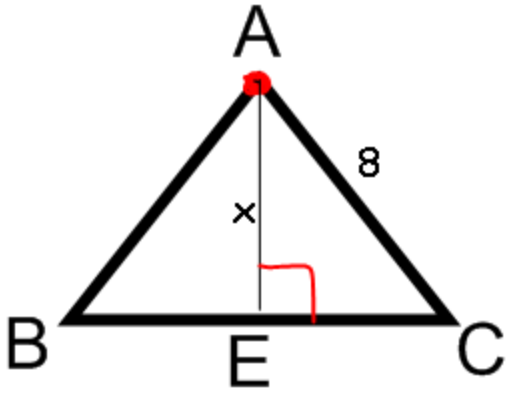
The **perpendicular bisector** of a segment is a line perpendicular to a segment at the segment's midpoint.

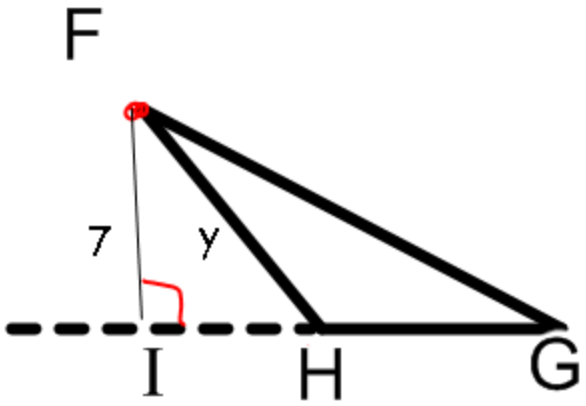


3-4 Perpendicular Lines

The shortest segment from a point to a line is perpendicular to the line.

Therefore the **distance from a point to a line** is the length of the perpendicular segment from the point to the line.





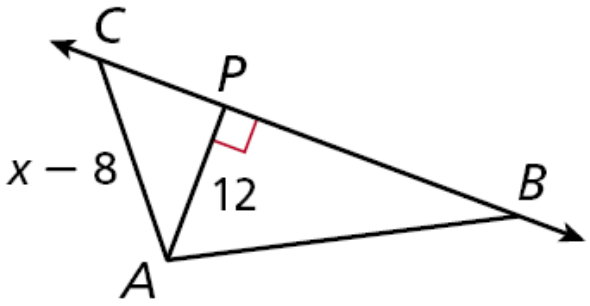
$\overline{AE}$ is shorter than $\overline{AC}$.

$\overline{FI}$ is the shortest.

Example 1: Distance From a Point to a Line

A. Name the shortest segment from point *A* to $\overleftrightarrow{BC}$.

$\overline{AP}$ is perpendicular to $\overleftrightarrow{BC}$ so the shortest segment from *A* to *BC* is $\overline{AP}$.



B. Write and solve an inequality for *x*.

$AC > AP$ — *$\overline{AP}$ is the shortest segment.*

$x - 8 > 12$ — *Substitute $x - 8$ for AC and 12 for AP.*

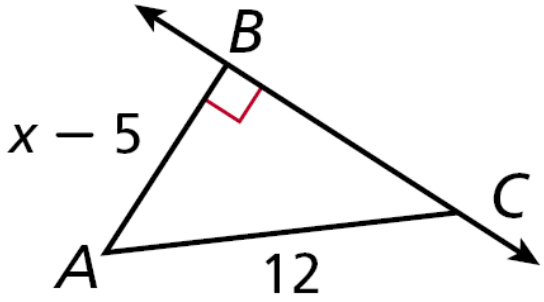
$+ 8 \quad + 8$ — *Add 8 to both sides of the inequality.*

$x > 20$

Check It Out! Example 1

A. Name the shortest segment from point *A* to $\overleftrightarrow{BC}$.

$\overline{AB}$ is the perpendicular segment to $\overleftrightarrow{BC}$, so $\overline{AB}$ is the shortest segment from *A* to $\overleftrightarrow{BC}$.



B. Write and solve an inequality for *x*.

$AC > AB$ — $\overline{AB}$ *is the shortest segment.*

$12 > x - 5$ — *Substitute 12 for AC and x – 5 for AB.*

$+5 \quad +5$ — *Add 5 to both sides of the inequality.*

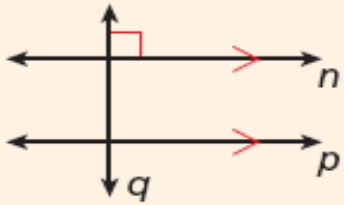
$17 > x$

3-4 Perpendicular Lines

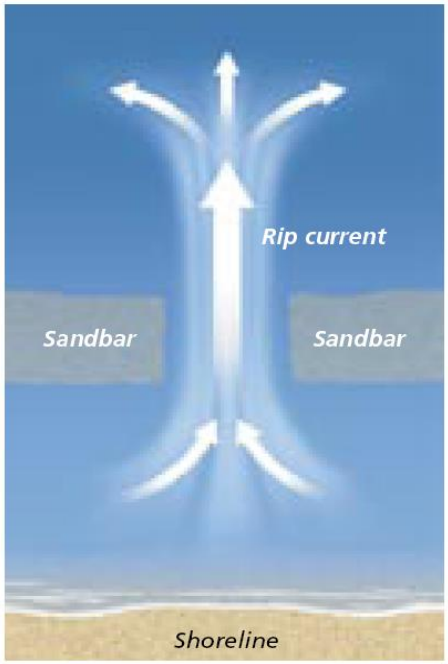
Theorems

THEOREM	HYPOTHESIS	CONCLUSION
3-4-1 If two intersecting lines form a linear pair of congruent angles, then the lines are perpendicular. (2 intersecting lines form lin. pair of $\cong \measuredangle s \rightarrow$ lines $\perp$.)		$\ell \perp m$

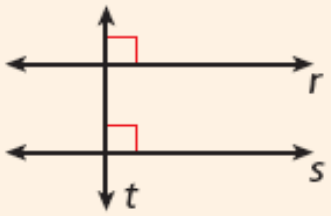
3-4 Perpendicular Lines

	HYPOTHESIS	CONCLUSION
3-4-2 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 $n \perp q$ & $n \parallel p$,	Then $q \perp p$

A swimmer who gets caught in a rip current should swim in a direction parallel to the shore. This theorem explains why the swimmer will be perpendicular to the current as well.



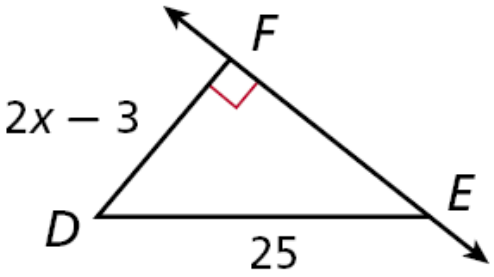
3-4 Perpendicular Lines

	HYPOTHESIS	CONCLUSION
3-4-3 If two coplanar lines are perpendicular to the same line, then the two lines are parallel to each other. (2 lines ⊥ to same line → 2 lines ∥.)	 If $r \perp t$ & $s \perp t$,	Then $r \parallel s$

A *carpenter's square* forms a right angle. A carpenter places the square so that one side is parallel to an edge of a board, and then draws a line along the other side of the square. Then he slides the square to the right and draws a second line. The two lines are parallel because they are both perpendicular to the edge thus explaining this theorem.

Lesson Quiz: Part I

1. Write and solve an inequality for x.



2. Solve to find x and y in the diagram.