Name ______________________ Date ______________

LESSON 5.3

Study Guide

For use with pages 310–316

GOAL **Use angle bisectors to find distance relationships.**

Vocabulary

The point of concurrency of the three angle bisectors of a triangle is called the **incenter** of the triangle.

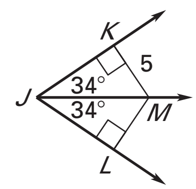
Theorem 5.5 Angle Bisector Theorem: If a point is on the bisector of an angle, then it is equidistant from the two sides of the angle.

Theorem 5.6 Converse of the Angle Bisector Theorem: If a point is in the interior of an angle and is equidistant from the sides of the angle, then it lies on the bisector of the angle.

Theorem 5.7 Concurrency of Angle Bisectors of a Triangle: The angle bisectors of a triangle intersect at a point that is equidistant from the sides of the triangle.

EXAMPLE 1 Use the Angle Bisector Theorem

Find the measure of $\overline{LM}$.

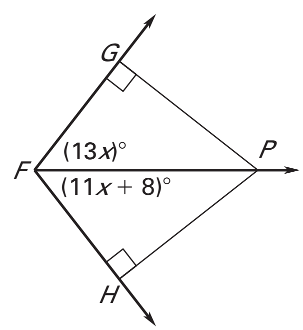


Solution

$\overrightarrow{JM}$ bisects $\angle KJL$ because $m\angle KJM = m\angle LJM$. Because $\overrightarrow{JM}$ bisects $\angle KJL$ and $\overline{MK} \perp \overline{JK}$ and $\overline{ML} \perp \overline{JL}$, $ML = MK$ by the Angle Bisector Theorem. So, $ML = MK = 5$.

EXAMPLE 2 Use algebra to solve a problem

For what value of *x* does *P* lie on the bisector of $\angle GFH$?



Solution

From the definition of an angle bisector, you know that P lies on the bisector of $\angle GFH$ if $m\angle GFP = m\angle HFP$.

$m\angle GFP = m\angle HFP$	Set angle measures equal.
$13x = 11x + 8$	Substitute.
$x = 4$	Solve for x.

Point P lies on the bisector of $\angle GFH$ when $x = 4$.

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LESSON 5.3

Study Guide *continued*

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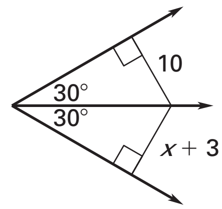
Exercises for Examples 1 and 2

Find the value of *x*.

1.



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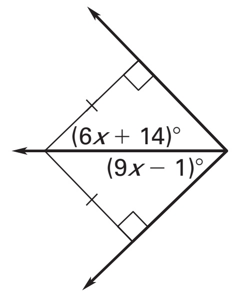

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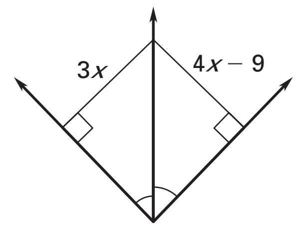
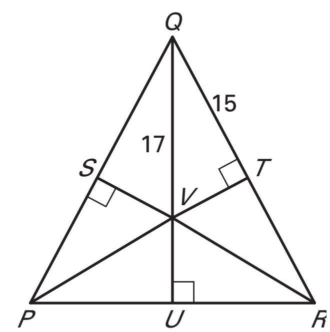


EXAMPLE 3

Use the concurrency of angle bisectors

In the diagram, *V* is the incenter of $\triangle PQR$. Find *VS*.



Solution

By the Concurrency of Angle Bisectors of a Triangle Theorem, the incenter V is equidistant from the sides of $\triangle PQR$. So, to find VS, you can find VT in $\triangle PQR$ by using the Pythagorean Theorem.

$c^2 = a^2 + b^2$	Pythagorean Theorem
$17^2 = VT^2 + 15^2$	Substitute known values.
$289 = VT^2 + 225$	Multiply.
$64 = VT^2$	Subtract 225 from each side.
$8 = VT$	Take the positive square root of each side.

Because $VT = VS$, $VS = 8$.

Exercises for Example 3

4. In Example 3, suppose you are not given QV or QT, but you are given that $RU = 24$ and $RV = 25$. Find VS.

5. In the diagram, D is the incenter of $\triangle ABC$. Find DF.