Name _____ Date _____

LESSON 4.7

Study Guide

For use with pages 264–270

GOAL **Use theorems about isosceles and equilateral triangles.**

Vocabulary

When an isosceles triangle has exactly two congruent sides, these two sides are the **legs.** The angle formed by the legs is the **vertex angle.** The third side is the **base** of the isosceles triangle. The two angles adjacent to the base are called **base angles.**

Theorem 4.7 Base Angles Theorem: If two sides of a triangle are congruent, then the angles opposite them are congruent.

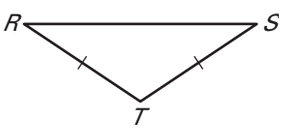
Theorem 4.8 Converse of Base Angles Theorem: If two angles of a triangle are congruent, then the sides opposite them are congruent.

Corollary to the Base Angles Theorem: If a triangle is equilateral, then it is equiangular.

Corollary to the Converse of Base Angles Theorem: If a triangle is equiangular, then it is equilateral.

EXAMPLE 1 Identify congruent angles

In the diagram, $\overline{RT} \cong \overline{ST}$. Name two congruent angles.

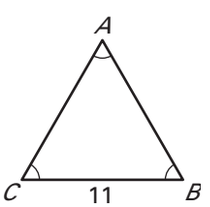


Solution

$\overline{RT} \cong \overline{ST}$, so by the Base Angles Theorem, $\geq R \cong \geq S$.

EXAMPLE 2 Find measures in a triangle

Find AB and AC in the triangle at the right.

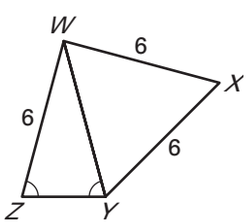


Solution

The diagram shows that $\triangle ABC$ is equiangular. Therefore, by the Corollary to the Converse of Base Angles Theorem, $\triangle ABC$ is equilateral. So, $AB = BC = AC = 11$.

Exercises for Examples 1 and 2

Use the information in the diagram to find the given values.



1. Find WY.
2. Find $m\geq WXY$.

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Study Guide *continued*

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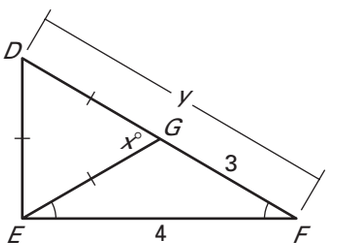
EXAMPLE 3 Use isosceles and equilateral triangles

In the diagram, $m\angle DEF = 90°$. Find the values of x and y.



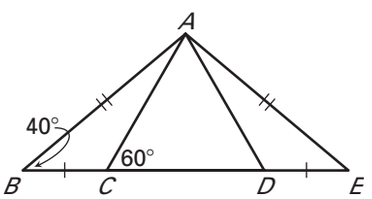
Solution

STEP 1 **Find** the value of x. Because $\triangle DEG$ is equilateral, it is also equiangular, and $m\angle GDE = m\angle DEG = x°$. So, by the Triangle Sum Theorem, $3x° = 180°$, and $x = 60$.

STEP 2 **Find** the value of y. Because $\angle GEF \cong \angle GFE$, $\overline{GE} \cong \overline{GF}$ by the Converse of Base Angles Theorem, so $GE = 3$. Because $\triangle DEG$ is equilateral, $DE = DG = GE = 3$. Because $m\angle DEF = 90°$, $\triangle DEF$ is a right triangle. Using the Pythagorean Theorem, $y = \sqrt{3^2 + 4^2} = 5$.

EXAMPLE 4 Solve a multi-step problem

Use the diagram to answer the questions.



a. What congruence postulate can you use to prove that $\triangle ABC \cong \triangle AED$?

b. Explain why $\triangle ACD$ is equiangular.

c. Show that $\triangle ABD \cong \triangle AEC$.

Solution

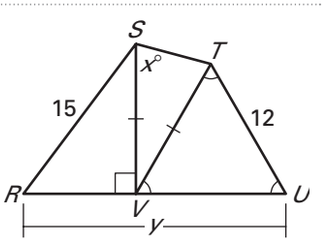
a. You can see that $\overline{AB} \cong \overline{AE}$ and $\overline{BC} \cong \overline{ED}$. By the Base Angles Theorem, you know that $\angle B \cong \angle E$. So, by the SAS Congruence Postulate, $\triangle ABC \cong \triangle AED$.

b. Because corresponding parts of congruent triangles are congruent, you know that $\angle ACB \cong \angle ADE$, and by the Congruent Supplements Theorem, $\angle ACD \cong \angle ADC$. So $m\angle ADC = m\angle ACD = 60°$, and $m\angle CAD = 180° - 60° - 60° = 60°$, and $\triangle ACD$ is equiangular.

c. From part (b) you know that $\triangle ACD$ is equiangular. So, $\angle ADB \cong \angle ACE$ and therefore $\triangle ABD \cong \triangle AEC$ by the AAS Congruence Postulate.

Exercises for Examples 3 and 4

3. Find the values of x and y in the diagram at the right.



4. In Example 4 above, show that $\triangle ABD \cong \triangle AEC$ using the SSS Congruence Postulate.