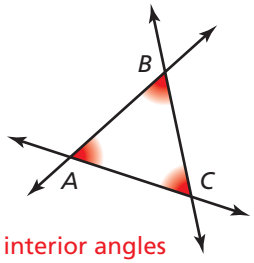
Name _____ Date _____

Finding Angles of Triangles

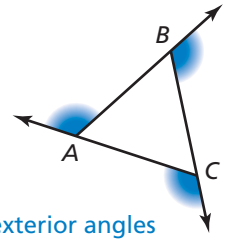
Using Interior and Exterior Angles

When the sides of a polygon are extended, other angles are formed. The original angles are the **interior angles**. The angles that form linear pairs with the interior angles are the **exterior angles**.

The theorems given below show how the angle measures of a triangle are related. You can use these theorems to find angle measures.



interior angles



exterior angles

Triangle Sum Theorem

The sum of the measures of the interior angles of a triangle is 180°.

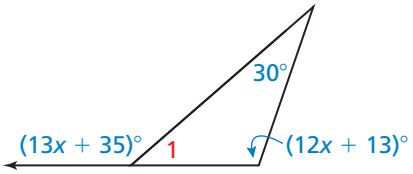
Exterior Angle Theorem

The measure of an exterior angle of a triangle is equal to the sum of the measures of the two nonadjacent interior angles.

Corollary to the Triangle Sum Theorem

The acute angles of a right triangle are complementary.

Example 1 **Find $m\angle 1$.**



First write and solve an equation to find the value of x.

$(13x + 35)° = 30° + (12x + 13)°$ Apply the Exterior Angle Theorem.

$x = 8$ Solve for x.

Substitute 8 for x in $(12x + 13)°$ to find the obtuse angle measure, 109°. Then write and solve an equation to find $m\angle 1$.

$m\angle 1 + 30° + 109° = 180°$ Apply the Triangle Sum Theorem.

$m\angle 1 = 41°$ Solve for $m\angle 1$.

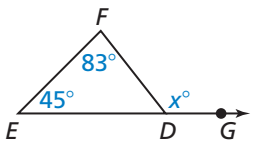
▶ So, the measure of $\angle 1$ is 41°.

Practice

Check your answers at BigIdeasMath.com.

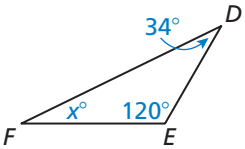
Find the value of x.

1.



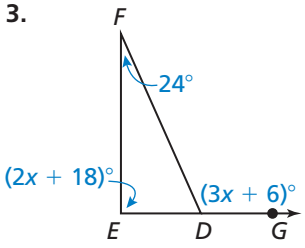
$x = 128$

2.



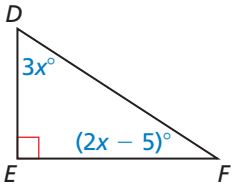
$x = 26$

3.



$x = 36$

4.



$x = 19$

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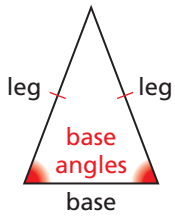
Name _____ Date _____

Finding Angles of Triangles

Using Isosceles and Equilateral Triangles

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



You can use the theorems given below to find angle measures and side lengths.

Base Angles Theorem

If two sides of a triangle are congruent, then the angles opposite them are congruent.

Converse of the Base Angles Theorem

If two angles of a triangle are congruent, then the sides opposite them are congruent.

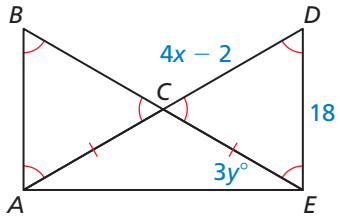
Corollary to the Base Angles Theorem

If a triangle is equilateral, then it is equiangular.

Corollary to the Converse of the Base Angles Theorem

If a triangle is equiangular, then it is equilateral.

Example 1 **Find the values of x and y in the diagram.**



Step 1 Find the value of x. Because $\triangle CDE$ is equiangular, it is also equilateral by the Corollary to the Converse of the Base Angles Theorem. So, $\overline{CD} \cong \overline{DE}$.

$CD = DE$ Definition of congruent segments

$4x - 2 = 18$ Substitute.

$x = 5$ Solve for x.

Step 2 Find the value of y. By the Triangle Sum Theorem, $3(m\angle DCE) = 180°$, so $m\angle DCE = 60°$. Because $\angle ACE$ and $\angle DCE$ form a linear pair, they are supplementary angles and $m\angle ACE = 180° - 60° = 120°$. The diagram shows that $\triangle ACE$ is isosceles. By the Base Angles Theorem, $\angle CAE \cong \angle CEA$. So, $m\angle CAE = m\angle CEA$.

$120° + 3y° + 3y° = 180°$ Apply the Triangle Sum Theorem.

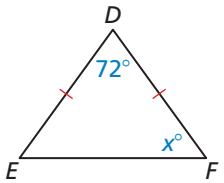
$y = 10$ Solve for y.

Practice

Check your answers at BigIdeasMath.com.

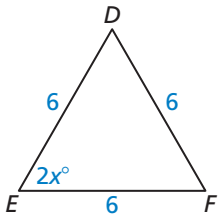
Find the value(s) of the variable(s).

1.



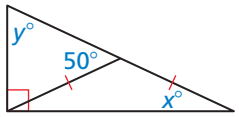
$x = 54$

2.



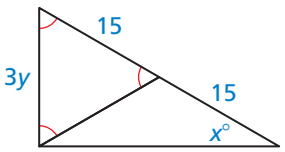
$x = 30$

3.



$x = 25, y = 65$

4.



$x = 30, y = 5$

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