4-2 Classifying Triangles

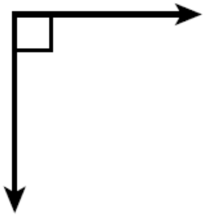
Warm Up

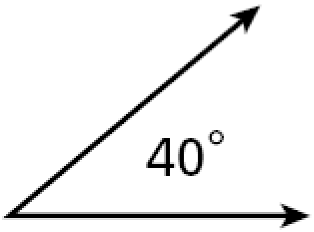
Lesson Presentation

Lesson Quiz

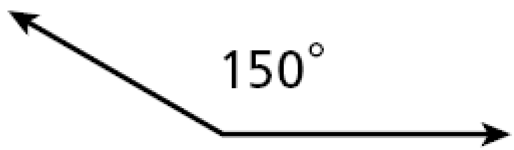
Warm Up

Classify each angle as acute, obtuse, or right.

1.  right

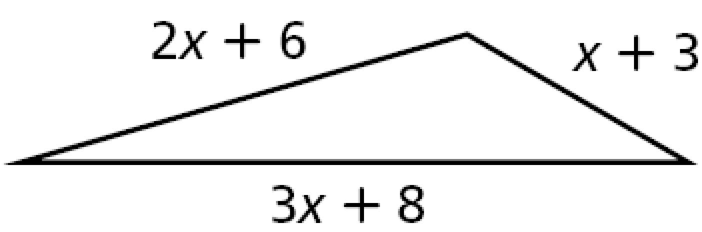
2. 

acute

3. 

obtuse

4. If the perimeter is 47, find *x* and the lengths of the three sides.



$x = 5; 8; 16; 23$

Objectives

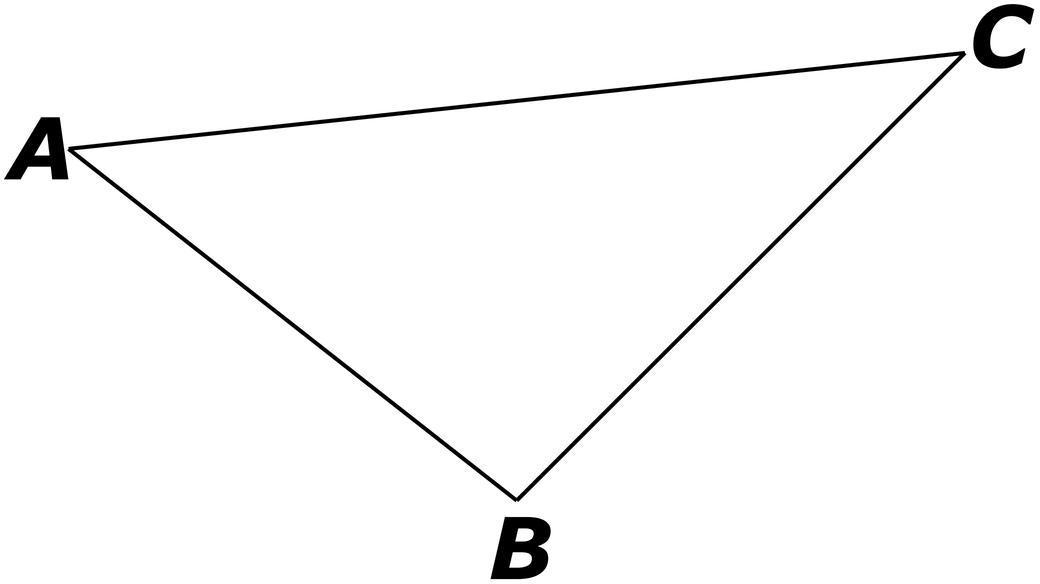
Classify triangles by their angle measures and side lengths.

Use triangle classification to find angle measures and side lengths.

Vocabulary

acute triangle
equiangular triangle
right triangle
obtuse triangle
equilateral triangle
isosceles triangle
scalene triangle

Recall that a *triangle* (△) is a polygon with three sides. Triangles can be classified in two ways: by their angle measures or by their side lengths.

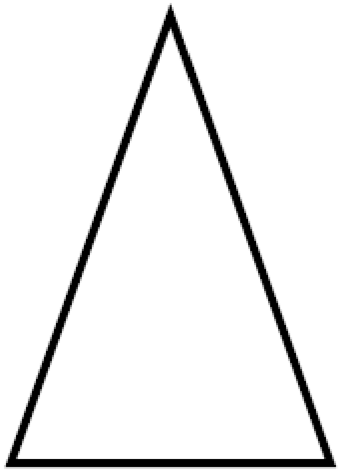


$\overline{AB}$, $\overline{BC}$, and $\overline{AC}$ are the sides of $\triangle ABC$.

A, *B*, *C* are the triangle's *vertices*.

Triangle Classification By Angle Measures

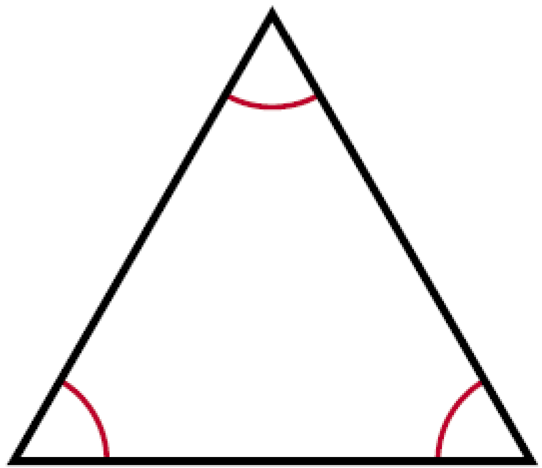
Acute Triangle



Three acute angles

Triangle Classification By Angle Measures

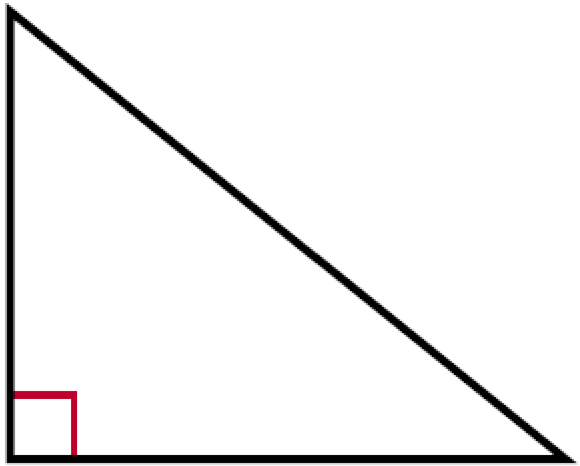
Equiangular Triangle



Three congruent acute angles

Triangle Classification By Angle Measures

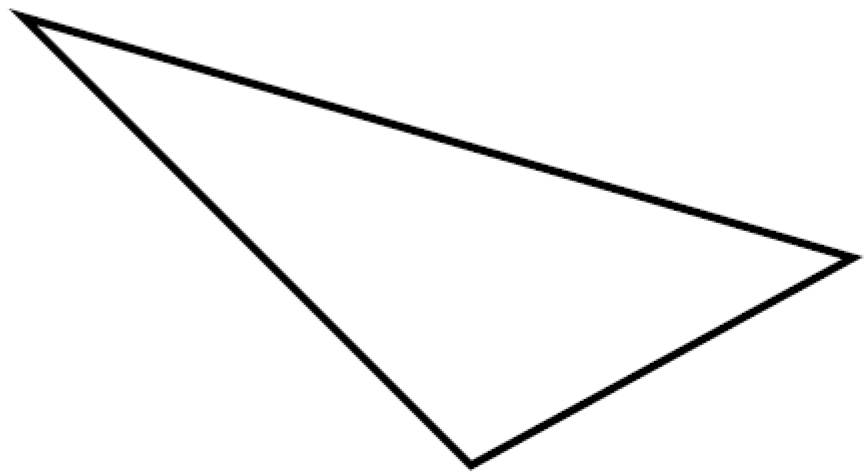
Right Triangle



One right angle

Triangle Classification By Angle Measures

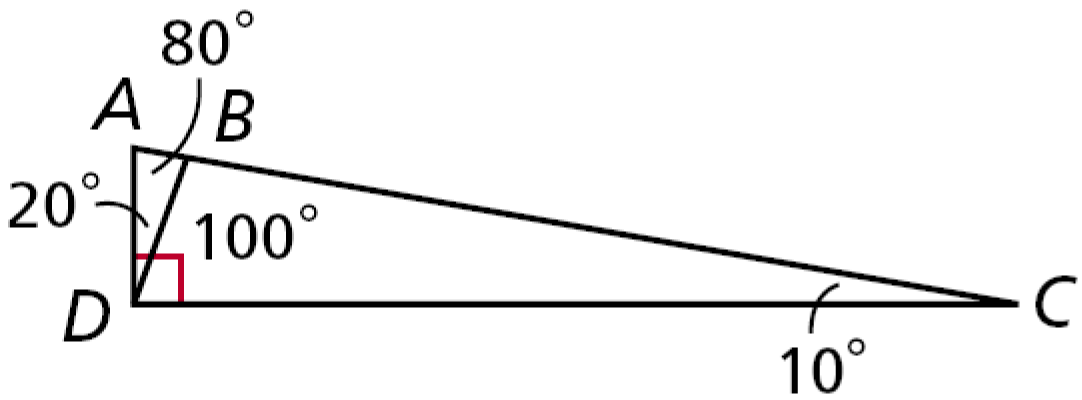
Obtuse Triangle



One obtuse angle

Example 1A: Classifying Triangles by Angle Measures

Classify △*BDC* by its angle measures.

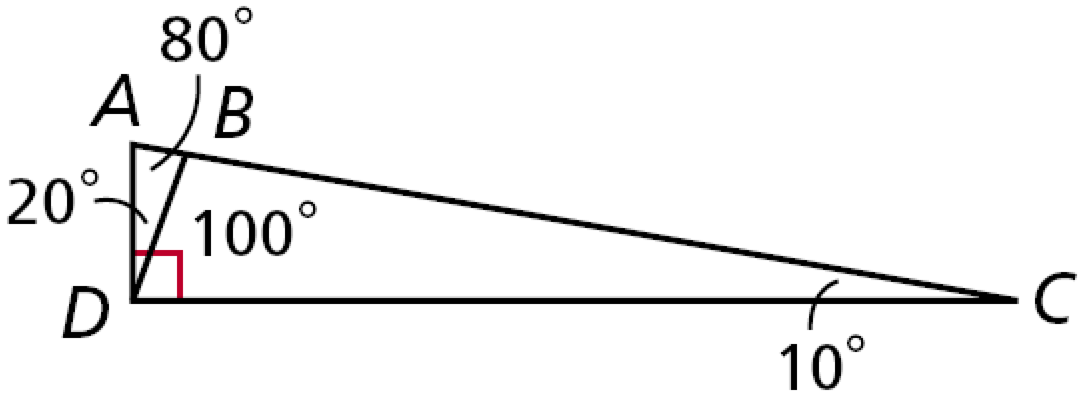


∠*B* is an obtuse angle.

∠*B* is an obtuse angle. So △*BDC* is an obtuse triangle.

Example 1B: Classifying Triangles by Angle Measures

Classify △*ABD* by its angle measures.

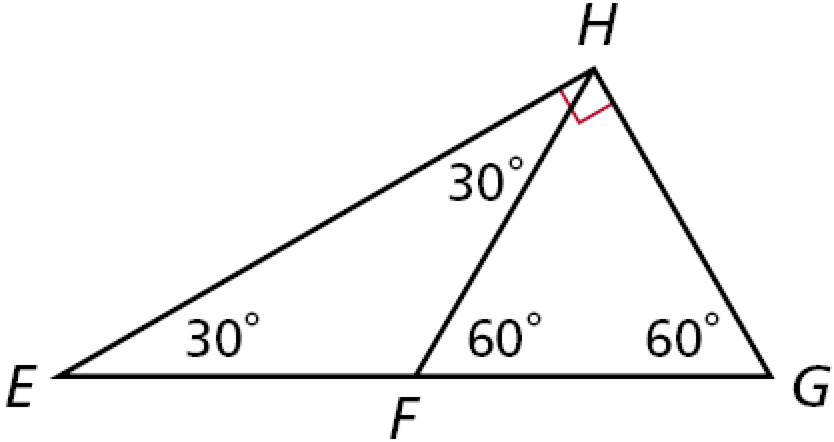


∠*ABD* and ∠*CBD* form a linear pair, so they are supplementary.

Therefore m∠*ABD* + m∠*CBD* = 180°. By substitution, m∠*ABD* + 100° = 180°. So m∠*ABD* = 80°. △*ABD* is an acute triangle by definition.

Check It Out! Example 1

Classify △*FHG* by its angle measures.

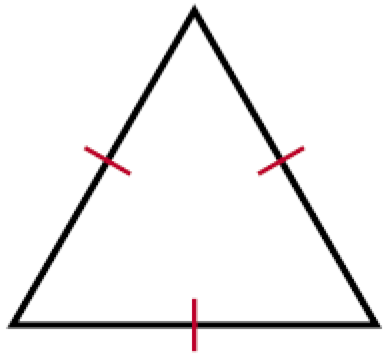


∠*EHG* is a right angle. Therefore m∠*EHF* +m∠*FHG* = 90°. By substitution, 30°+ m∠*FHG* = 90°. So m∠*FHG* = 60°.

△*FHG* is an equiangular triangle by definition.

Triangle Classification **By Side Lengths**

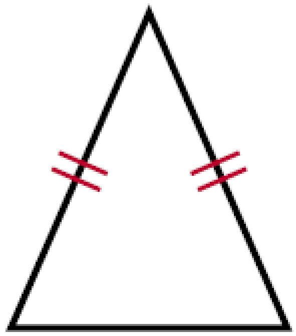
Equilateral Triangle



Three congruent sides

Triangle Classification By Side Lengths

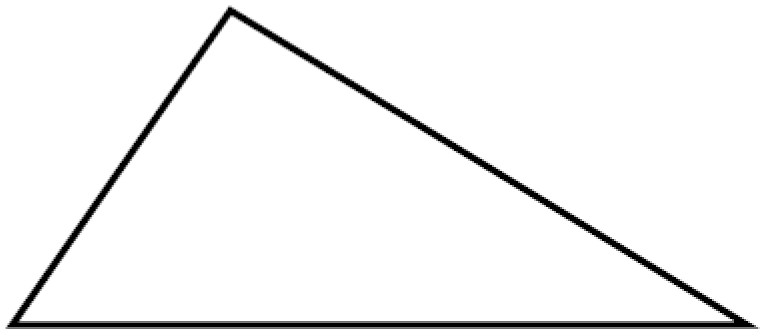
Isosceles Triangle



At least two congruent sides

Triangle Classification By Side Lengths

Scalene Triangle



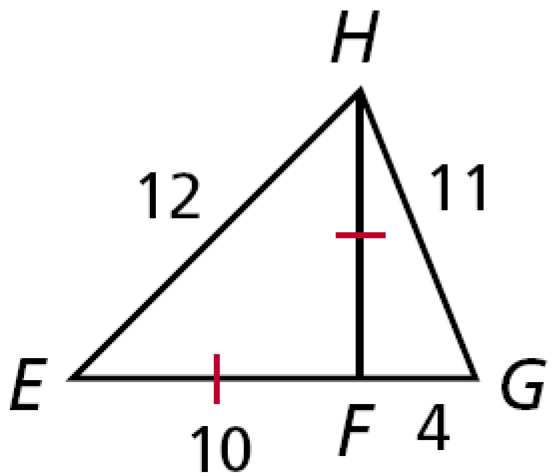
No congruent sides

Remember!

When you look at a figure, you cannot assume segments are congruent based on appearance. They must be marked as congruent.

Example 2A: Classifying Triangles by Side Lengths

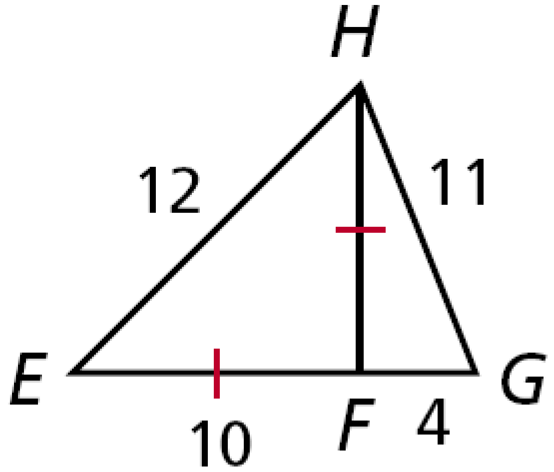
Classify △*EHF* by its side lengths.



From the figure, $\overline{EF} \cong \overline{HF}$. So $HF = 10$, and △*EHF* is isosceles.

Example 2B: Classifying Triangles by Side Lengths

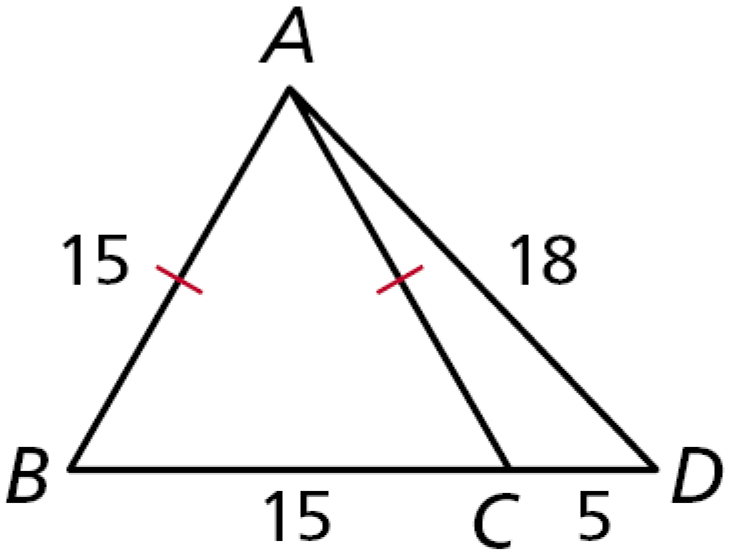
Classify △*EHG* by its side lengths.



By the Segment Addition Postulate, $EG = EF + FG = 10 + 4 = 14$. Since no sides are congruent, △*EHG* is scalene.

Check It Out! Example 2

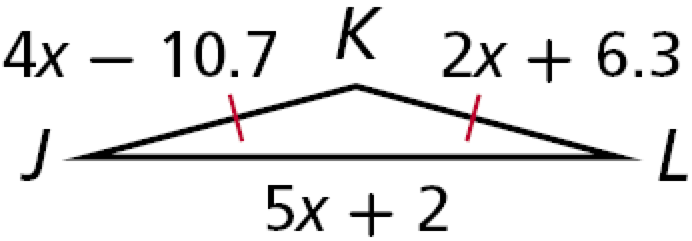
Classify △ACD by its side lengths.



From the figure, $\overline{AB} \cong \overline{AC}$. So AC = 15, and △ACD is scalene.

Example 3: Using Triangle Classification

Find the side lengths of $\triangle$ *JKL*.

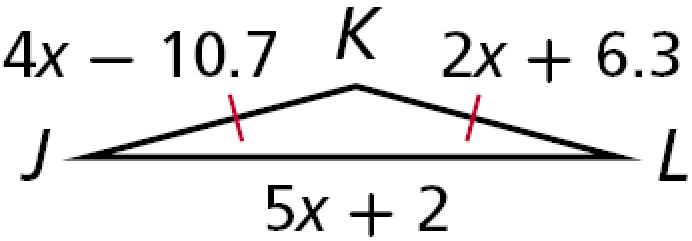


Step 1 Find the value of x.

$\overline{JK} \cong \overline{KL}$	*Given.*
$JK = KL$	*Def. of ≅ segs.*
$4x - 10.7 = 2x + 6.3$	*Substitute (4x – 10.7) for JK and (2x + 6.3) for KL.*
$2x = 17.0$	*Add 10.7 and subtract 2x from both sides.*
$x = 8.5$	*Divide both sides by 2.*

Example 3 Continued

Find the side lengths of △*JKL*.



Step 2 Substitute 8.5 into the expressions to find the side lengths.

$JK = 4x - 10.7$

$= 4(8.5) - 10.7 = 23.3$

$KL = 2x + 6.3$

$= 2(8.5) + 6.3 = 23.3$

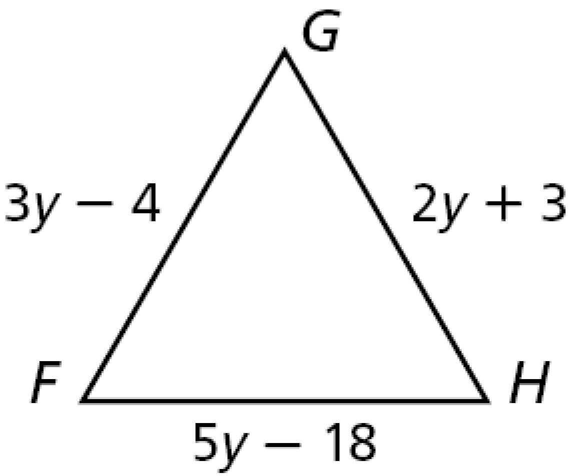
$JL = 5x + 2$

$= 5(8.5) + 2 = 44.5$

Check It Out! Example 3

Find the side lengths of equilateral $\triangle FGH$.

Step 1 Find the value of *y*.

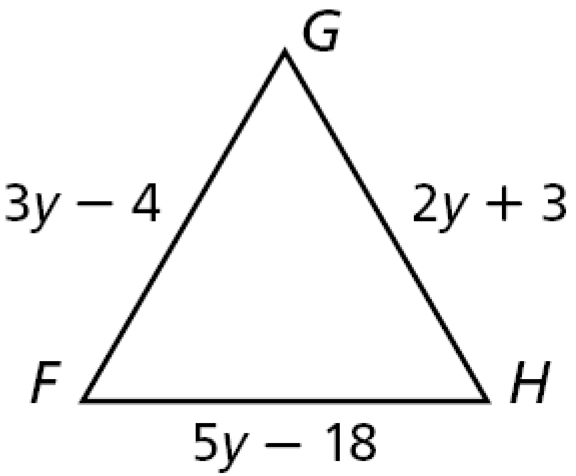


$\overline{FG} \cong \overline{GH} \cong \overline{FH}$	*Given.*
$FG = GH = FH$	*Def. of ≅ segs.*
$3y - 4 = 2y + 3$	*Substitute (3y – 4) for FG and (2y + 3) for GH.*
$y = 7$	*Add 4 and subtract 2y from both sides.*

Check It Out! Example 3 Continued

Find the side lengths of equilateral $\triangle FGH$.

Step 2 Substitute 7 into the expressions to find the side lengths.



$$FG = 3y - 4$$
$$= 3(7) - 4 = 17$$
$$GH = 2y + 3$$
$$= 2(7) + 3 = 17$$
$$FH = 5y - 18$$
$$= 5(7) - 18 = 17$$

Example 4: Application

A steel mill produces roof supports by welding pieces of steel beams into equilateral triangles. Each side of the triangle is 18 feet long. How many triangles can be formed from 420 feet of steel beam?

The amount of steel needed to make one triangle is equal to the perimeter *P* of the equilateral triangle.

$P = 3(18)$

$P = 54$ ft

Example 4: Application Continued

A steel mill produces roof supports by welding pieces of steel beams into equilateral triangles. Each side of the triangle is 18 feet long. How many triangles can be formed from 420 feet of steel beam?

To find the number of triangles that can be made from 420 feet of steel beam, divide 420 by the amount of steel needed for one triangle.

$420 \div 54 = 7\frac{7}{9}$ triangles

There is not enough steel to complete an eighth triangle. So the steel mill can make 7 triangles from a 420 ft. piece of steel beam.

Check It Out! Example 4a

Each measure is the side length of an equilateral triangle. Determine how many 7 in. triangles can be formed from a 100 in. piece of steel.

The amount of steel needed to make one triangle is equal to the perimeter *P* of the equilateral triangle.

$P = 3(7)$

$P = 21$ in.

Check It Out! Example 4a Continued

Each measure is the side length of an equilateral triangle. Determine how many 7 in. triangles can be formed from a 100 in. piece of steel.

To find the number of triangles that can be made from 100 inches of steel, divide 100 by the amount of steel needed for one triangle.

$100 \div 7 = 14\frac{2}{7}$ triangles

There is not enough steel to complete a fifteenth triangle. So the manufacturer can make 14 triangles from a 100 in. piece of steel.

Check It Out! Example 4b

Each measure is the side length of an equilateral triangle. Determine how many 10 in. triangles can be formed from a 100 in. piece of steel.

The amount of steel needed to make one triangle is equal to the perimeter *P* of the equilateral triangle.

$P = 3(10)$

$P = 30$ in.

Check It Out! Example 4b Continued

Each measure is the side length of an equilateral triangle. Determine how many 10 in. triangles can be formed from a 100 in. piece of steel.

To find the number of triangles that can be made from 100 inches of steel, divide 100 by the amount of steel needed for one triangle.

$100 \div 10 = 10$ triangles

The manufacturer can make 10 triangles from a 100 in. piece of steel.

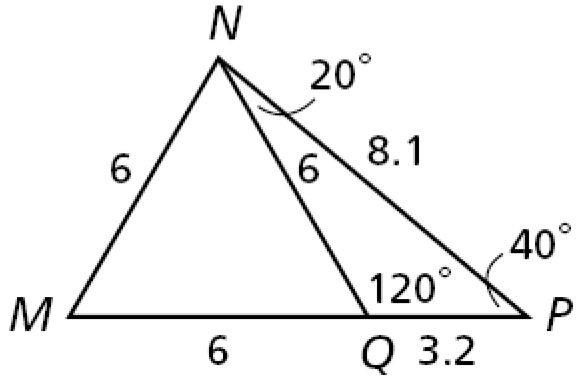
Lesson Quiz

Classify each triangle by its angles and sides.

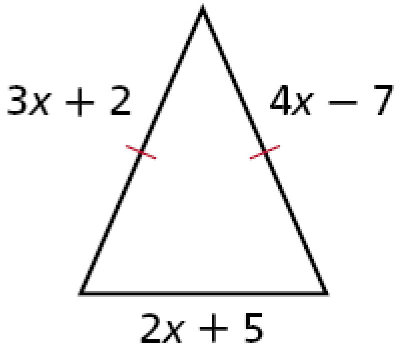
1. $\triangle MNQ$ acute; equilateral

2. $\triangle NQP$ obtuse; scalene

3. $\triangle MNP$ acute; scalene



4. Find the side lengths of the triangle.



29; 29; 23