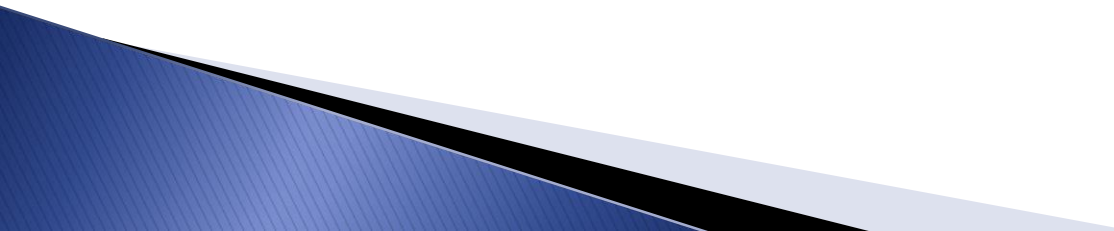


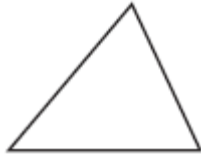
Lesson 13

Introduction to Triangles

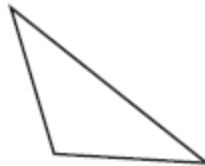
A triangle is a three-sided polygon. A triangle can be classified by its angles or by its sides. The following are three ways to classify a triangle according to its angles.



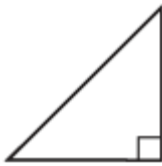
Acute Triangle – Any triangle that has three acute angles is an acute triangle.



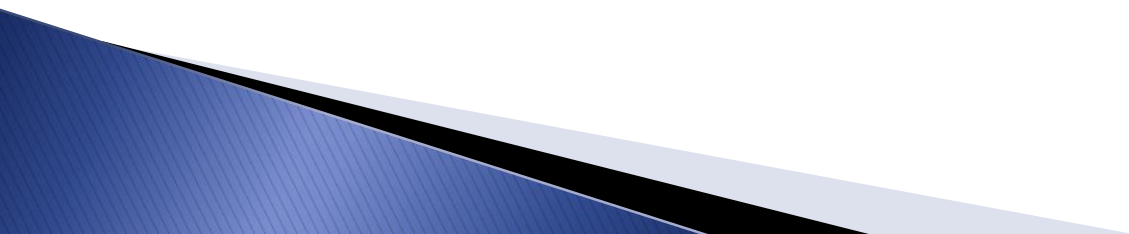
Obtuse Triangle – Any triangle that has one obtuse angle is an obtuse triangle.



Right Triangle – Any triangle that has one right angle is a right triangle.



Equiangular triangle – A special kind of acute triangle which has three congruent angles.

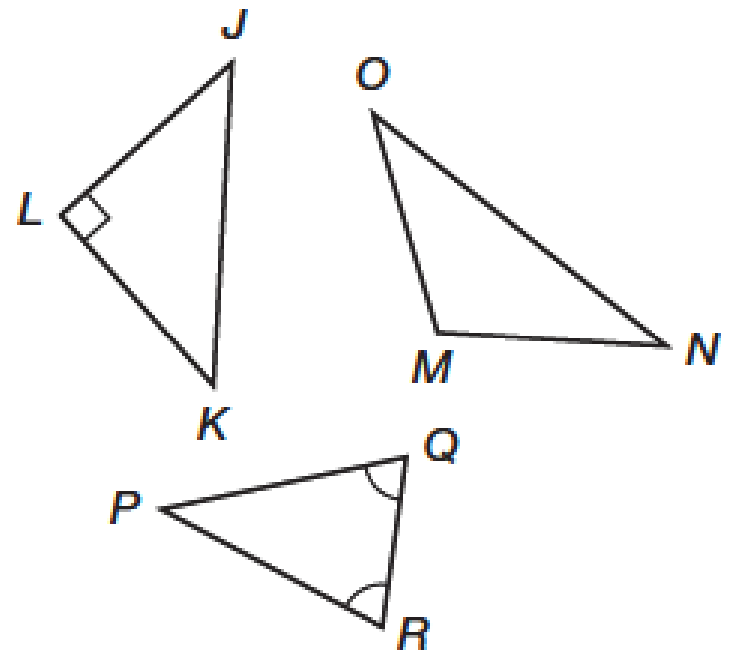


Example 1 Classifying Triangles by Angles

a. In the diagram, which triangle is obtuse?

SOLUTION

$\triangle MNO$ is obtuse because it has one obtuse angle M .

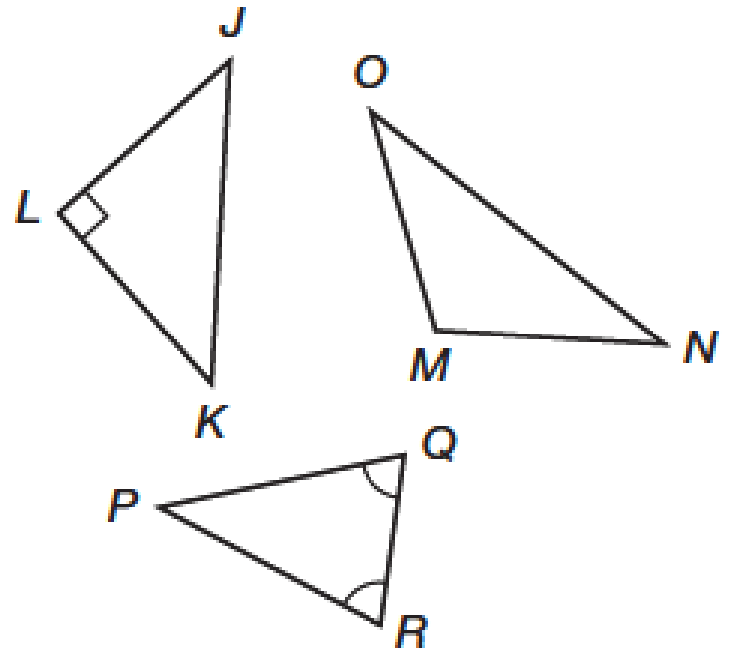


Example 1 Classifying Triangles by Angles

b. Which triangle is a right triangle?

SOLUTION

$\triangle JLK$ is a right triangle because $\angle L$ is a right angle.



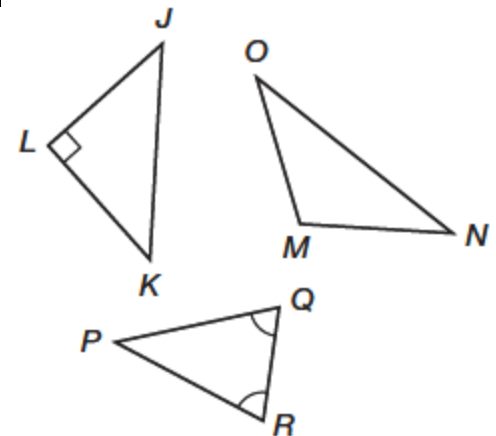
Example 1 Classifying Triangles by Angles

c. Are any of the triangles equiangular?

SOLUTION

No. $\triangle JLK$ and $\triangle MNO$ are not acute, so they cannot be equiangular.

$\triangle PQR$ is acute (because all its angles are acute), but is not equiangular because $\angle P$ is not congruent to the other two angles.

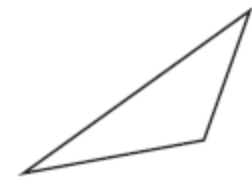
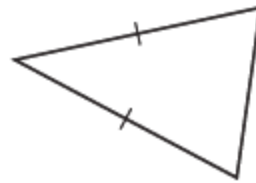
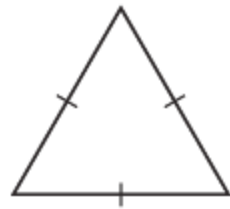


Triangles may also be classified by the lengths of their sides. The following are three ways to classify a triangle by its sides.

Equilateral Triangle – Any triangle that has three congruent sides is an equilateral triangle.

Isosceles Triangle – Any triangle with at least two congruent sides is an isosceles triangle.

Scalene Triangle – Any triangle that does not have any congruent sides is a scalene triangle.

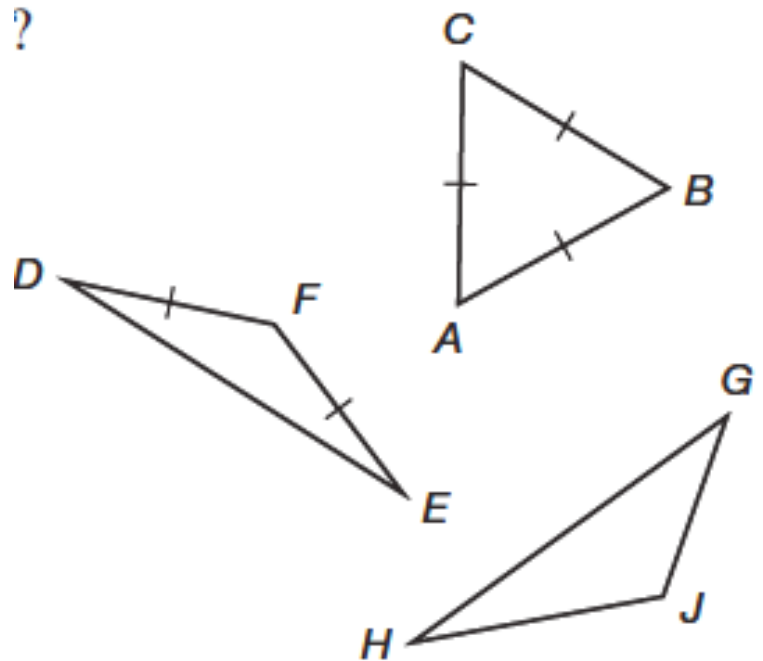


Example 2 Classifying Triangles by Sides

a. In the diagram, which triangle is scalene?

SOLUTION

$\triangle GHJ$ is scalene, because none of its sides are congruent.

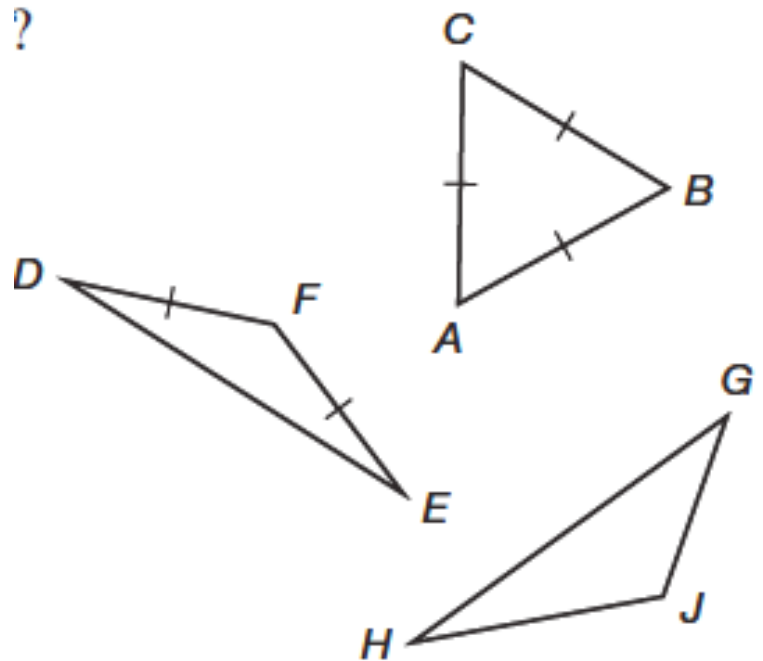


Example 2 Classifying Triangles by Sides

b. Which triangle is equilateral?

SOLUTION

$\triangle ABC$ is equilateral, because all three sides are congruent.



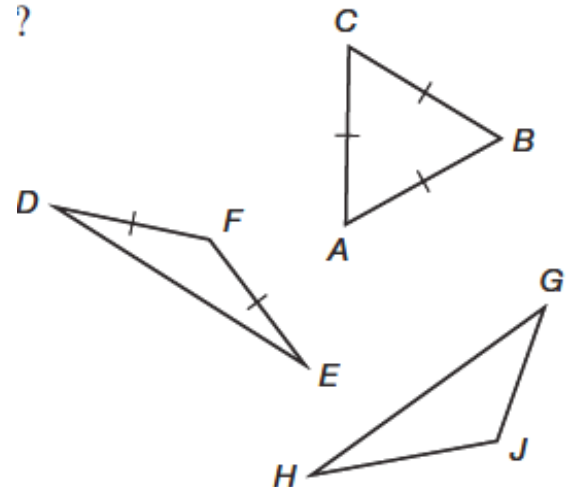
Example 2 Classifying Triangles by Sides

c. Are any of the triangles isosceles but not equilateral?

SOLUTION

Yes. $\triangle ABC$ and $\triangle DEF$ are both isosceles, because at least two sides are congruent.

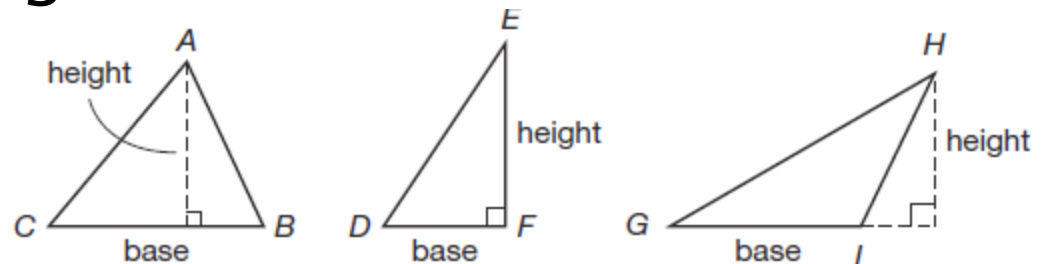
$\triangle DEF$ is not equilateral because its third side is not congruent to the other two. ?



Vertex of a triangle – One of the points where two sides of the triangle intersect.

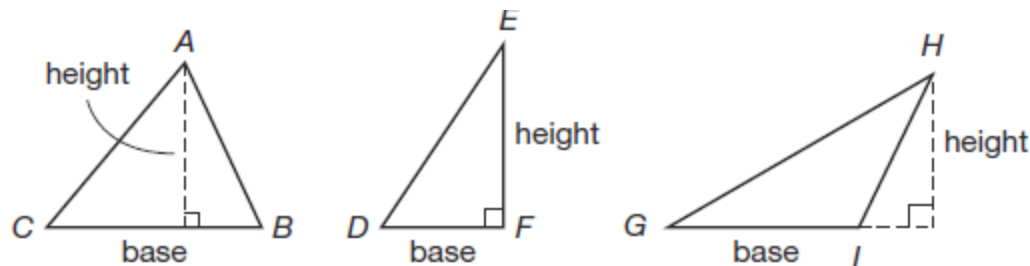
Base of a Triangle – Any one of the triangle's sides.

Height of a Triangle – The perpendicular segment from a vertex to the line containing the opposite side. The length of that segment is also called the height.



In $\triangle GHI$, the perpendicular segment from H does not intersect the base.

The base is extended so a perpendicular segment can be drawn to show the height. To find the area of a triangle, both the base and the height must be known.



Area of a Triangle – The area of a triangle is given by the formula below, where b is the length of the triangle's base and h is the height.

$$A = \frac{1}{2}bh$$

The diagram shows $\triangle ABC$ enclosed in rectangle $ABDE$. Notice that $\triangle AFC$ and $\triangle CEA$ have the same base and height, so areas A_1 and A_2 are equal. Similarly, $A_3 = A_4$. The area of rectangle $ABDE$ is $b \times h$. Therefore,

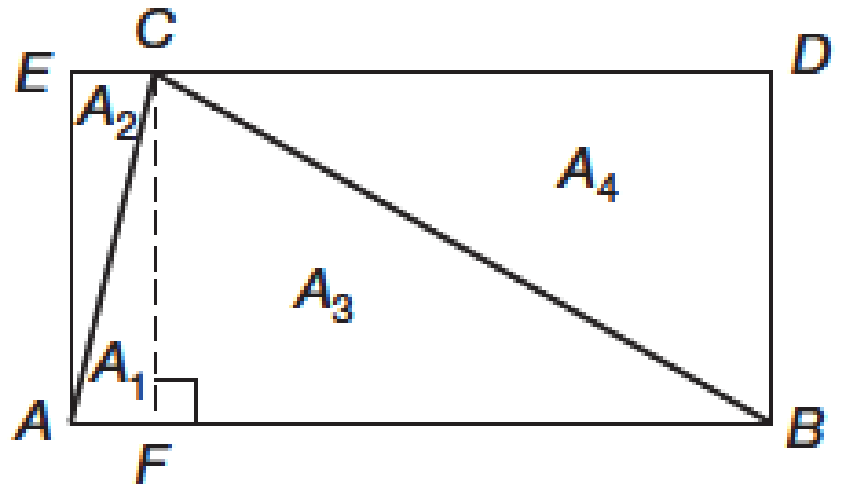
$$\text{Area of } ABCD = A_1 + A_2 + A_3 + A_4$$

$$bh = A_1 + A_1 + A_3 + A_3$$

$$bh = 2(A_1 + A_3)$$

$$\frac{1}{2}bh = A_1 + A_3$$

$$\frac{1}{2}bh = \text{Area of } \triangle ABC$$



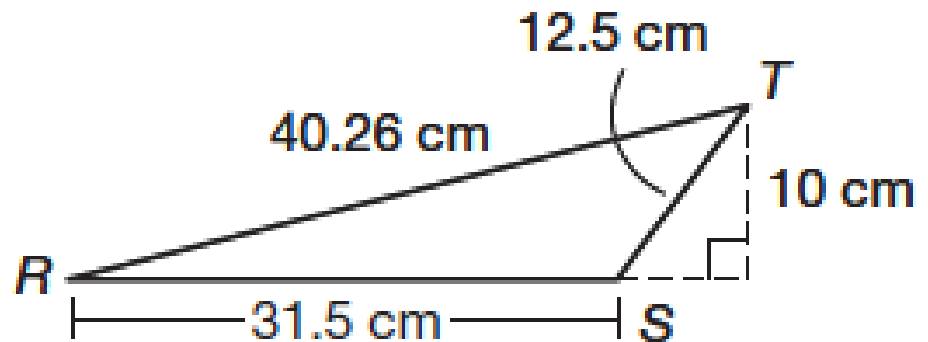
Example 3 Finding Perimeter and Area of a Triangle

a. Determine the perimeter of $\triangle RST$.

SOLUTION

$$\begin{aligned}P &= TR + RS + ST \\ &= 40.26 + 31.5 + 12.5 \\ &= 84.26\end{aligned}$$

The perimeter is 84.26 cm.



Example 3 Finding Perimeter and Area of a Triangle

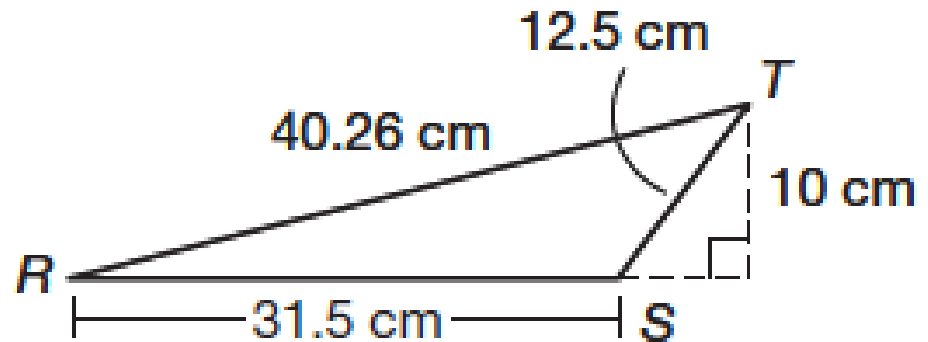
b. Determine the area of $\triangle RST$.

SOLUTION

$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2}(31.5)(10)$$

$$A = 157.5$$



The area is 157.5 square centimeters.

Example 4 Application: Farming

A triangular plot of land has a northwestern boundary measuring 64.6 yards, a southern boundary measuring 138.0 yards, and a northeastern boundary measuring 114.1 yards. The perpendicular distance from the southern boundary to the northern corner of the plot is 53.0 yards.

a. How much fencing is required to surround the plot?

SOLUTION The perimeter is

$$\begin{aligned} P &= 64.6 + 138.0 + 114.1 \\ &= 316.7 \end{aligned}$$

316.7 yards of fencing are required.

Example 4 Application: Farming

b. It takes 100 pounds of barley seed to seed 2400 square yards of land. How much seed is needed for the whole plot, to the nearest pound?

SOLUTION The area of the plot is

$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2}(138)(53)$$

$$A = 3657yd^2$$

100 pound of barley covers 2400 square yards

Use a proportion:

$$\frac{100}{2400} = \frac{x}{3657}$$

$$(3657)(100) = 2400x$$

$$365700 = 2400x$$

$$\frac{365700}{2400} = x$$

$$152.375 = x$$

To the nearest pound, 152 pounds of seed is needed for the whole plot.

You Try!!!!

e. A right isosceles triangle has legs measuring 13.2 centimeters and a hypotenuse measuring 18.7 centimeters. What is its perimeter?

45.1 cm

f. What is the area of the triangle in part e?

87.12cm^2

Assignment

Page 81

Lesson Practice (Ask Mr. Heintz)

Page 82

Practice 1–30 (Do the starred ones first)