5.5 and 5.6 Use Inequalities in Triangles

Mark the largest angle and largest side.

Mark the smallest angle and smallest side.
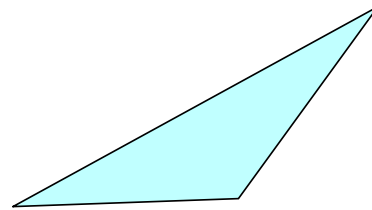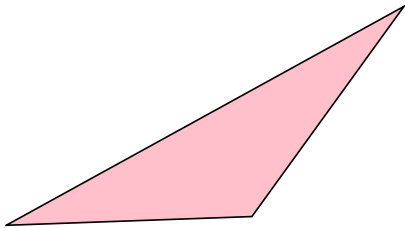
THEOREMS
For Your Notebook

THEOREM 5.10

If one side of a triangle is longer than another side, then the angle opposite the longer side is larger than the angle opposite the shorter side.

$AB > BC$, so $m\angle C > m\angle A$.

THEOREM 5.11

If one angle of a triangle is larger than another angle, then the side opposite the larger angle is longer than the side opposite the smaller angle.

$m\angle A > m\angle C$, so $BC > AB$.

Example 1:

STAGE PROP You are constructing a stage prop that shows a large triangular mountain. The bottom edge of the mountain is about 27 feet long, the left slope is about 24 feet long, and the right slope is about 20 feet long. You are told that one of the angles is about 46° and one is about 59°. What is the angle measure of the peak of the mountain?
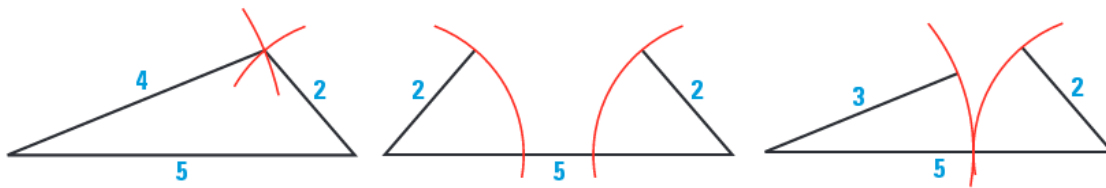
(A) 46°   (B) 59°   (C) 75°   (D) 85°

Example 2:

1. List the sides of $\triangle RST$ in order from shortest to long [121° label on S, 29° on R, 30° on T] $\succ T$
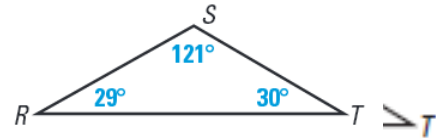
2. A stage prop is a right triangle with sides that are 6, 8 and 10 feet long and angles of 90°, about 37° and about 53°. Sketch and label a diagram with the shortest side on the bottom and the right angle at the left.

The Triangle Inequality **NOT** every group of three segments can be used to form a triangle.
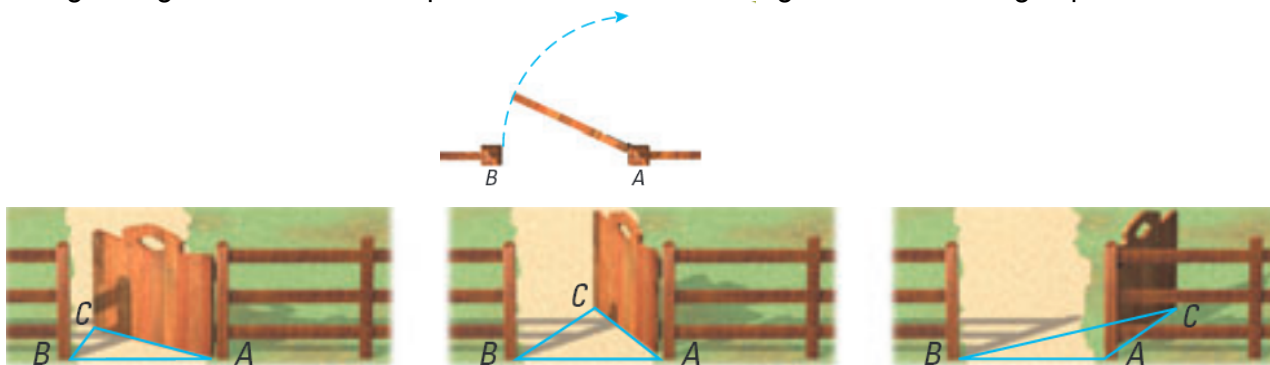**FOR EXAMPLE:**

THEOREM	*For Your Notebook*
THEOREM 5.12 Triangle Inequality Theorem	
The sum of the lengths of any two sides of a triangle is greater than the length of the third side.	
$AB + BC > AC$ $AC + BC > AB$ $AB + AC > BC$	

Example 3: **Find possible side lengths**

1. A triangle has one side of length 12 and another of length 8. Describe the possible lengths of the third side.

2. A triangle has one side of length 11 and another of length 15. Describe the possible lengths of the third side.

Imagine a gate between fence posts A and B that has hinges at A and swings open at B.

As the gate swings open, what happens to $\angle A$ and side $\overline{BC}$.

THEOREMS   *For Your Notebook*

THEOREM 5.13 Hinge Theorem

If two sides of one triangle are congruent to two sides of another triangle, and the included angle of the first is larger than the included angle of the second, then the third side of the first is longer than the third side of the second.

WX > ST

THEOREM 5.14 Converse of the Hinge Theorem

If two sides of one triangle are congruent to two sides of another triangle, and the third side of the first is longer than the third side of the second, then the included angle of the first is larger than the included angle of the second.

m∠C > m∠F

Example 4: **Use the Converse of the Hinge Theorem**

Given that $\overline{ST} \cong \overline{PR},$ how does $\angle PST$ compare to $\angle SPR$?

24 in.

23 in.