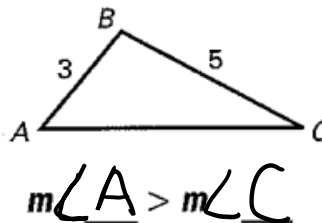


# 5.5

## Inequalities in One Triangle

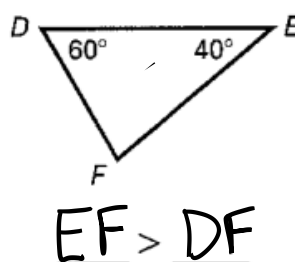
### THEOREM 5.10

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



### THEOREM 5.11

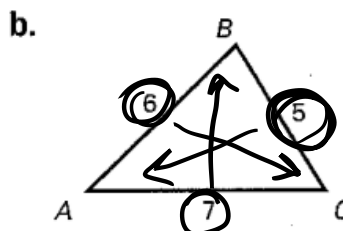
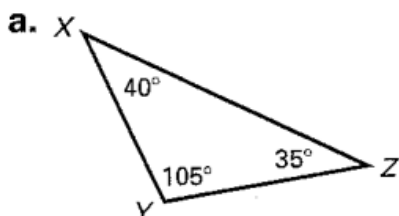
If one angle of a triangle is larger than another angle, then the side opposite the larger angle is longer than the side opposite the smaller angle.



### Example 1

### Writing Measurements in Order from Least to Greatest

Write the measures of the triangles in order from least to greatest.



### Solution

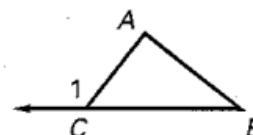
a.  $m\angle Z < m\angle X < m\angle Y$   
 $XY < YZ < XZ$

b.  $BC < AB < AC$   
 $m\angle A < m\angle C < m\angle B$

### THEOREM 5.12: EXTERIOR ANGLE INEQUALITY

The measure of an exterior angle of a triangle is greater than the measure of either of the two nonadjacent interior angles.

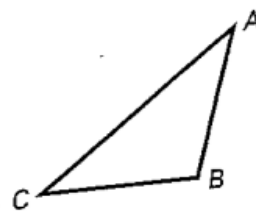
$m\angle 1 > m\angle A$  and  $m\angle 1 > m\angle B$



**THEOREM 5.13: TRIANGLE INEQUALITY**

The sum of the lengths of any two sides of a triangle is greater than the length of the third side.

$$\begin{aligned} AB + BC &> AC \\ AC + AB &> BC \\ BC + AC &> AB \end{aligned}$$

**Example 3****Finding Possible Side Lengths**

A triangle has one side of 12 inches and another side of 20 inches. Describe the possible lengths of the third side.

**Solution**

Let  $x$  represent the length of the third side. Using the Triangle Inequality, you can write and solve inequalities.

$$\begin{aligned} x + 12 &> 20 \\ x &> 8 \end{aligned}$$

$$\begin{aligned} 12 + 20 &> x \\ 32 &> x \end{aligned}$$

**Answer** The length of the third side must be greater than 8 inches and less than 32 inches.

✓ **Checkpoint** Decide if it is possible to construct a triangle having the given side lengths. If it is not possible, explain.

3. 13 mm, 25 mm, 14 mm

$$\begin{aligned} 13 + 14 &= 27 \\ 27 &> 25 \\ \text{yes} \end{aligned}$$

4. 9 in., 17 in., 8 in.

$$\begin{aligned} 9 + 8 &= 17 \\ 17 &= 17 \\ \text{no} \end{aligned}$$

5. A triangle has one side of 8 millimeters and another side of 11 millimeters. Describe the possible lengths of the third side.

$$\begin{aligned} x + 8 &> 11 \\ x &> 3 \text{ mm} \\ 11 + 8 &> x \\ 19 &> x \\ 3 < x &< 19 \text{ mm} \end{aligned}$$

