**Activity 3.2.3 Sides and Angles** **in a Triangle**

Study the two proofs and answer all questions in **bold.**



I. Prove the **Angle Opposite Longer Side Theorem:** If two sides of a triangle are not equal, the angle opposite the longer side is greater than the angle opposite the shorter side.

Given: ∆*ABC* with *AC* > *AB*.

Prove: m $∠$*ABC* > m $∠$ *BCA*

*Step 1.*  Construct a circle with center *A* passing through point *B*. Let *D* be the point where the circle intersects side *AC*.

**How can we be sure that point *D* lies between points *A* and *C*?**



*Step 2*. Join points *B* and *D*.

*Step 3.* In ∆*BDC* exterior angle *ADB* is greater than interior angle *BCA.*



 **What theorem are we using here?**

*Step 4.* *AB* = *AD*

**Why?**

Therefore m $∠$*ADB* $=$ $ $m $∠$ *ABD*

**What theorem are we using here?**



 *Step 5.* m $∠$ *ABC* > m $∠$ *ABD*.

**Explain.**



*Step 6.* Putting it all together we have
m $∠$ *ABC* > m $∠$ *ABD* = m $∠$ *ADB* > m $∠$ *BCA*

**So that leads to what conclusion?**

2. Prove the **Side Opposite Greater Angle Theorem:** If two angles of a triangle are not equal, the side opposite the larger angle is longer than the side opposite the smaller angle.



Given: ∆*ABC* with m $∠$*ABC* > m $∠$ *BCA*

Prove: *AC* > *AB*.

*Step 1*. Suppose *AC* = *AB.*

**Then what could you conclude about m** $∠$***ABC* and m** $∠$***BCA?***

**What theorem would lead to this conclusion?**

**Why is this impossible?**

*Step 2.* Suppose *AC* < *AB.*

**Then what could you conclude about m** $∠$***ABC* and m** $∠$***BCA?***

**What theorem would lead to this conclusion?**

**Why is this impossible?**

Step 3. **If we know that *AC* cannot be equal to *AB* and that *AC* cannot be less than *AB*, what alternative is left?**

**Explain.**