## Math 1312 Section 5.3 Proving Triangles Similar

### **Postulate:**

If three angles of one triangle are congruent to the three angles of a second triangle, then the triangles are similar (**AAA**).

The following corollaries of AAA Postulate are can be applied to help determine if two given triangles are similar:

## **Corollary 1 (AA):**

If two angles of one triangle are congruent to two angles of another triangle, then the triangles are similar.

### Example 1:

Given:  $\angle A \cong \angle P$ ,  $\angle C \cong \angle R$ 



Conclusion:

### Corollary 2 (SSS):

If each side of one triangle and the corresponding side of another triangle are proportional, then the triangles are similar.



Given:  $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR}$ 

Conclusion:





# Corollary 3 (SAS):

If the measures of two sides of one triangle are proportional to the corresponding sides of another triangle AND the included angles are congruent, then the triangles are similar.

## Example 3:



## Example 4:

In the figure below,  $AB \parallel DE$ , DA = 2, CA = 8, and CE = 3. Find CB.



# Example 5:

In the figure below,  $\overline{FG} \cong \overline{EG}$ , BE = 15, CF = 20, AE = 9, DF = 12. Determine which triangles in the figure are similar.



# Example 6:

Determine whether each pair of triangles is similar. If so, write a mathematical sentence and give a reason that justifies your decision.





**CSSTP:** Corresponding sides of similar triangles are proportional.

**CASTC:** Corresponding angles of similar triangles are congruent.

### **Theorem:**

The lengths of the corresponding altitudes of similar triangles have the same ratio as the lengths of any pair of corresponding sides.

#### **Rules:**

- 1. If two triangles are similar, then the **perimeters are proportional** to the measures of corresponding sides.
- 2. If two triangles are similar, then the measures of the corresponding **altitudes** (form 90°) **are proportional** to the measures of the corresponding sides.
- 3. If two triangles are similar, then the measures of the **corresponding angle bisectors** of the triangles **are proportional** to the measures of the corresponding sides.
- 4. If two triangles are similar, then the measures of the corresponding **medians are proportional** to the measures of the corresponding sides.

## Example 7:

 $\Delta ABD \sim \Delta ADC$ . If AD = 16, AC = 32, and DC = 23 find the perimeter of  $\Delta ABD$ .



#### Example 8:

 $\Delta$ PQR ~  $\Delta$ TUV. IF QO is an altitude of  $\Delta$ PQR, and US is an altitude of  $\Delta$ TUV, then complete the following:



#### Lemma:

If a line segment divides two sides of a triangle proportionally, then the line segment is parallel to the third side of the triangle.

## **Converse:**

If we are given  $\triangle ABC$  and  $\triangle DEC$ , where  $DE \parallel AB$ .

Because DE || AB, we can conclude that  $\angle 1 \cong \angle 3$  and  $\angle 2 \cong \angle 4$  (corresponding angles are congruent).

This makes  $\triangle ABC \sim \triangle DEC$  by the AA similarity property.

