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SIMILARITY

SIMILARITY (definition): Two objects are *similar* if they have the same shape, but they do not have to have the same size. The objects must be proportional: one object can be scaled (enlarged or reduced), possibly with additional translation, rotation, and reflection, to be the exactly the same as the other object. This means that either object can be rescaled and repositioned (and possibly reflected), so as to coincide precisely with the other object.

Properties of Similar Figures

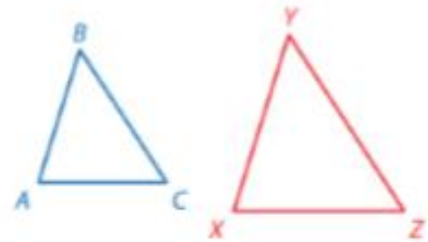
Corresponding angles of similar figures are congruent.

Corresponding sides of similar figures are proportional.

If $\triangle ABC \sim \triangle XYZ$, then

$\angle A \cong \angle X \quad \angle B \cong \angle Y \quad \angle C \cong \angle Z$

$\frac{AB}{XY} = \frac{BC}{YZ} = \frac{AC}{XZ}$



SIMILARITY STATEMENT: When two objects are similar, we can write a similarity statement. In the above example, the similarity statement is:

$$\Delta\, ABC \sim \Delta\, XYZ.$$

The order of the *vertices* (*angles represented by letters*) in the similarity statement is very important. The statement $\Delta\, ABC \sim \Delta\, XYZ$ indicates that:

$\angle A$ corresponds to $\angle X$,
$\angle B$ corresponds to $\angle Y$,
$\angle C$ corresponds to $\angle Z$.

The reason the order is so important is that with any set of similar objects, the corresponding angles are congruent, meaning they have the exact same measure. In the above example:

$$\angle A \cong \angle X \qquad \angle B \cong \angle Y \qquad \angle C \cong \angle Z$$

The order of the vertices also indicate with sides are proportional, meaning they have the exact same ratio. We normally put the smaller length over the larger length when determining proportionality. In the above example:

$$\frac{AB}{XY} \cong \frac{BC}{YZ} \cong \frac{AC}{XZ}$$

Only if the vertices are congruent and the sides are proportional, are the objects similar. If one is not congruent or proportional, the objects are not similar.

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TRIANGLE SIMILARITY

SIMILARITY POSTULATES: There are three postulates we can use to prove that two *triangles* are similar.

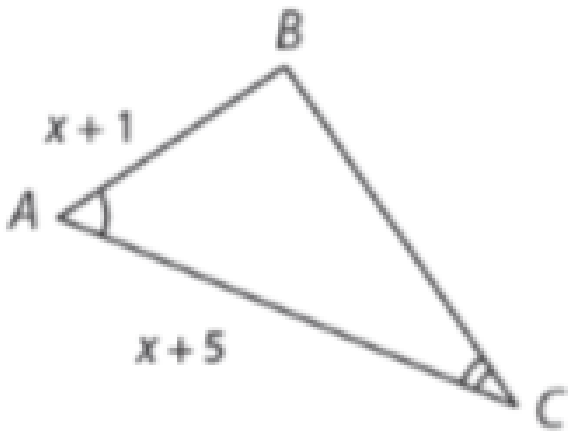
1. ANGLE-ANGLE (**AA**): If two angles of one triangle are congruent to two angles of another triangle, then the two triangles are similar.

2. SIDE-SIDE-SIDE (**SSS**): If all three sides of one triangle are proportional to the corresponding sides of another triangle, then the triangles are similar.

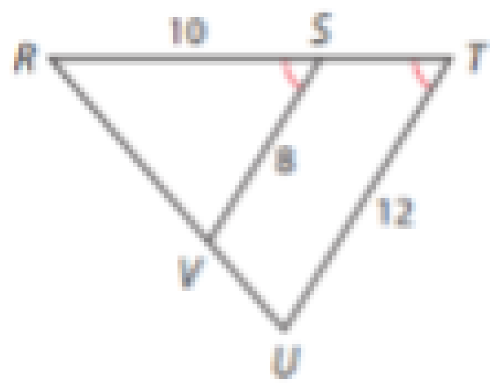
3. SIDE-ANGLE-SIDE (**SAS**): If two sides of one triangle are proportional to the corresponding sides of another triangle ***and*** the included angles are congruent, the triangles are similar.

PRACTICE

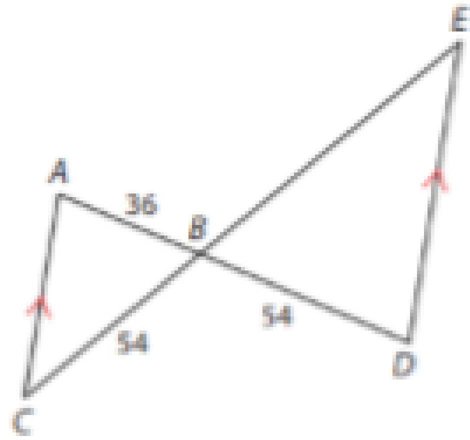
1. Given: $\Delta\, ABC \sim \Delta\, HGJ$. Find *x*.



2. Given: $\Delta\, RSV \sim \Delta\, RTU$. Find RT.



3. Given: $\Delta ABC \sim \Delta DBE$. Find BE.

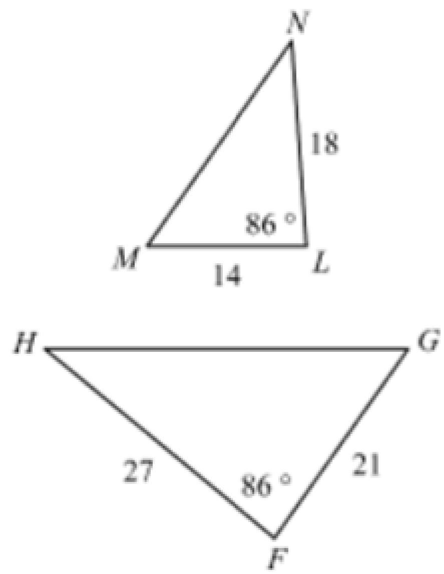


In the following questions:
1) State if the triangle are similar;
2) If they are similar, by what similarity theorem can it be proven (AA, SSS, SAS);
3) If they are similar, finish the similarity statement.

4. Are the triangles similar?

If yes, by what theorem?

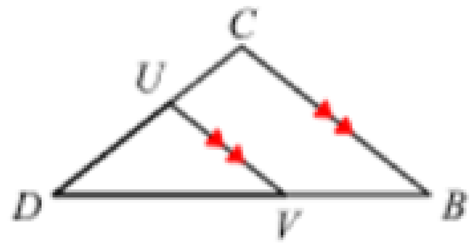
If yes: $\Delta FGH \sim$ ___________



5. Are the triangles similar?

   If yes, by what theorem?

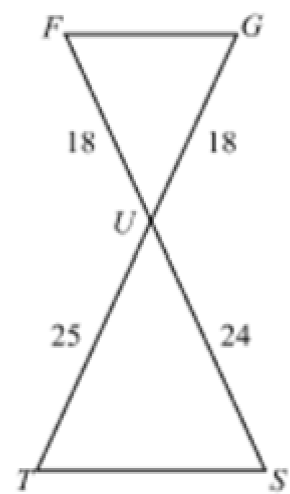
   If yes: $\Delta\, DCB \sim$ __________



6. Are the triangles similar?

   If yes, by what theorem?

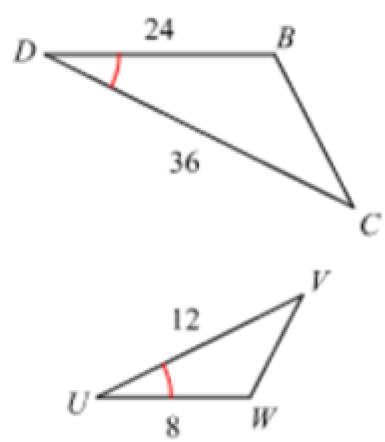
   If yes: $\Delta\, UTS \sim$ __________



7. Are the triangles similar?

   If yes, by what theorem?

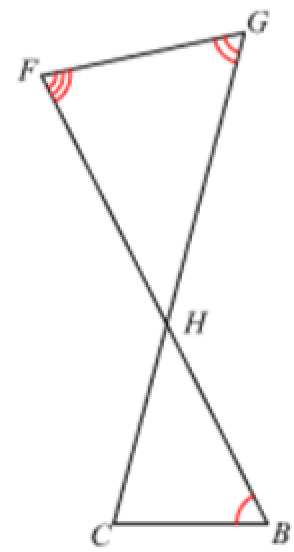
   If yes: $\Delta\, DCB \sim$ __________



8. Are the triangles similar?

   If yes, by what theorem?

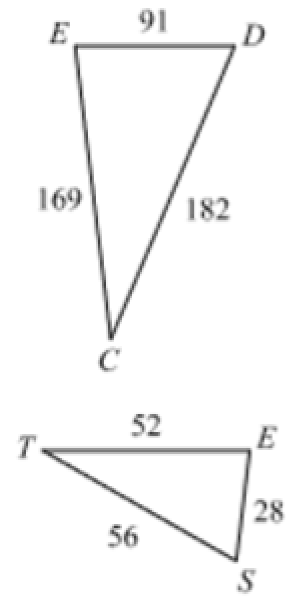
   If yes: $\Delta\ HGF \sim$ __________



9. Are the triangles similar?

   If yes, by what theorem?

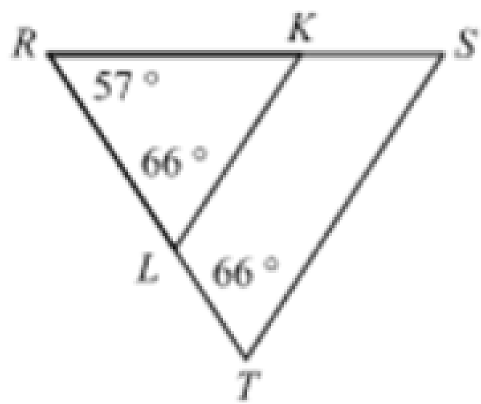
   If yes: $\Delta\ EDC \sim$ __________



10. Are the triangles similar?

   If yes, by what theorem?

   If yes: $\Delta\ RST \sim$ __________



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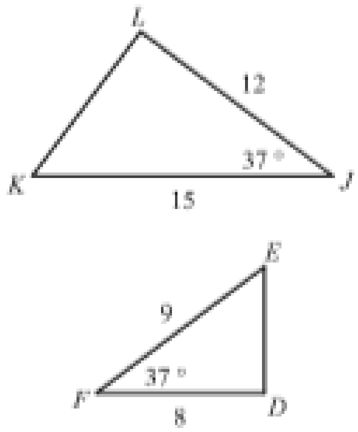
State if the triangles in each pair are similar. If so, state how you know they are similar and complete the similarity statement.

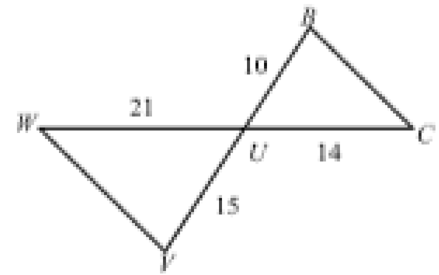
1)



$\Delta JKL \sim$ ______

A) similar; AA similarity; ΔDEF
B) not similar
C) similar; SSS similarity; ΔEDF
D) similar; SAS similarity; ΔEDF

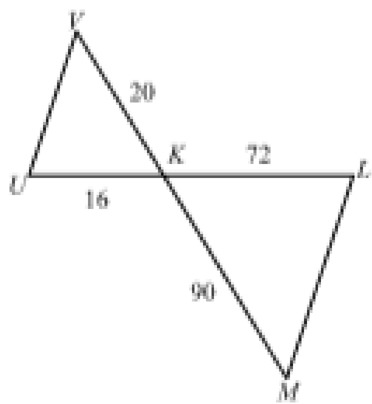
2)



$\Delta UVW \sim$ ______

A) similar; SSS similarity; ΔUBC
B) not similar
C) similar; SSS similarity; ΔBUC
D) similar; SAS similarity; ΔUBC

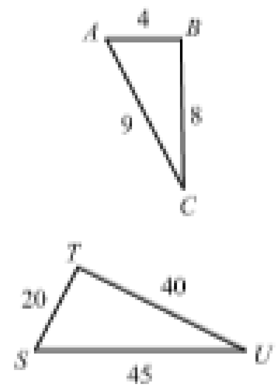
3)



$\Delta KLM \sim$ ______

A) not similar
B) similar; SAS similarity; ΔKUV
C) similar; SAS similarity; ΔUVK
D) similar; AA similarity; ΔKVU

4)



$\Delta STU \sim$ ______

A) similar; SSS similarity; ΔABC
B) similar; AA similarity; ΔACB
C) similar; AA similarity; ΔABC
D) not similar

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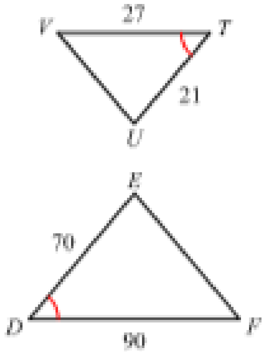
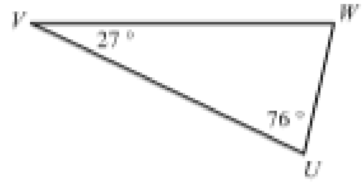
7)



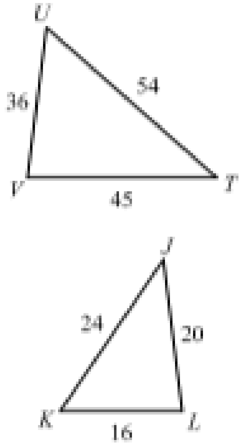
$\Delta DEF \sim$ ______

8)



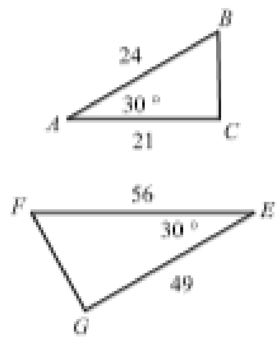
$\Delta UVW \sim$ ______

9)



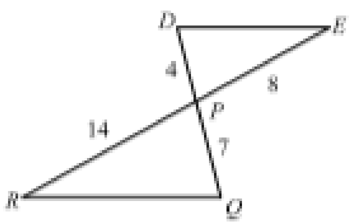
$\Delta VUT \sim$ ______

10)



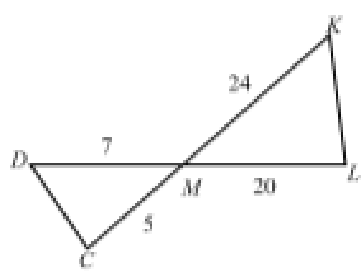
$\Delta EFG \sim$ ______

11)



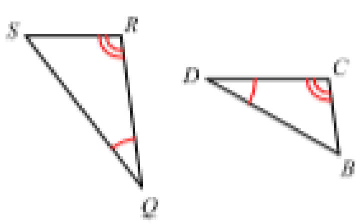
$\Delta PQR \sim$ ______

12)



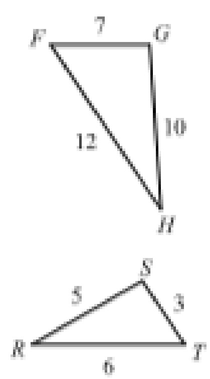
$\Delta MLK \sim$ ______

13)



$\Delta QRS \sim$ ______

14)



$\Delta HGF \sim$ ______

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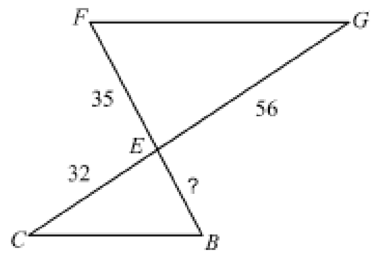
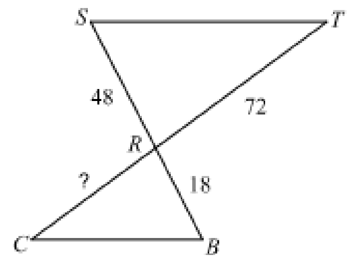
Find the missing length. The triangles in each pair are similar.

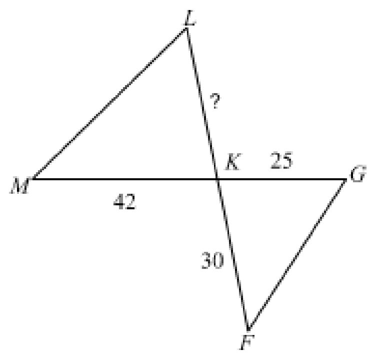
1) $\triangle EFG \sim \triangle EBC$



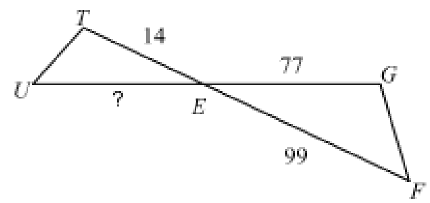
2) $\triangle RST \sim \triangle RBC$



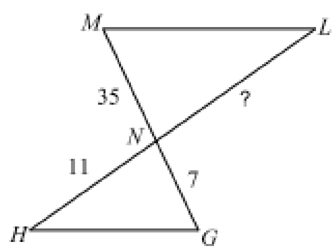
3) $\triangle KLM \sim \triangle KGF$



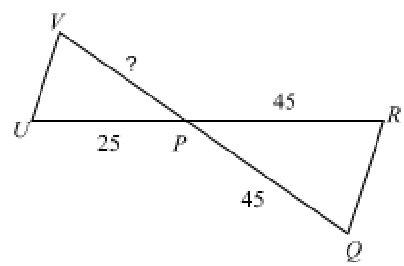
4) $\triangle EFG \sim \triangle EUT$



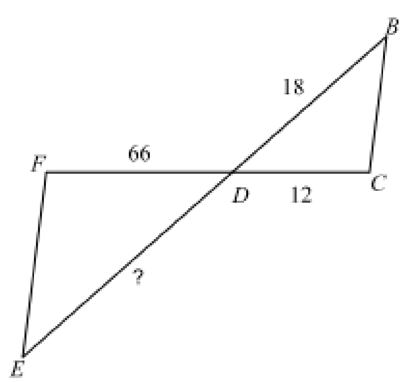
5) $\triangle NML \sim \triangle NGH$



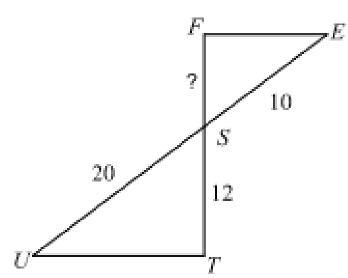
6) $\triangle PQR \sim \triangle PUV$



7) $\triangle DEF \sim \triangle DBC$



8) $\triangle STU \sim \triangle SFE$



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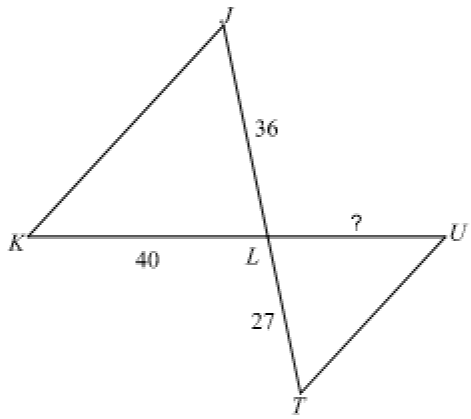
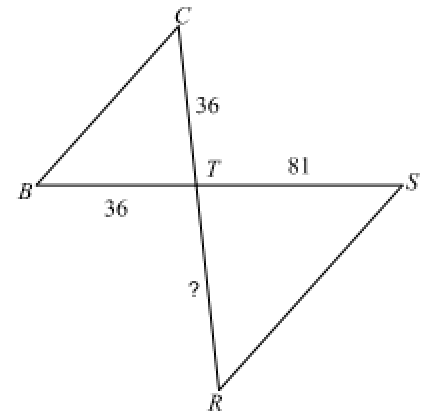
9) $\Delta LKJ \sim \Delta LUT$

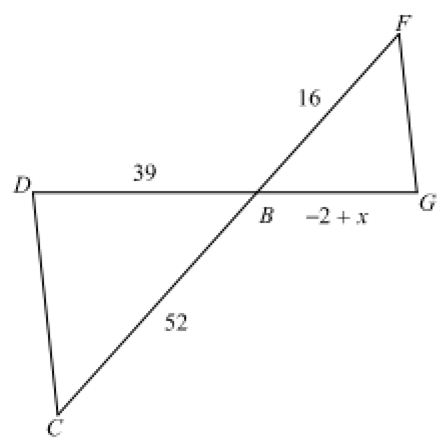


10) $\Delta TSR \sim \Delta TBC$

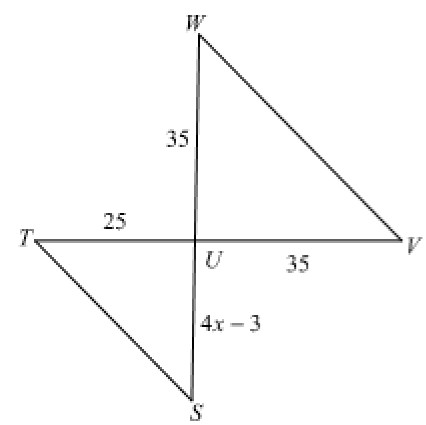


Solve for x. The triangles in each pair are similar.

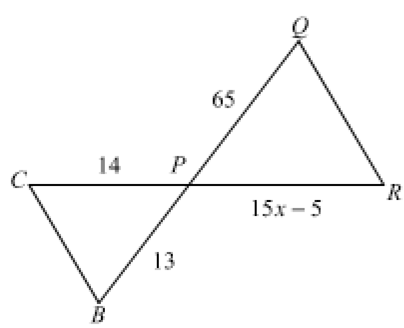
11) $\Delta BCD \sim \Delta BFG$



12) $\Delta UVW \sim \Delta UST$



13) $\Delta PQR \sim \Delta PBC$



14) $\Delta TUV \sim \Delta TRQ$