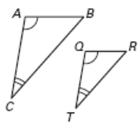
§7.3 Identifying Similar Triangles

- The triangles shown are similar. List all pairs of congruent angles and write the statement of proportionality.



Angles

$\angle A \cong \angle Q$

$\angle C \cong \angle T$

$\angle B \cong \angle R$

Statement of Proportionality

$$\frac{AB}{QR} = \frac{AC}{QT} = \frac{BC}{RT}$$

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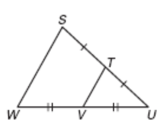

Angles

$\angle U \cong \angle U$

$\angle UTV \cong \angle USW$

$\angle UVT \cong \angle UWS$

Statement of Proportionality

$$\frac{UT}{US} = \frac{UV}{UW} = \frac{TV}{SW}$$

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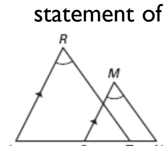


Angles

$\angle R \cong \angle M$

$\angle L \cong \angle MOT$

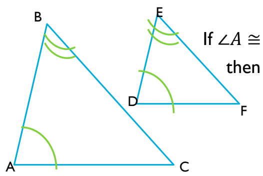
$\angle RTL \cong \angle N$

Statement of Proportionality

$$\frac{RT}{MN} = \frac{RL}{MO} = \frac{LT}{ON}$$

Postulate:
Angle-Angle (AA) Similarity Postulate

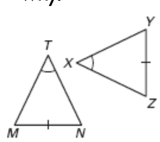
- If two angles of one triangle are congruent to two angles of another triangle, then the two triangles are similar.



If $\angle A \cong \angle D$ and $\angle B \cong \angle E$
then $\Delta ABC \sim \Delta DEF$

Example.

- Decide whether the triangles can be proved similar. If they are similar, write a similarity statement. If they are not similar, explain why.

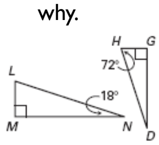


Not similar.

We are only given an angle (A) and a side of congruence. This is not enough to determine if the triangles are similar.

Example.

- Decide whether the triangles can be proved similar. If they are similar, write a similarity statement. If they are not similar, explain why.

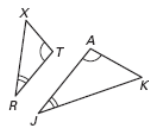


Yes, similar

$\Delta LMN \sim \Delta HGD$

Example.

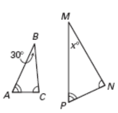
- Decide whether the triangles can be proved similar. If they are similar, write a similarity statement. If they are not similar, explain why.



Yes, similar

$\Delta TRX \sim \Delta AJK$

Example. The triangles are similar. Find the value of the variable.

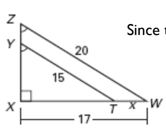


Since they're similar, they have congruent angles.

If we first write a similarity statement, we see $\Delta ABC \sim \Delta PMN$

Therefore, $\angle M \cong \angle B$ and so

$$x = m\angle M = m\angle B = 30°$$



Since they're similar, they have proportional sides.

If we first write a similarity statement, we see $\Delta YXT \sim \Delta ZXW$

Therefore, $\frac{XT}{XW} = \frac{YT}{ZW}$ and so $\frac{17-x}{17} = \frac{15}{20}$

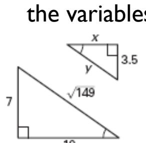
$$\frac{17-x}{17} = \frac{3}{4}$$

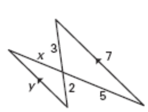
$$68 - 4x = 51$$
$$4x = 17$$

$$x = 4\frac{1}{4}$$

You Try It.

- The triangles are similar. Find the value of the variables.

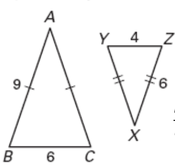




Similarity Theorems

- SSS Similarity Theorem
  - If the lengths of the corresponding sides of two triangles are proportional, then the triangles are similar.
- SAS Similarity Theorem
  - If an angle of one triangle is congruent to an angle of a second triangle and the lengths of the sides including these angles are proportional, then the triangles are similar.

Example. Are the triangles similar? If so, state the similarity and the postulate or theorem that justifies your answer.



No angles are marked as being congruent, so that leaves us with only the SSS theorem to check.

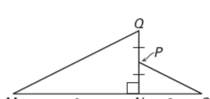
$$\frac{long\ side\ of\ \Delta ABC}{long\ side\ of\ \Delta XYZ} \overset{?}{=} \frac{short\ side\ of\ \Delta ABC}{short\ side\ of\ \Delta XYZ}$$

$$\frac{AC}{XZ} \overset{?}{=} \frac{BC}{YZ} \qquad \frac{9}{6} \overset{?}{=} \frac{6}{4} \qquad \frac{3}{2} \overset{?}{=} \frac{3}{2}$$

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

Yes, $\Delta ABC \sim \Delta XYZ$ by SSS Similarity Theorem

Example. Are the triangles similar? If so, state the similarity and the postulate or theorem that justifies your answer.



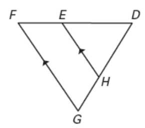
We have two right angles formed by the perpendiculars, so we have 1 pair of congruent angles ($\angle QNM \cong \angle PNO$) by the Right Angles Theorem.
We also have that $QP = PN$ so that means $QN : PN$ is 2:1. That means we should check to see if SAS Similarity works.

$$\frac{QN}{PN} \overset{?}{=} \frac{MN}{ON}$$

$$\frac{2}{1} \overset{?}{=} \frac{6}{3} \qquad \frac{2}{1} \overset{?}{=} \frac{2}{1}$$

Yes, $\Delta QNM \sim \Delta PNO$ by SAS Similarity Theorem

Example. Are the triangles similar? If so, state the similarity and the postulate or theorem that justifies your answer.

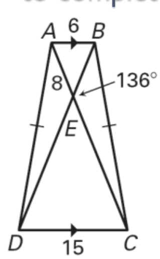


Given those parallel lines, we can prove that $\angle DHE \cong \angle DGF$ since they are corresponding angles on parallel lines cut by a transversal.

Then, use the fact that $\angle D \cong \angle D$ by the reflexive property of angle congruence, and you can see that you have 2 pairs of congruent angles in the two triangles.

Yes, $\Delta DHE \sim \Delta DGF$ by AA Similarity Postulate

Example. Use the diagram shown to complete the statements.



$\triangle AEB \sim \underline{\Delta CED}$

$m\angle DEC = \underline{m\angle BEA} = 44°$

$m\angle EBA = \underline{m\angle EDC} = 68°$

$EC = \underline{\frac{15}{6} EA} = \frac{5}{2} EA$

$= \frac{5}{2} \cdot 8 = 20$

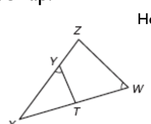
perimeter $\triangle DEC$: perimeter $\triangle BEA = \underline{15:6}$

$= 5:2$

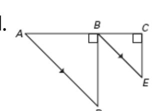
Yes, there are 2 proofs on your homework.

- Remember a few things…
  - There are often shared pieces when triangles overlap.

Here, $\angle X$ is in both ΔXYT and ΔXZW



  - Take nothing for granted.



State that you have right angles.
State that they are then congruent.
That's TWO STATEMENTS.