Name:____________________ Date:_______________

Similarity: Triangle Theorems

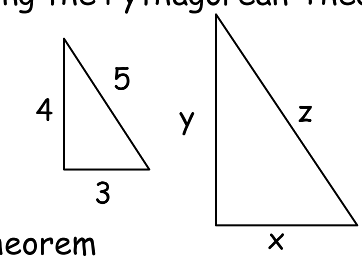
Similarity is when two objects are the same shape, but not necessarily the same size. We can use similarity to solve for right triangles. It has three properties that we will deal with.

Reflexive Property of Similarity: ΔXYZ ~ ΔXYZ

Symmetric Property of Similarity: If ΔXYZ ~ ΔTUV, then ΔTUV ~ ΔXYZ

Transitive Property of Similarity: If ΔXYZ ~ ΔTUV and ΔTUV ~ ΔLMN, then ΔXYZ ~ ΔLMN

Example 1: Two similar right triangles are given. Apply a scale factor of 2 to determine the side lengths of the second triangle. Check your answer using the Pythagorean Theorem.



Step 1: Multiply the known values by the SF.

$X = 3 \cdot 2 = 6$

$Y = 4 \cdot 2 = 8$

$Z = 5 \cdot 2 = 10$

Step 2: Check your answer using Pythagorean Theorem

$a^2 + b^2 = c^2$

$(6)^2 + (8)^2 = (10)^2$

$36 + 64 = 100$

The Side-Side-Side (SSS) Similarity Theorem states that if the three sides of one triangle are proportional to the three corresponding sides of another triangle, then the triangles are similar.

Example 2: Line segment AB is drawn parallel to one side of ΔYXZ, bisecting XZ. Determine the measurements of ΔABZ using the SSS similarity theorem.

Step 1: Use Pythagorean Theorem to determine the length of XZ.

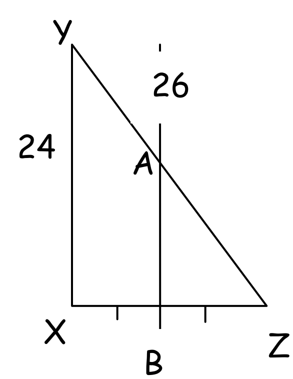
$(26)^2 = (24)^2 + (XZ)^2$

$(26)^2 - (24)^2 = (XZ)^2$

$676 - 576 = (XZ)^2$

$(XZ)^2 = 100$

$XZ = 10$



Step 2: Determine the length of BZ

Bisect means to cut in half.

$BZ = \frac{1}{2} XZ = \frac{1}{2} (10) = 5$

$BZ = 5$

Step 3: Determine the scale factor of ΔYXZ: ΔABZ

If BZ is $\frac{1}{2}$ XZ, then our scale factor is $\frac{1}{2}$.

Step 4: Use SSS similarity theorem to apply scale factor and find the unknown measures: AB = 12; AZ = 13; BZ = 5

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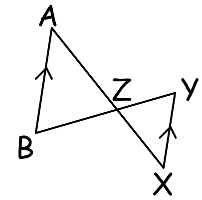
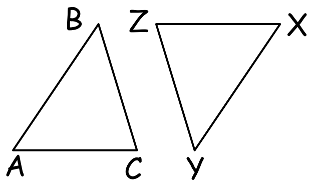
The Angle-Angle Similarity Postulate states that if two angles of one triangle are congruent to two angles of another triangle, then the triangles are similar.

1. Explain why ΔABZ and ΔXYZ are similar and write a similarity statement.





2. Use the SSS Similarity theorem to choose the correct statement if $\Delta ABC \sim \Delta XYZ$

A. $\angle XZY \sim \angle CAB$ B. $BC \sim ZX$ C. $AC \sim XZ$ D. $BC \sim ZY$

3-10. Complete the proof using similar triangles.

Given: A is the midpoint of XY.

B is the midpoint of YZ.

Prove: $\Delta AYB \sim \Delta XYZ$

1. A is the midpoint of XY
B is the midpoint of YZ — 1. Given

2. $XA \cong AY$, $YB \cong BZ$ — 2. ______________________(3)

3. ______________________(4) — 3. Def of $\cong$ segments

4. ______________________(5) — 4. Segment Addition postulate

5. $XY = XA + XA$, $YZ = YB + YB$ — 5. ______________________(6)

6. ______________________(7) — 6. Simplify

7. $^{XY}/_{XA} = 2$, $^{YZ}/_{YB} = 2$ — 7. ______________________(8)

8. $^{XY}/_{XA} = {}^{YZ}/_{YB}$ — 8. Transitive Property of Equality

9. ______________________(9) — 9. Reflexive Property of $\cong$

10. $\Delta AYB \sim \Delta XYZ$ — 10. ______________________(10)

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Answer Key

Similarity: Triangle Theorems

1. Since AB and YZ are parallel, $\angle B \cong \angle Y$ and $\angle A \cong \angle X$ (alternate interior angles theorem). Therefore, $\Delta ABZ \sim \Delta XYZ$.
2. C
3. Def of midpoint
4. XA = AY; YB = BZ
5. XY = XA + AY; YZ = YB + BZ
6. Substitution Property
7. XY = 2AY; YZ = 2YB
8. Division Property of Equality
9. $\angle Y \cong \angle Y$
10. SAS ~