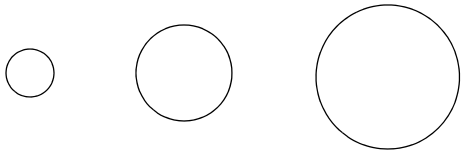
Section 12.2
Similarity

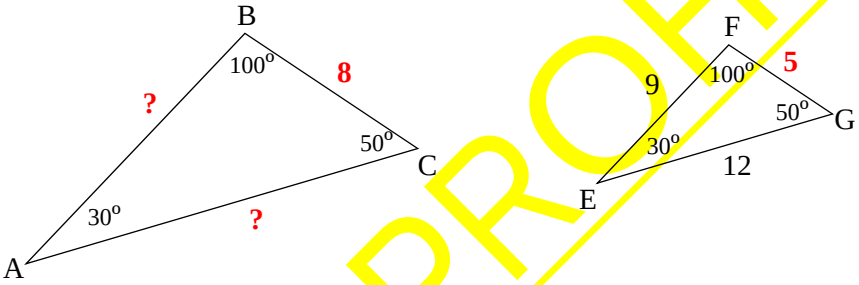
In geometry, similarity is a visual thing. Figures are similar if they are the same shape and have different measurement. In other words, they are either a smaller version or a larger version of the original. For example, by this definition, all three circles below are similar, but the measures of each one of them are different.

Examples:



Because sizes of similar shapes are proportional, *ratios* are used to solve similarity problems.

Example: In the two similar triangles shown below, find the two missing sides.



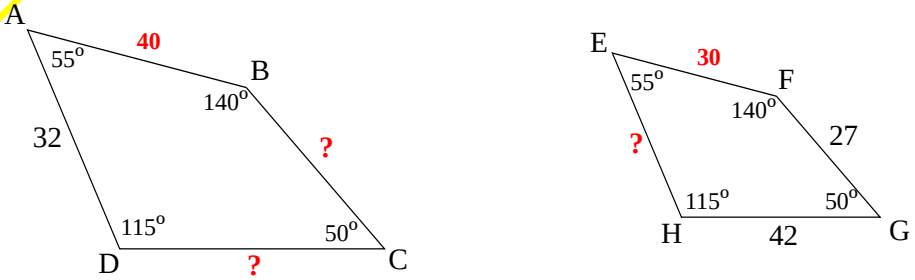
The corresponding, known sides are 8 and 5 (red bold), and two missing sides are $\overline{AB}$ and $\overline{AC}$. To find missing sides set up proportions using the corresponding sides of each triangle, then multiply numbers across and divide by the third number:

$$\frac{AB}{EF} = \frac{BC}{FG} \quad \text{and} \quad \frac{AC}{EG} = \frac{BC}{FG}$$

$$\frac{AB}{9} = \frac{8}{5} \quad \text{and} \quad \frac{AC}{12} = \frac{8}{5}$$

$$AB = \frac{9 \times 8}{5} = 14.4 \quad \text{and} \quad AC = \frac{12 \times 8}{5} = 19.2$$

Example: The two quadrilaterals shown below are similar. Find the missing sides.



Because the two quadrilaterals are similar, their corresponding sides are proportional.

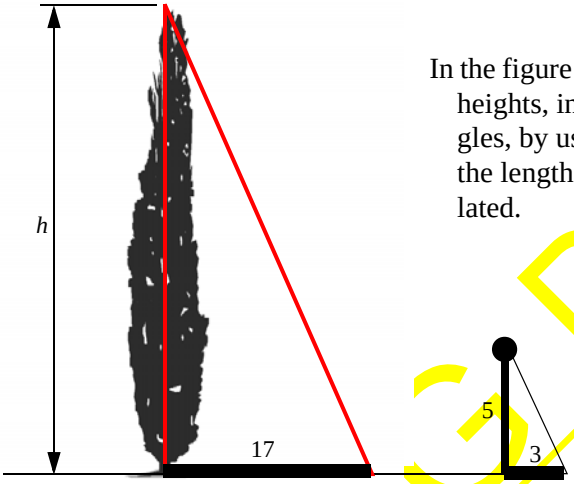
The corresponding known sides are 40 and 30 (in red), and the three missing sides are $\overline{BC}$ and $\overline{CD}$ and $\overline{EH}$. To find them set up the proportions:

$$\frac{40}{30} = \frac{BC}{27} \rightarrow BC = \frac{40 \times 27}{30} = 36$$

$$\frac{40}{30} = \frac{DC}{42} \rightarrow CD = \frac{40 \times 42}{30} = 56$$

$$\frac{40}{30} = \frac{32}{EH} \rightarrow EH = \frac{30 \times 32}{40} = 24$$

Example: Anybody can find the height of a tall tree without climbing to the top.



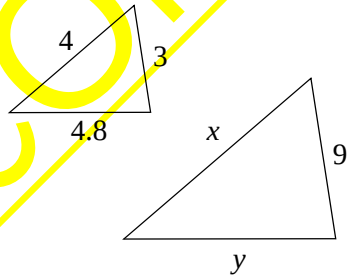
In the figure shown, the tree and the pole in the ground have different heights, in feet. Because their shadows make similar right triangles, by using the height and length of the shadow of the pole and the length of the shadow of the tree, the height of the tree is calculated.

$$\frac{height}{shadow} \quad \begin{matrix}\text{tree} \\ = \\ \frac{h}{17}\end{matrix} \quad \begin{matrix}\text{pole} \\ = \\ \frac{5}{3}\end{matrix}$$

$$h = \frac{5 \times 17}{3} = 28.\overline{3} \text{ feet}$$

Practice:
Find missing side ***w***, ***x***, ***y*** or ***z***. Each pair of figures are similar.

1.



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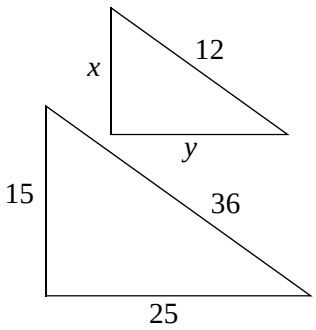

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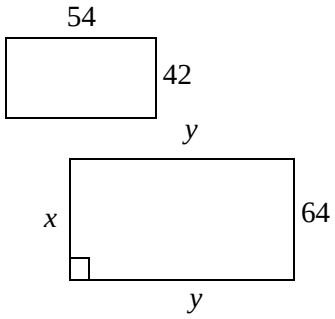

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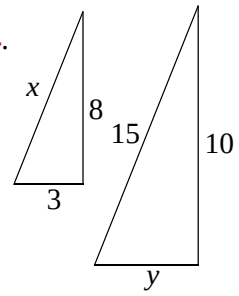

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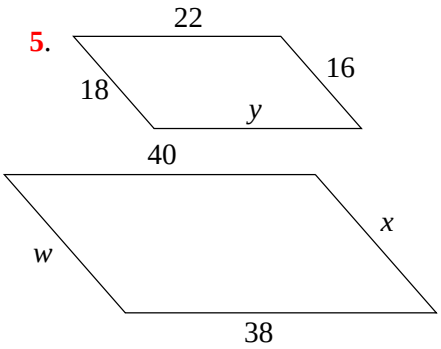

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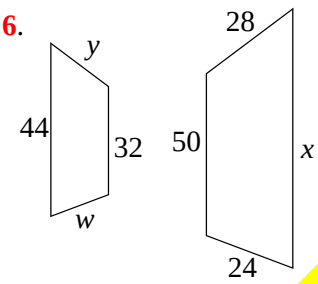

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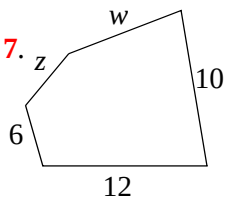

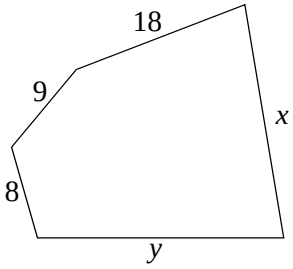

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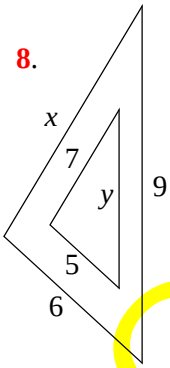

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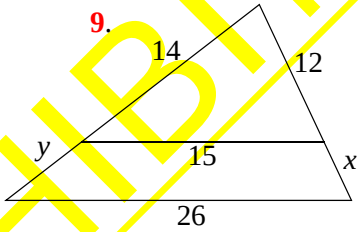

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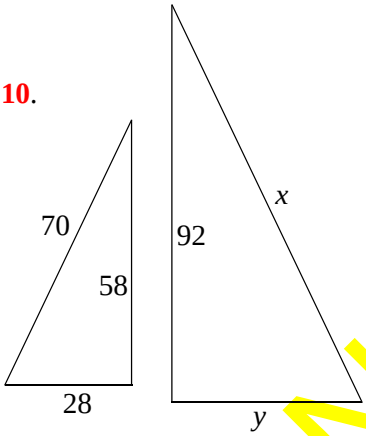

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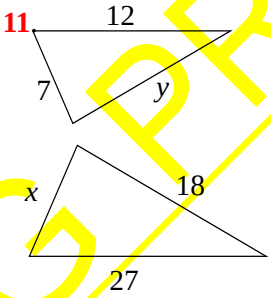

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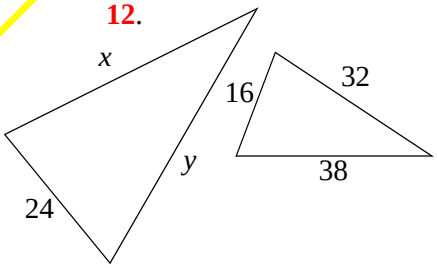

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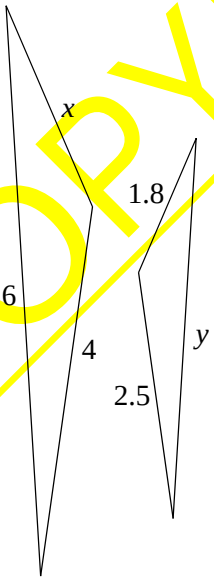

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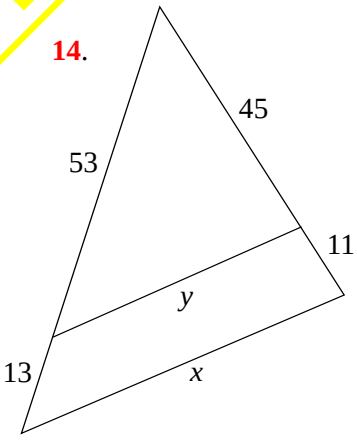

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