# Similar Triangles I

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In geometry, two polygons are similar when one is a replica (scale model) of the other.

Consider Dr. Evil and Mini Me from Mike Meyers' hit movie Austin Powers. Mini Me is supposed to be an exact replica of Dr. Evil.

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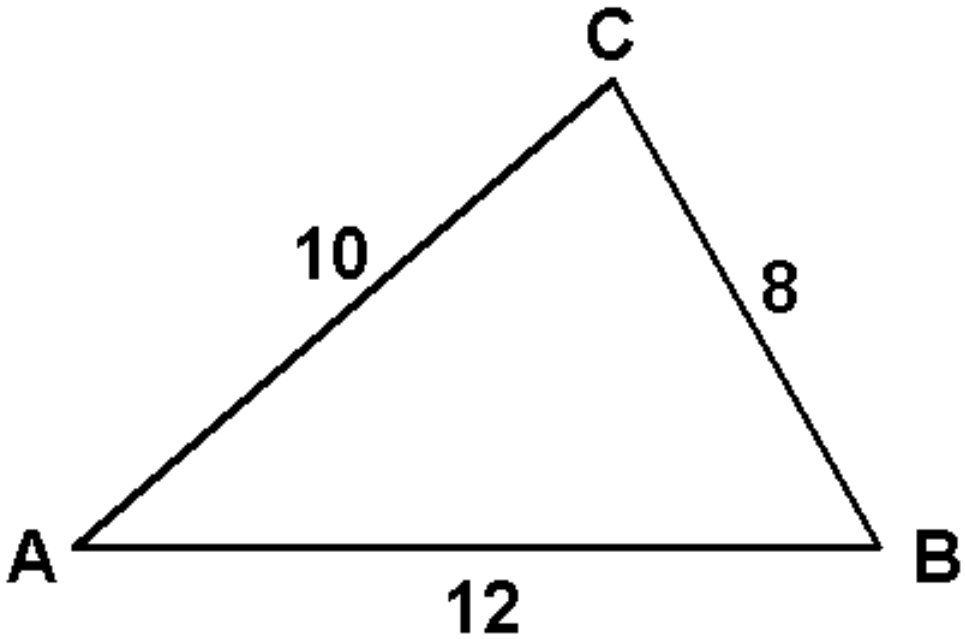
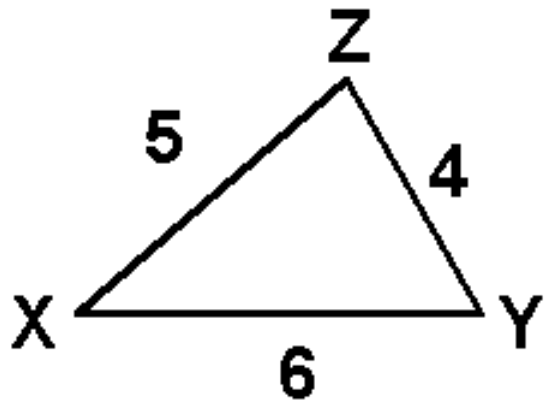
Triangles are a class of polygons in geometry. Therefore we can talk about triangles that are similar. The following is a picture of similar triangles.




*Note*: One triangle is a scale model of the other triangle.

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Q: How do we truly know that the above two triangles are similar (scaled model)?

*Answer*– We must take a closer look at the sides of our triangles. The following conditions must all be satisfied.

1. $\frac{\overline{AB}}{\overline{XY}} = K$

2. $\frac{\overline{BC}}{\overline{YZ}} = K$

3. $\frac{\overline{AC}}{\overline{XZ}} = K$

Scaling Factor

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This can all be summarized as:

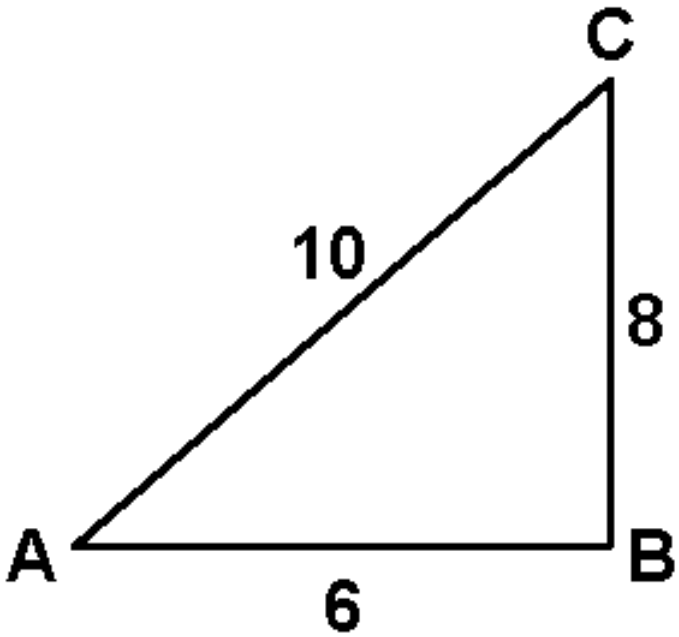
$$\frac{\overline{AB}}{\overline{XY}} = \frac{\overline{BC}}{\overline{YZ}} = \frac{\overline{AC}}{\overline{XZ}} = K, \text{ Scaling factor}$$

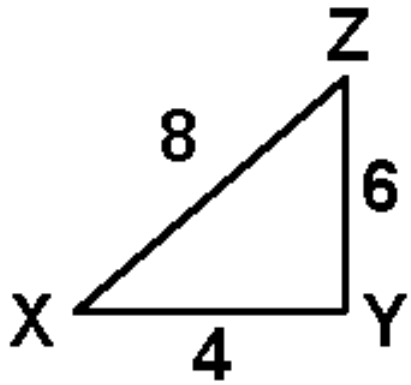
Our problem becomes as follows:

$$\frac{12}{6} = \frac{8}{4} = \frac{10}{5} = K, \text{ Scaling factor}$$

This tells us that $\Delta$ ABC and $\Delta$ XYZ are similar.

# Q: Can these triangles be similar?

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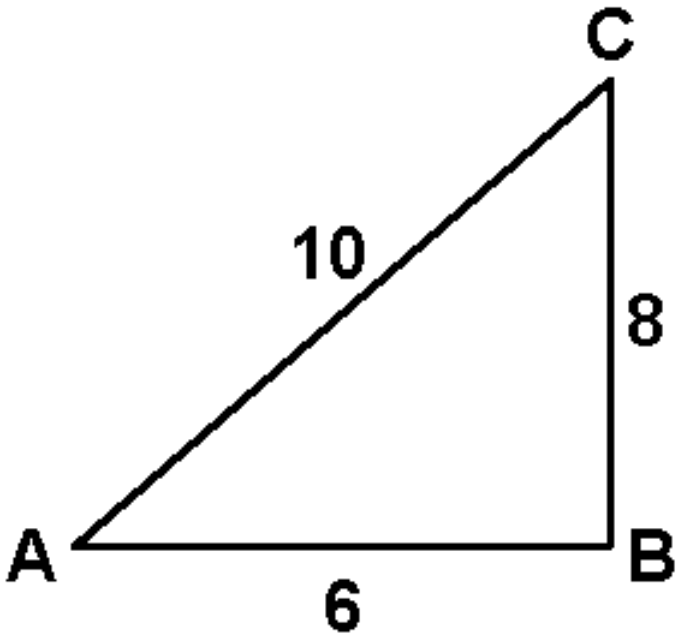
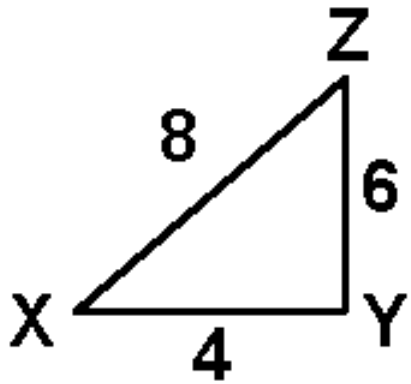
*Answer*—Yes, right triangles can also be similar but use the criteria.




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

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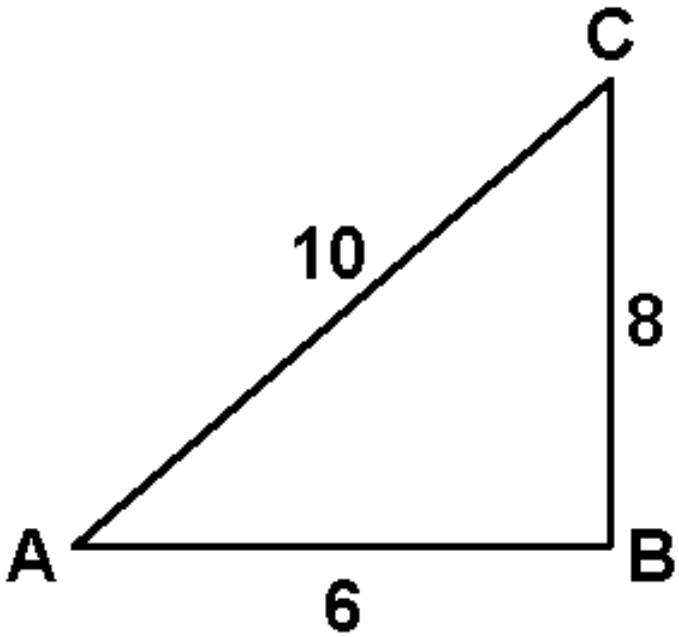


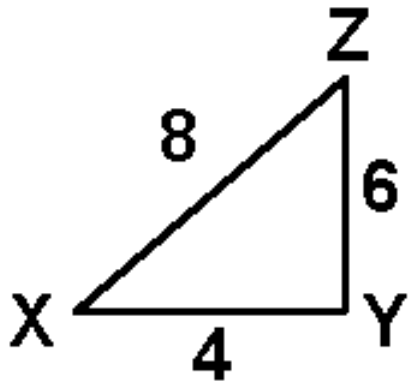


$$\frac{6}{4} = \frac{8}{6} = \frac{10}{8} = K$$

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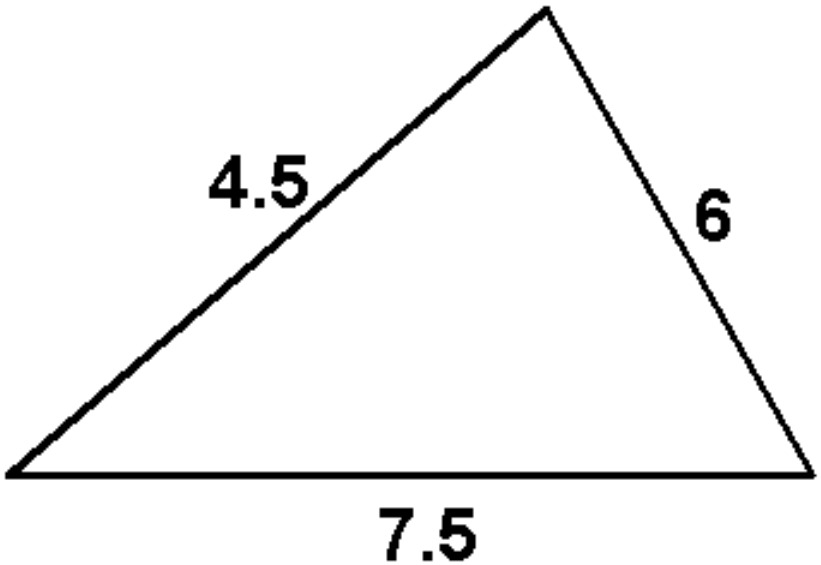
# Do we have equality?

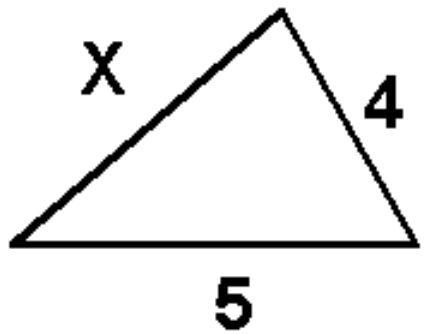
$$\frac{6}{4} = \frac{8}{6} = \frac{10}{8} = K$$

$$\frac{6}{4} = 1.5 \text{ but } \frac{8}{6} = 1.\overline{3}$$

This tells us our triangles are not similar. You can't have two different scaling factors!

Q: The two triangles below are known to be similar, determine the missing value X.

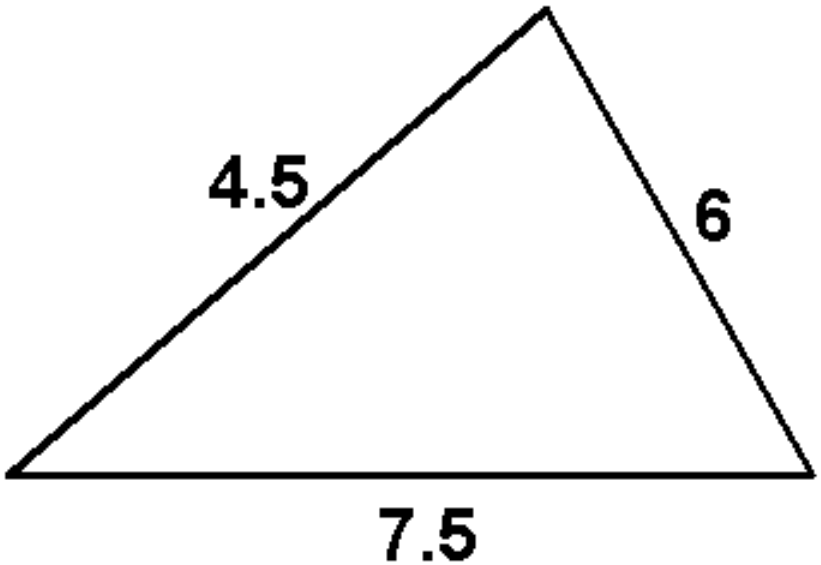


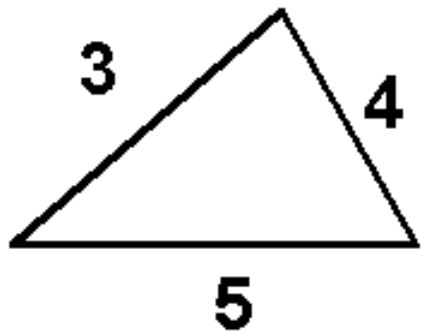



*Answer*– Using the fact that our triangles are similar . . .

$$\frac{7.5}{5} = \frac{4.5}{X} \Rightarrow \quad X = 3$$

The missing side has a length that's 3 units. The picture should look like this . . .

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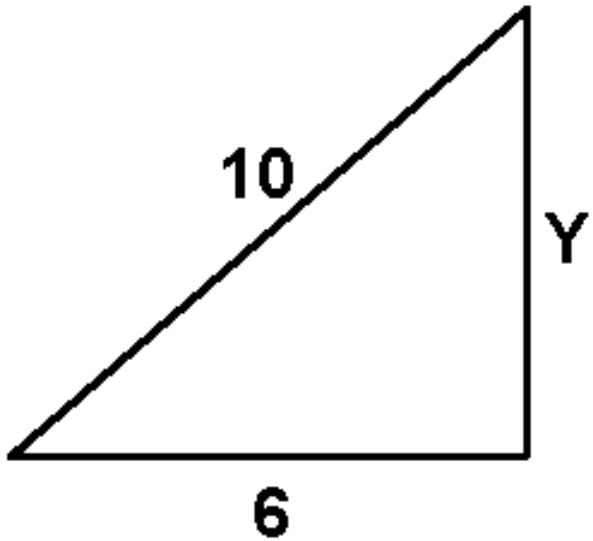
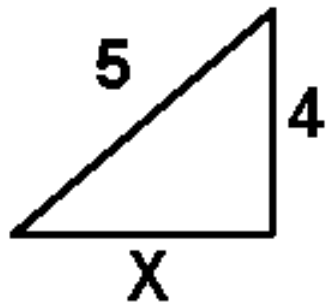
Q: The following triangles are similar. Can you determine the missing sides X and Y?



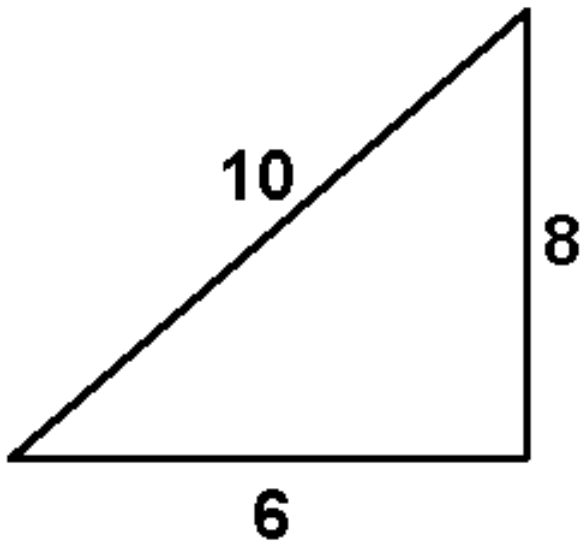
*Answer*– Using the criteria,

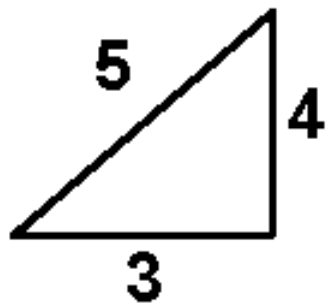
$$\frac{10}{5} = \frac{Y}{4} = \frac{6}{X}, \text{ but } \frac{10}{5} = 2 !$$

So, $\frac{Y}{4} = 2$ and $\frac{6}{X} = 2$

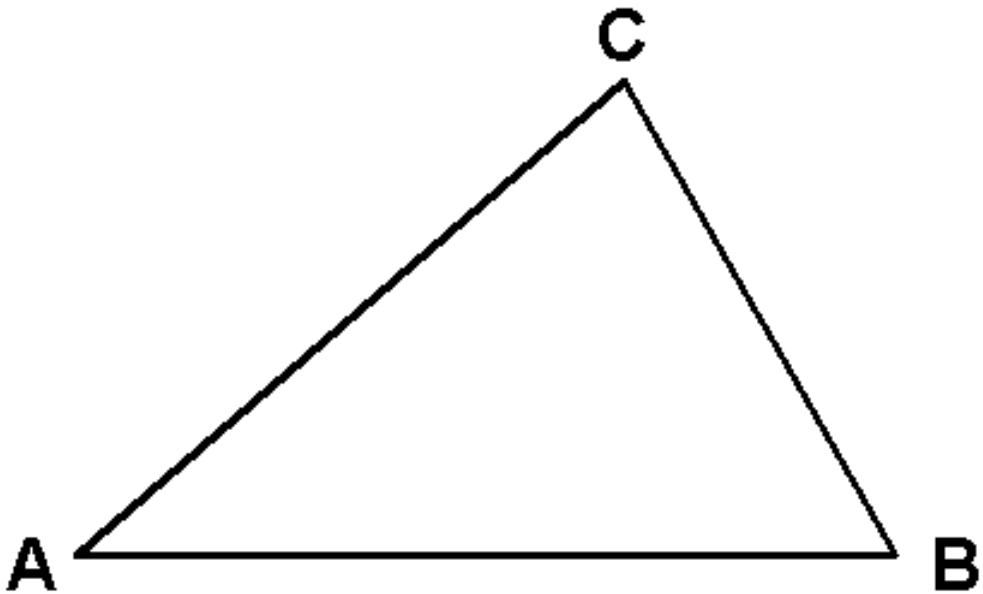
$Y = 8$ $X = 3$

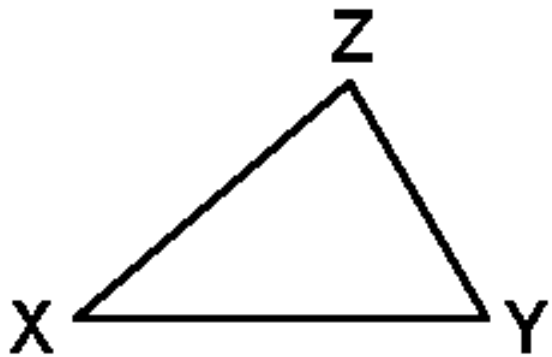
# Our triangles should look like this:



Let's take a closer look at the criteria that tells us when triangles are similar:




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

BACK NEXT EXIT

Mathematicians find this next relationship useful as well.

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

Why?

# End of Similar Triangles I

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