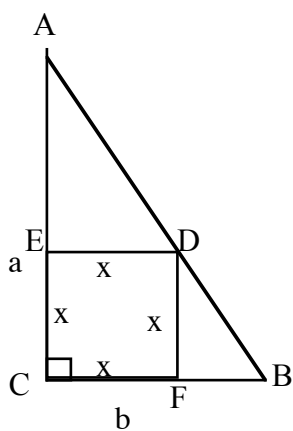# Solutions to Section I: Similarity

I1. The diagram below from problem 1 includes labels of vertices.

Solution I: $\triangle DFB \sim \triangle ACB$ by AA. This is because the two triangles are right triangles and they share $\angle B$. Since corresponding sides of similar triangles are proportional,

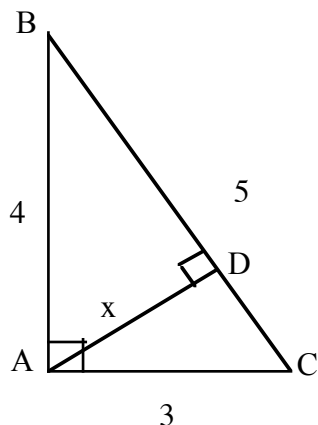$$\frac{x}{a} = \frac{b-x}{b}$$

Now cross-multiply and solve for x:

$$
\begin{aligned}
xb &= a(b-x) \\
xb &= ab - ax \\
xa + xb &= ab \\
x(a+b) &= ab \\
x &= \frac{ab}{a+b}
\end{aligned}
$$

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Solution II: $\triangle AED \sim \triangle ACB$ by AA. This is because the two triangles are right triangles and they share $\angle A$. Since corresponding sides of similar triangles are proportional,

$$\frac{a-x}{a} = \frac{x}{b}$$

Solving for x again gives $x = \frac{ab}{a+b}$.

I2. The diagram below from problem 2 includes labels of vertices.

Solution I: $\triangle DAC \sim \triangle ABC$ by AA. This is because the two triangles are right triangles and they share $\angle C$. Since corresponding sides of similar triangles are proportional,

$$\frac{3}{5} = \frac{x}{4}$$

Solving for x gives, $x = 12/5$.

Solution II: $\triangle DBA \sim \triangle ABC$ by AA. This is because the two triangles are right triangles and they share $\angle B$. Since corresponding sides of similar triangles are proportional,

$$\frac{4}{5} = \frac{x}{3}$$

Solving for x again gives, $x = 12/5$.

I3. Part a: Yes, $\triangle ABE \sim \triangle ACD$ because the two triangles share $\angle A$, and $\angle D \cong \angle BEA$ (since these two angles are corresponding angles for the transversal $\overleftrightarrow{DA}$).

Part b: The ratio of the measure of $\overline{AE}$ to the measure of $\overline{AD}$ is 7/10.

I4. Let y be the height of the flagpole in feet. We may assume that height of the flagpole and the length of its shadow are the linear dimensions of two legs of a right triangle, and the height of the man and the length of his shadow are the linear dimensions of two legs of a similar right triangle. Then,

$$\frac{y}{6} = \frac{52}{8}$$

Therefore, $y = (6)(52)/8 = 39$. The flagpole is 39 feet high.

I5.

  a. $6/15 = 2/5$

  b. $(6/15)^2 = (2/5)^2 = 4/25$

  c. $2/5$

  d. $(\frac{2}{5})^2 \times 300 = 48$ **square units**

  d. $\frac{2}{5} \times 80 = 32$ **units**