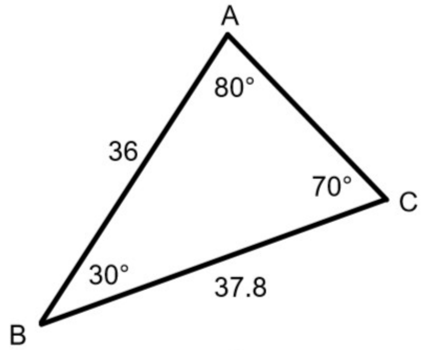
Using Similarity to Solve Triangles

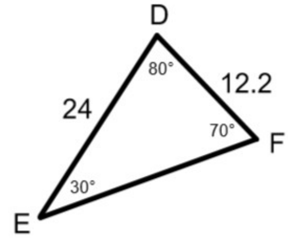
If we know two triangles are similar, we can use the properties of similarity to solve for missing information. We must establish similarity **first** before trying to solve!

<u>Example 1:</u> Determine the measure of the missing side lengths.



We are given all the angles, so we note that A = D, B = E, and C = F. Thus ABC ~ DEF.

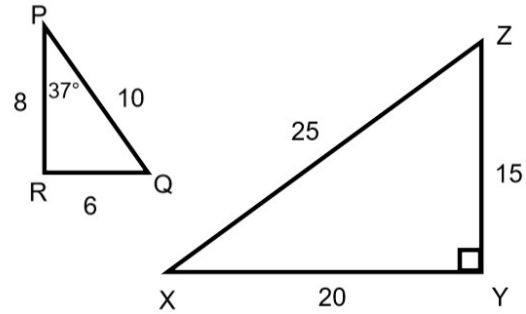
Sides AB and DE are known, so we know the ratio $\frac{AB}{DE}$.



Side AC corresponds to DF, which is known. We set up a ratio and solve:

$$\frac{AC}{DF}=\frac{AB}{DE}$$
$$\frac{AC}{12.2}=\frac{36}{24}$$
$$\frac{AC}{12.2}=1.5$$
$$AC=1.5\times 12.2$$
$$AC=18.3$$

<u>Example 2:</u> Determine the measure of the missing angles.



Since we know all the sides, we check to see if the ratios are all the same.

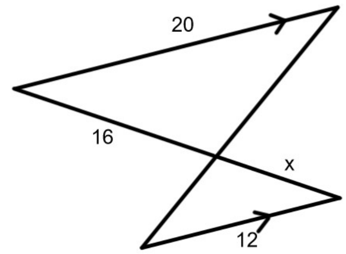
Smallest sides: $\frac{RQ}{YZ}=\frac{6}{15}=\frac{2}{5}$

Middle sides: $\frac{PR}{XY}=\frac{8}{20}=\frac{2}{5}$

Longest sides: $\frac{PQ}{XZ}=\frac{10}{25}=\frac{2}{5}$ The ratios are equal, so PRQ ~ XYZ.

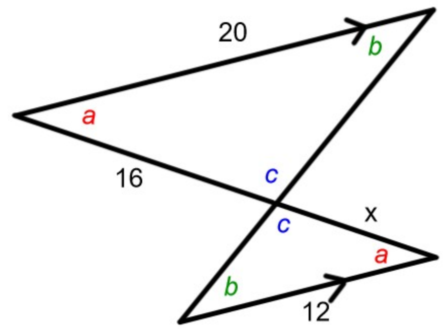
Angles R and Y correspond, so **R = 90**.
Angles P and X correspond, so **P = 37**.
For the remaining angle, we use our triangle properties: Q (and Z) = 180 – 90 – 37 = **53**.

Example 3: Determine the value of *x*.



First, we must establish the triangles are similar. This might seem difficult because there are no angles given! We will use properties of parallel lines to establish similarity.

The angles marked **a** are the same due to the Z-pattern.
The angles marked **b** are the same due to the Z-pattern.
The angles marked **c** are the same because they are opposite.



Now we can set up a ratio.

$$\frac{12}{20}=\frac{x}{16}$$
$$\frac{3}{5}=\frac{x}{16}$$
$$\frac{48}{5}=x$$
$$x\approx 9.6$$

Practice: pg. 380 #7, 8, 10, 14