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1. Determine whether the following statements are true or false. If it is true give a brief explanation. If it is false, give a counterexample.

   (a) All squares are similar.

   True, all angles are 90°, thus all corresponding angles are equal. Since all the sides are equal in each square, the ratio of corresponding sides will all be equal.

   (b) All rectangles are similar.

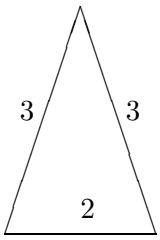
   False. Consider a 2 by 3 rectangle and a 2 by 5 rectangle. Corresponding angles are equal, but the ratio of corresponding sides are not.

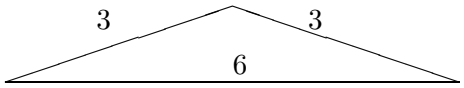
   (c) All equilateral triangles are similar.

   True, all angles are 60°, thus all corresponding angles are equal. Since all the sides are equal in each triangle, the ratio of corresponding sides will all be equal.

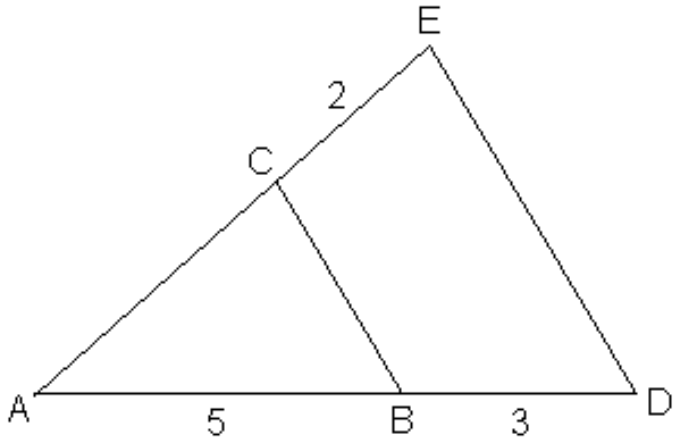
   (d) All isosceles triangles are similar.

   False, consider the triangles below.





2. Triangle ABC is similar to triangle AED. Find length of segment AC.



$$\frac{5}{8} = \frac{x}{x+2}$$
$$5(x+2) = 8x$$
$$5x + 10 = 8x$$
$$3x = 10$$
$$x = 3\frac{1}{3}$$

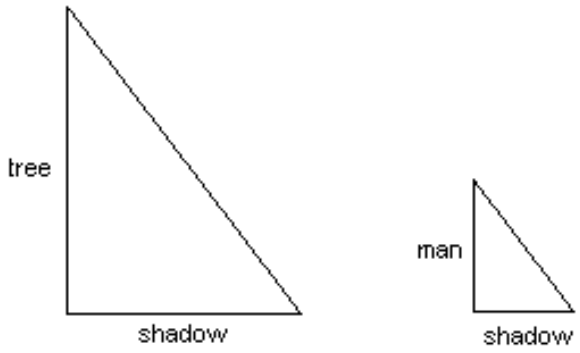
Therefore $AC = 3\frac{1}{3}$.

3. Consider the following problem:

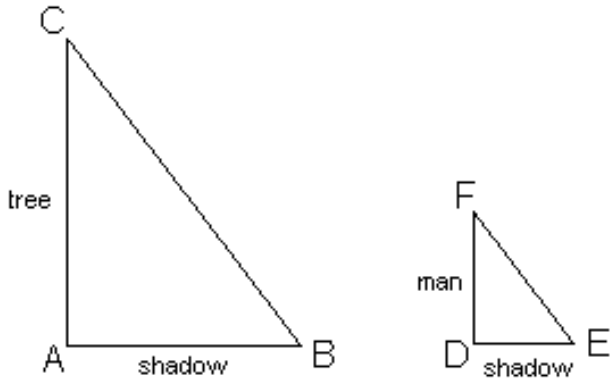
   A tree casts a shadow that is 15 feet long. At the same time a 6 foot tall man casts a shadow that is 4 feet long. How tall is the tree?

(a) This is a standard similar triangles word problem. Describe the two triangles involved in this problem.

The triangle defined by the tree, the shadow and the line of the sun. Similarly the man, the shadow and the line of the sun. See picture below.



(b) How do you know the two triangles are similar?



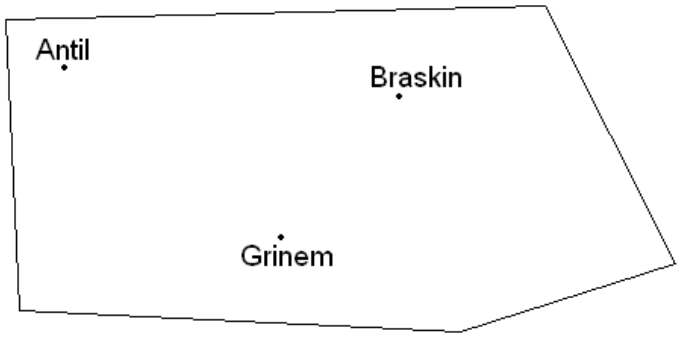
They both have a right angle. In addition, the sun is at the same angle, so angle B equals angle E.

(c) Solve the problem.

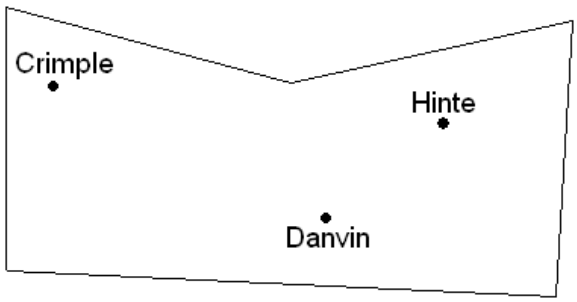
$$\frac{t}{15} = \frac{6}{4}$$
$$\frac{t}{15} = \frac{3}{2}$$
$$2t = 45$$
$$t = 22.5$$

Therefore the tree is 22.5 feet tall.

4. If the scale on the map below is 1 cm = 150 miles, how far is it from Antil to Braskin?



5. If it is 245 miles from Danvin to Crimple, what is the scale on the map?



6. On the planet Ozumil the standard units of measurement are frongs and hutes. Joe found a map the Ozumilians had of the United States. The scale on the map said "1 frong = 300 hutes". There were some notes on the side that said San Francisco to New York City, 1250 hutes. Joe happens to know it is 2909 miles from San Francisco to New York City.

   (a) Without doing any conversion is a hute bigger or smaller than a mile? How do you know?
   There are fewer hutes than miles between SF and NY, therefore hutes are bigger.

   (b) Which question would you rather answer: How many hutes are in a mile? or How many miles are in a hute? Why?

   (c) Answer the question you picked above.

$$\frac{1250}{2909} = \frac{x}{1}$$
$$x \approx .43$$

There are about .43 hutes per mile.

(d) How many frongs is it from San Francisco to New York City on the map?

$$\begin{aligned}\frac{1}{300} &= \frac{x}{1250}\\ x &= \frac{1250}{300}\\ x &= \frac{25}{6}\\ x &\approx 4.2\end{aligned}$$

It is about 4.2 frongs between SF and NY on the map.

(e) Joe measured the distance from San Francisco to New York City and found that it is 3 inches. How many inches are in a frong?

$$\begin{aligned}\frac{x}{1} &= \frac{3}{\frac{25}{6}}\\ x &= \frac{18}{25}\\ x &= .72\end{aligned}$$

There are .72 inches in a frong.