Homework assignment Grade 9 Geometry (Congruence and Similarity) November 10, 2008

1) Determine the angle measure indicated by each letter.



- 2) Solve for x and y
 - a) $\frac{7}{30} = \frac{14}{x}$ b) $\frac{3}{19} = \frac{x}{7}$ c) $\frac{4}{9} = \frac{5}{x} = \frac{y}{12}$
- 3) The diagram shows congruent triangles. Name the equal angles and the equal sides.



4) These two rectangles are similar. Determine the length of side FG.



- 5) A pole 3.8 m high casts a shadow that measures 1.3 m. A nearby tree casts a shadow 7.8 m long. Find the height of the tree.
- 6) Is it possible to construct a triangle with side lengths 6.5 cm, 9.0 cm, and 11.5 cm? If your answer is yes, construct the triangle. If your answer is no, explain.
- 7) The shadow of a relay tower is 32.0 m long on level ground. At the same time, a boy 1.8 m tall casts a shadow 1.5 m long. What is the height of the tower?
- 8) Using the diagram below, use what you have learned about similar triangles to prove the Pythagorean Theorem $a^2 + b^2 = c^2$.





1) Determine the angle measure indicated by each letter.



- 2) Solve for x and y
 - d) $\frac{7}{30} = \frac{14}{x}$ e) $\frac{3}{19} = \frac{x}{7}$ f) $\frac{4}{9} = \frac{5}{x} = \frac{y}{12}$ x = (14)(30) / 7 = 60 x = (3)(7) / 19 = 21/19 x = 45/4y = 48/9 = 16/3
- 3) The diagram shows congruent triangles. Name the equal angles and the equal sides.



4) These two rectangles are similar. Determine the length of side FG.



5) A pole 3.8 m high casts a shadow that measures 1.3 m. A nearby tree casts a shadow 7.8 m long. Find the height of the tree.

 $\frac{3.8}{1.3} = \frac{x}{7.8} \qquad x = (3.8)(7.8)/(1.3) = 22.8 \text{ m}$

6) Is it possible to construct a triangle with side lengths 6.5 cm, 9.0 cm, and 11.5 cm? If your answer is yes, construct the triangle. If your answer is no, explain. Yes 9.0 cm 11.5 cm (not drawn to scale)



7) The shadow of a relay tower is 32.0 m long on level ground. At the same time, a boy 1.8 m tall casts a shadow 1.5 m long. What is the height of the tower?

 $\frac{32.0}{x} = \frac{1.5}{1.8} \qquad x = (32)(1.8) / (1.5) = 38.4 \text{ m}$

8) Using the diagram below, use what you have learned about similar triangles to prove the Pythagorean Theorem $a^2 + b^2 = c^2$.



Proof using similar triangles.

Like most of the proofs of the Pythagorean theorem, this one is based on the proportionality of the sides of two similar triangles.

Let *ABC* represent a right triangle, with the right angle located at *C*, as shown on the figure. We draw the altitude from point *C*, and call *H* its intersection with the side *AB*. The new triangle *ACH* is similar to our triangle *ABC*, because they both have a right angle (by definition of the altitude), and they share the angle at *A*, meaning that the third angle will be the same in both triangles as well. By a similar reasoning, the triangle CBH is also similar to *ABC*. The similarities lead to the two ratios. As

$$BC = a, AC = b, \text{ and } AB = c,$$

so

$$\frac{a}{c} = \frac{HB}{a}$$
 and $\frac{b}{c} = \frac{AH}{b}$.

These can be written as

$$a^2 = c \times HB$$
 and $b^2 = c \times AH$.

Summing these two equalities, we obtain

$$a^{2} + b^{2} = c \times HB + c \times AH = c \times (HB + AH) = c^{2}.$$

In other words, the Pythagorean theorem:

$$a^2 + b^2 = c^2.$$