

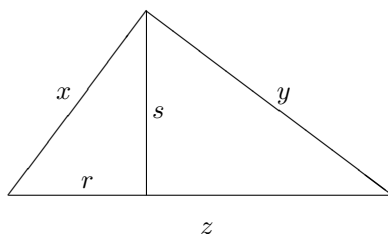
Playsheet 12

Big Theorem!

MATH 130-02
Tuesday, March 17, 2009

Directions: Groups should consist of three or four people. Work together on each problem; do not delegate different problems to different people. Submit one **neatly written** write-up per group. Remember to use complete sentences as appropriate and explain your reasoning. That is, **show your work!**

1. Consider the right triangle below.



- (a) In the smallest triangle, what is the ratio of the shortest side to the longest side? What is this ratio in the largest triangle? Set these quantities equal (the triangles are similar, so their sides are in proportion!).
 - (b) In the medium triangle, what is the ratio of the medium side to the longest side? What is this ratio in the largest triangle? Set these quantities equal.
 - (c) Use some algebra to solve for x^2 and y^2 in your equations above. What do you get when you add x^2 and y^2 ? Does this look familiar? Explain.
-
- (a) Cut out the little square and the four triangles. Arrange them into a single large square and draw below the figure you obtain.
 - (b) What is the area of the large square in terms of c ? What is its area in terms of a and b ? What do you conclude?

2. **Garfield's proof:** this proof of the Pythagorean Theorem was published by President James Garfield a few years before he became president.
- (a) Line up the shortest side and the medium side of two of your cut out triangles so they make a single long side. If you join the vertices of these triangles with a line segment, the result is a trapezoid. Draw this figure below.

 - (b) Compute the area of the trapezoid by adding the areas of the two triangles and the half of a square that make up the trapezoid.

 - (c) Compute the area of the trapezoid by applying the formula $A = \frac{1}{2}(b_1 + b_2)h$, where b_1 and b_2 are the lengths of the parallel bases and h is the height.

 - (d) Now set the two expressions for the area equal and simplify to obtain the Pythagorean Theorem.
3. Cut out the three squares that are drawn around a triangle. Dissect the two smaller squares in such a way that the pieces exactly cover the largest square. Draw your result below.
4. A carpenter is building a square frame five feet wide by 12 feet tall. How long should the diagonal be in order to ensure that the frame is indeed square?