Name:

Math 490, Spring 2013: Homework #1
Due Tuesday, January 29, 2013

1a. State the Pythagorean theorem.

b. Prove the Pythagorean theorem at least three DIFFERENT ways and be prepared to present one of your proofs in class on Tuesday, January 29.

c. Describe a proof of the Pythagorean theorem to someone who has never seen a proof of the theorem before. Try to get him or her inspired and intrigued by math! After you do this, write about the event and the various reactions (and turn it in).

2. Prove the converse of the Pythagorean theorem. That is, prove that: in $\triangle ABC$ with side lengths a, b, and c, if $a^2 + b^2 = c^2$, then $\triangle ABC$ is a right triangle and the right angle is opposite the side with length c.

3. Look at the Common Core State Standards, Mathematics. Where is the Pythagorean theorem first mentioned? When is it proved?

4. Can there be a right triangle with sides of length 1, 2 and 3? Why or why not? Can you find a right triangle whose side lengths are consecutive natural numbers? If so, can you find MORE than one such example? Why or why not?

5. In the 1939 movie *The Wizard of Oz*, when the brainless scarecrow is given the confidence to think by the Wizard (by merely handing him a diploma, by the way), the first words the scarecrow utters are, "The sum of the square roots of any two sides of an isosceles triangle is equal to the square root of the remaining side." Analyze the scarecrow's assertion and the value of the scarecrow's diploma (in your opinion, based on his assertion).

6. Start with a right triangle with both legs having length 1. What is the length of the hypotenuse? Suppose we draw a line segment of length 1 perpendicular to the hypotenuse with endpoint a vertex of the triangle and then make a new triangle by drawing a line segment connecting the endpoint of the new line segment to the base of the original triangle. What is the length of this new hypotenuse? Suppose we continue in this manner. Describe a formula for the lengths of all the hypotenuses.

7. In the Dan Meyer activity, Bucky the Badger, linked here:
http://mrmeyer.com/threeacts/buckythebadger/:

a. how many *different* ways could the Badgers have scored 11 touchdowns (all worth 7 points) and 2 field goals (3 points each)?

b. if you were Bucky, would you rather your team score their field goals at the start of the game or the end? Why?

c. what are some numbers of pushups that Bucky will never do in any game? (Give at least 3 possibilities.) Explain your answers.

d. give a formula for $p(x)$, where x is the number of touchdowns Wisconsin scored in a game where they only score touchdowns (all worth 7 points), and $p(x)$ is the number of pushups Bucky will have done by the end of the game. (Simplify $p(x)$ as much as possible.)