10th Grade Assignment – Week #4

<u>Important Notes for our Main Lesson</u>:

- During our main lesson together in these next three weeks, I will (as normal) give two lectures each week, and you will meet with your work group twice per week. In these two lectures, I will deliver the content of the main lesson, and I will give suggestions for essays and main lesson book pages in the weekly assignments. I advise that you plan on setting aside extra time in the morning ("main lesson time") to work on these assignments.

- What is a "main lesson book page"? In short, it is something that you have created that is either a summary of something that was covered in the lecture, group meeting, or part of your individual work, or it can be a separate essay that reflects your thoughts on a given topic.

- *An Excellent Main Lesson Book* ("A" quality work)…
    - Is something that you are proud of. It reflects your original work and thoughts.
    - Is a balanced representation of what we covered in class.
    - Shows that you have a solid understanding of the material.
    - Is a resource for you, to be used as a reference in the future.
    - Is well presented and clear. Math concepts are clearly explained for the reader.
    - Could be given to another person, who was not present in the lessons, and, by reading your main lesson book, that person could have a good sense of what was done in the class.

- Here is a tip for writing a strong essay: Think carefully about your introduction. The first few sentences set the tone for the paper and draw in your reader. How can you capture the reader's interest? Similarly, how can you end your essay in a powerful way?

- You should not use the Internet to help you write any essay or do any main lesson book page.

- The grade for the main lesson is simply based upon the main lesson book (essays) you have done. There is no separate course report for this main lesson. The grade for the main lesson will be included as part of the 10th grade Math Academy semester course report.

- Before turning in your essays to your tutor, I recommend that you have a parent (or other adult) read through your essays, correct grammar and spelling, and make suggestions for improvement. Send the final version to your tutor.

<u>Group Assignment</u>:

for Tuesday:

- *Three Students*. Discuss the following question: How would it be different to be
(1) a student (member) of the School of Pythagoras,
(2) a pre-Greek student (perhaps in Egypt or another older culture), or
(3) a modern student?
Consider both how the experience would be different in general, and in particular, how the study of mathematics would be different.

- *Euclidean Construction Puzzles:* Some of the following puzzles are more difficult than others. Decide which ones to work on, and then discuss together how you could do the construction. (Of course, the construction must be a Euclidean <u>theoretically perfect</u> construction.)
    1) The division of an angle into four equal parts.
    2) The division of an angle into three equal parts.
    3) The construction of a 12-gon.
    4) The construction of a 10-gon.
    5) The construction of a 15-gon.
    6) The construction of a 7-gon.
    7) The construction of a 17-gon.
    8) Finding the center of a given circle.
    9) The division of a line into 7 equal parts.

10) The construction of a line tangent to a given circle (where the center of the circle is given) through a given point outside the circle.

<u>Group Assignment</u>:

for Thursday:

- From the below document, *Six Proofs of the Pythagorean Theorem*, study proof #2, proof #3, and proof #4. For each proof, it is very important that you explain the proof to one another so that each person in your group completely understands it, and sees why it is an explanation that the Pythagorean Theorem is indisputably true.

- Continue working on the *Euclidean Construction Puzzles* from Tuesday.

Individual Work

Always remember, do what you can with each assignment. You don't have to do everything. The goal is to learn and improve!

- Before the end of this week, take the **Geometry Basics** test that is found at the end of this document. You should take the test at home, supervised by your parent. You should not use notes for the test. If it is possible for you, try not to use a calculator. Send the test to your tutor once you have completed it.

- Do the **Pythagorean Cutout Puzzle** (which is also Proof #1 from the *Six Proofs of the Pythagorean Theorem*). The cutout puzzle is found on one of the below pages.

- **Create your own main lesson book pages**.
  Here are some ideas:

  <u>After Lecture #1:</u>

  - *Three Students* essay. (see Tuesday's group assignment)
  - *School of Pythagoras*. Write an interesting essay about the School of Pythagoras. (Don't just write what I said. How can you make it your own?)

  <u>After Lecture #2:</u>

  - *Mystery of the Square and the proof that square root of two is irrational.* Give a full explanation, beginning wit the idea of *commensurability* and culminating with the proof that the square root of 2 is irrational.
  - *Euclidean Constructions.* Include drawings and explanations from some of the *Euclidean Construction Puzzles* from Tuesday's group assignment.
  - *Biography of Pythagoras.* Write an interesting essay!

Pythagoras and his School

Quotes
- "Every man has been made by God in order to acquire knowledge and contemplate."
- "Numbers rule the universe."
- "Were it not for number and its nature, nothing that exists would be clear to anyone. You can observe the power of number not only in the affairs of the gods, but in all the acts and thoughts of people."

Aphorisms
- Walk on unfrequented paths.
- Govern your tongue before all other things, following the gods.
- Do not poke the fire with a sword.

Their Practices
- Communal living
- Egalitarian; included women
- Strict diet
- Strict secrecy

The Four Subjects of Study
- *Arithmetic*: Number in Itself.
- *Geometry*: Number in Space
- *Music*: Number in Time
- *Astronomy*: Number in the Heavens

Central Beliefs
- That at its deepest level, reality is mathematical in nature.
- That philosophy can be used for spiritual purification.
- That the soul can rise to union with the divine.
- That certain symbols have mystical significance.

The Characteristics of Numbers (Listed here is just one of several characteristics for each.)
- *One*: Harmony
- *Two*: Balance
- *Three*: Wisdom
- *Four*: Justice
- *Five*: Nature
- *Six*: Perfection
- *Seven*: Fate
- *Eight*: Love
- *Nine*: Compassion
- *Ten*: God
- *Even numbers*: Feminine
- *Odd numbers*: Masculine

Pythagorean Theorem Cutout Puzzle

2

1

3

4

5
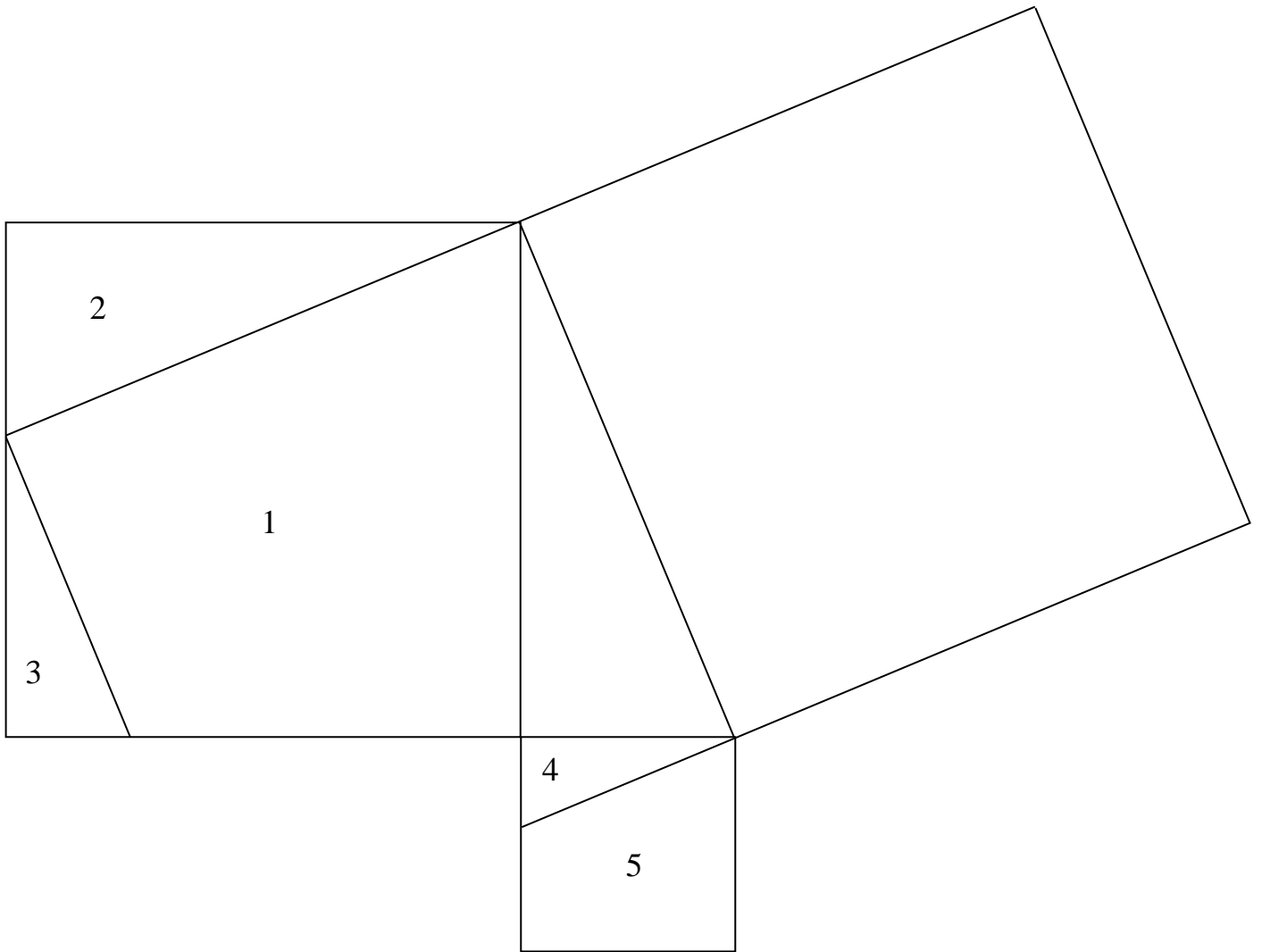
Six Proofs of the Pythagorean Theorem

1. *A cut-out puzzle proof* (See the previous page for a larger version.)
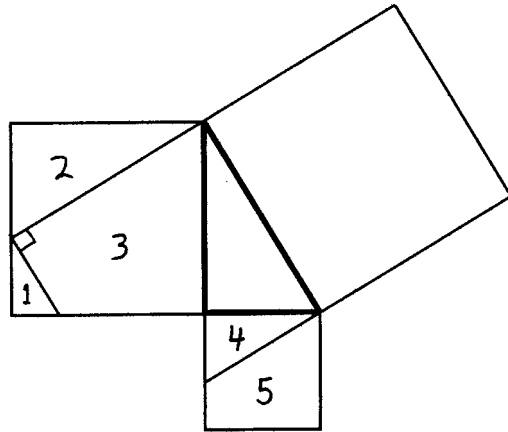
2. *Baravalle's proof using the Shear and Stretch.*
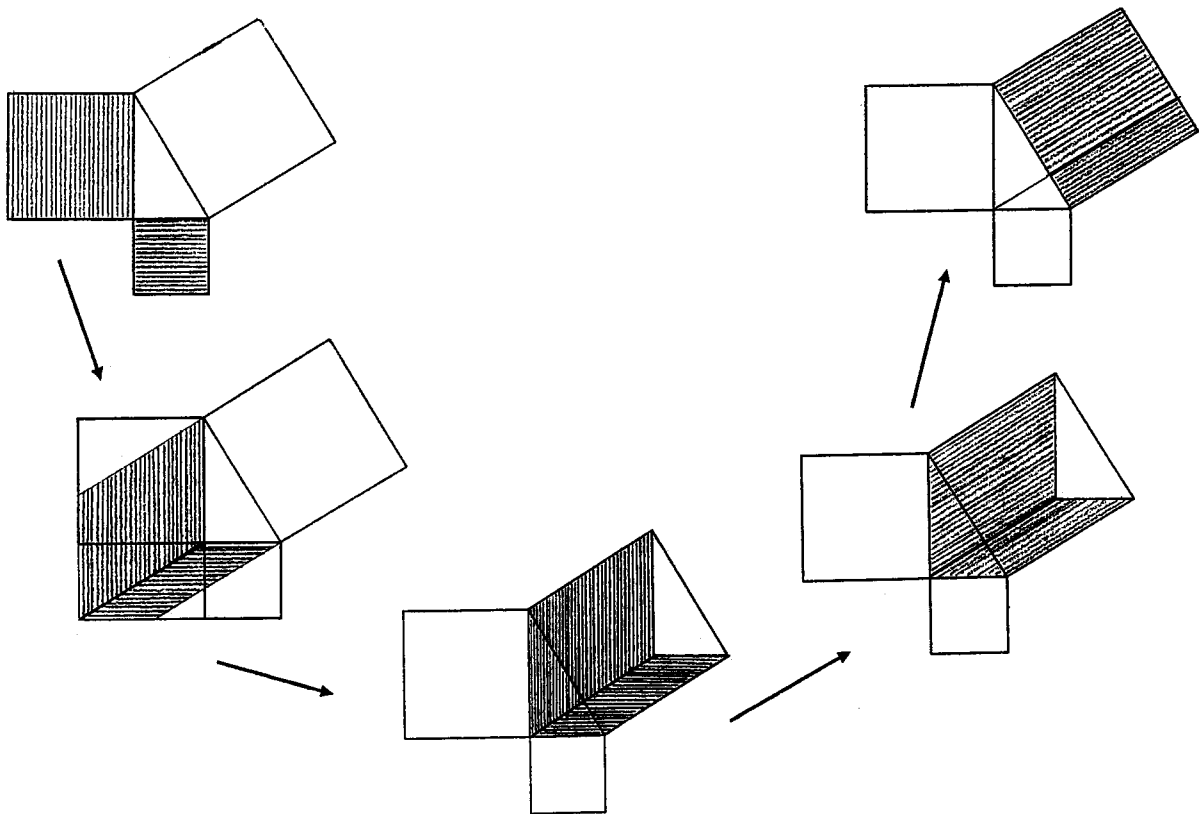
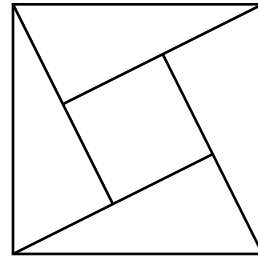# Six Proofs of the Pythagorean Theorem (Continued.)

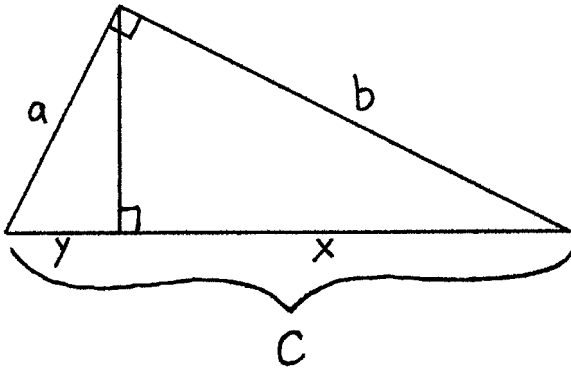**3**. *Rearranging the Triangles.* This is, perhaps, similar to what Pythagoras did.
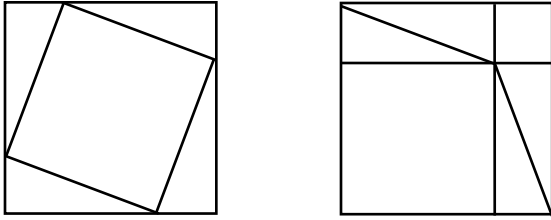
4. *From Tabit ibn Qorra* (ca. 870AD)
Behold!
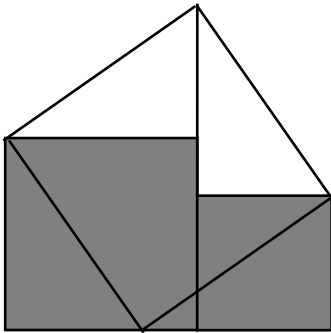
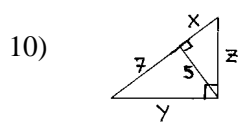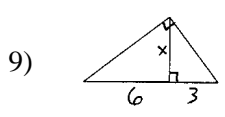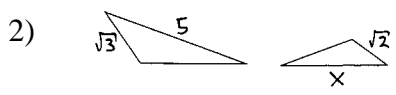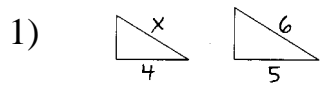**5**. *From Bhaskara* (ca. 1150AD) This proof requires a bit of algebra.

6. *Proportion Proof.* This proof is found in many modern high school geometry books, and it is the only one of the six that doesn't involve squares or area.

Geometry Basics
End of Unit Test

Find each variable.
All pairs of figures are similar.
(2 points for each variable)

1)

2)

3)

4)

5)

6)

7)

8)

9)

10)
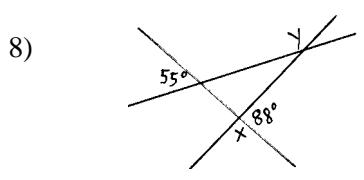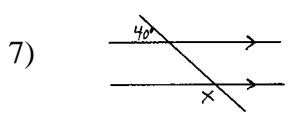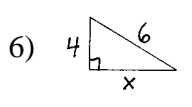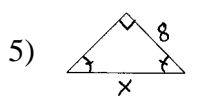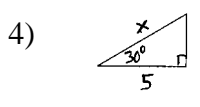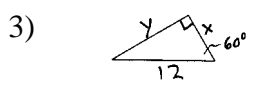
Short Answer (4 points each)

11)   What does the SAS Congruency Theorem
        state?

12)   Why isn't SSA used as a congruency
        theorem?

For each pair of triangles, state the congruency
theorem that proves they are definitely
congruent, or state that they are not definitely
congruent. (2 points each.)

13)

14)

15)

16)
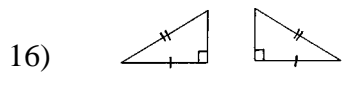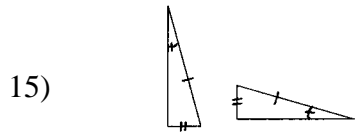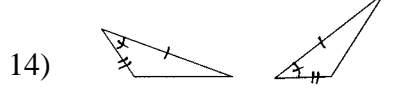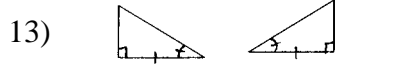
Constructions. Label all sides and angles.
Leave construction lines. (4 points each)

17) Construct ΔdAe.
18) Construct ΔBdC.
19) Construct ΔfeC.
20) Construct ΔefC.