Math 181: Problem Set #4

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Due in 1 week at the start of class.

Make sure you have read chapter 3 of the Katz textbook and Chapters 1 to 6 of the *Archimedes Codex*.

Problem 1

Attached the first few pages of the Vatican's copy of Euclid's *Elements*. (Recall this is the oldest full copy of the book.) Complete the document analysis worksheet for this text. (The text is written in ancient Greek, so you won't be able to understand what the words mean. What information can you get without knowing the exact content of the text?)

Problem 2

The text in Figure 1 is the text from Euclid's *Elements* that explains how to write down Pythagorean triples. Express Euclid's method as an algebraic formula. (Recall a Pythagorean triples is a triple of integers (x, y, z) such that $x^2 + y^2 = z^2$).)

Problem 3

Using only the postulates and common notions from Euclid's *Elements*, find a construction to bisect a given angle and prove that it is correct. (This is Proposition I–9 of Euclid's text. Feel free to consult the book.)

Problem 4

Solve Exercise 3 in Chapter 3 of the Katz textbook.

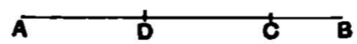
Collaboration Policy

With each week's homework, you must turn in a one paragraph description of all the resources you used on that homework. You must mention any person you talked

LEMMA I.

To find two square numbers such that their sum is also square.

Let two numbers AB, BC be set out, and let them be either both even or both odd.



Then since, whether an even number is subtracted from an even number, or an odd number from an odd number, the remainder is even, [IX. 24, 26]

therefore the remainder AC is even.

Let AC be bisected at D.

Let AB, BC also be either similar plane numbers, or square numbers, which are themselves also similar plane numbers.

Now the product of AB, BC together with the square on CD is equal to the square on BD. [II. 6]

And the product of AB, BC is square, inasmuch as it was proved that, if two similar plane numbers by multiplying one another make some number, the product is square. [IX. 1]

Therefore two square numbers, the product of AB, BC, and the square on CD, have been found which, when added together, make the square on BD.

And it is manifest that two square numbers, the square on BD and the square on CD, have again been found such that their difference, the product of AB, BC, is a square, whenever AB, BC are similar plane numbers.

But when they are not similar plane numbers, two square numbers, the square on BD and the square on DC, have been found such that their difference, the product of AB, BC, is not square.

Q. E. D.

Figure 1: Euclid's method for generating Pythagorean triples

to about the problems, any book you looked at, any online resource (Wikipedia, Chegg,...) that you used. A sample paragraph is

> On this week's homework, I worked on the problem set collaboratively with Gauss and Grothendieck at The Redroom during happy hour. We found an Alex Jones video (http://youtube.blah.com) that gave a really clear explanation of Fermat's Last Theorem. We got really stuck on Problem 5, and so we went to Chegg.com and paid an online tutor ("Zariski") $50 to solve the problem for us. He said the problem was too hard for him. So I logged into my TruthSocial account (@CobraTatesThesis) and posted the question with @realDonaldTrump tagged. He responded with a tremendous, really fantastic solution to the problem, which by the way, Biden can't solve. At this point, it was midnight and I still had four more problems to go, so I just gave the questions to ChatGPT and cut-and-pasted the answers.