MA 350 Dr. G. Stoudt
First Reading Assignment

Readings

- From *A Mathematician's Apology* - G. H. Hardy, page 1
  This reading sets the tone for the course.
- Chapter I (Protomathematics in the Late Age of Stone and in Ancient Mesopotamia and Egypt) Introduction, page 7
- Reading 1: From *The Exact Sciences in Antiquity* - O. Neugebauer
- Reading 2: From the A′h-mosè or Rhind Papyrus
- Reading 4: The Ancient Hebrews and Protomathematics Based on the Old Testament of the Bible

Questions for Discussion

Reading 1

1. To get used to sexagesimal notation, verify that 1;24,51,10 (sexagesimal) is indeed approximately equal to 1.414 (decimal). (See pages 11 and 19.)
2. In the table of reciprocals on page 17, verify the pair 54 and 1,6,40.
3. Think about decimal representation and irrational numbers. For sexagesimal representation, what "takes the place of" irrational numbers? Do the Babylonians approximate these numbers? Find examples in the reading.
4. Verify the calculations discussed on pages 20 and 21 using lines 1, 6, and 14 in the table on page 20.
5. Verify that $2pq, p^2 - q^2$ and $p^2 + q^2$ are a Pythagorean triple under the conditions stated on page 21.
6. Do you see why $\frac{d}{l}$ is expressible as a finite sexagesimal fraction if and only if p and q are regular numbers? (page 21 bottom left)
7. Verify that the solution to $x\bar{x} = 1, x + \bar{x} = b$ given on page 22 is correct.
8. Solve $x\bar{x} = 1, x + \bar{x} = b$ in a "modern" way. Does what you see in the middle of page 22 look familiar?

Reading 2

1. How are multiplication and division usually introduced in elementary school? Can you relate this to the Rhind papyrus?
2. Can every positive integer be written as a sum of powers of 2? Uniquely?
3. Read carefully about "false position" on pages 29-31. Use the technique to solve
   $$\begin{aligned}\frac{2}{3}x - \frac{1}{2}y &= 500 \\ x + y &= 1800\end{aligned}$$. First assume that $x = y = 900$.

Homework Problems

1a. Verify using modern algebra the identity $\frac{1}{2}(x^2+y^2)=(\frac{x+y}{2})^2+(\frac{x-y}{2})^2$.

b. Use part a. to solve the system of equations
$$\begin{aligned} x-y&=a \\ x^2+y^2&=b \end{aligned}$$
using techniques similar to the Babylonian method.

2. Look up the area of a regular n-gon and write the formula in terms of the length of a side, s_n anda trigonometric function only. Calculate an approximation using the same n values as on page 25. How does the formula compare to the Babylonian area formulae on page 25?

3a. Show that taking $v+u=2;24$ leads to line 1 of Plimpton 322.
b. Show that taking $v+u=1;48$ leads to line 15 of Plimpton 322.
c. Find the value for $v+u$ that leads to line 6.
d. Find the value for $v+u$ that leads to line 13.

4. The Babylonians had a table that gave whole number values of n^2, n^3, and n^2+n^3 (see page 24). Consider the cubic equation $x^3+ax^2+bx+c=0$. Let $x=y+s$ and substitute, gathering like terms. What assumption on s is needed to reduce to a cubic of the form $y^3+Ay^2=D$, that is, to eliminate the y term? Make this substitution. Make another substitution of the form $y=$ __n to reduce to a form where the Babylonian table described above can be used, that is, get to the form $n^3+n^2=$ ___.

5. Multiply 237 by 18 using the Egyptian method.

6. Divide 242 by 11 using the Egyptian method.

7. Divide 19 by 8 using the Egyptian method.

8. Find the Egyptian unit fraction representation for $\frac{9}{20}$ and $\frac{4}{15}$.

9. Use the Egyptian method to approximate $\sqrt{\frac{42}{121}}$.