MA 350 Dr. G. Stoudt
Fourteenth Reading Assignment

Readings

- Reading 69: From "On the Transformation and Simplification of the Equations of Loci" (Integration)-Pierre de Fermat
- Reading 70: From "On a Method for the Evaluation of Maxima and Minima"-Pierre de Fermat
- Reading 71: From "On the Sines of a Quadrant of a Circle"-Blaise Pascal (end with the proof of Proposition 1)

Notes for the Readings

For Fermat, parabolas and hyperbolas are really higher parabolas (in modern notation $y = px^k$) and higher hyperbolas (in modern notation $y^m = px^k$). He only works with the portion of the curve in the first quadrant.

In finding the center of gravity of the paraboloid, you may assume the statement about centers of gravity being in constant proportion (top of page 379) is true.

The reference to Postulate 9 of Archimedes' *On the equilibrium of planes* should be a reference to Postulate 7 which states "In any figure whose perimeter is concave in (one and) the same direction the center of gravity must be within the figure."

You will need to make use of the Principle of the Lever, which is Proposition 6 of *The Equilibrium of Planes* I and can be found on page 37.

In the Pascal reading, make sure you read the end notes!

The "extreme sines" (page 381) are simply the sines at the ends of the interval under consideration. In Figure 71.2, if we sum (integrate) from A to O, the extreme sines are AB and OP.

Questions for Discussion

Reading 69

1. Translate Fermat's theorem of the geometric progression (in italics on page 374) into modern notation.
2. Be ready to verify the calculations on page 375.
3. Read the commentary by D. J. Struik. How does this relate to Riemann sums?

Reading 70

1. What is wrong with Fermat's rule on page 377?
2. Solve Fermat's example on page 377 using modern methods.
3. Be ready to verify the calculations on page 379.

Reading 71

1. Where is the characteristic (infinitessimal) triangle in figure 71.1 and what triangle(s) is it similar to?
2. Be prepared to go through the proof.

Homework Problems

1. For the curve $y^2 = x$, verify using modern techniques the result that the subtangent CE is twice the abscissa CD. (See page 378. This should also remind you of Apollonius.)

2. Using modern calculus find the center of gravity (centroid, center of mass) of the paraboloid $z = 9 - (x^2 + y^2)$. Use this to verify $\frac{IA}{AO} = \frac{3}{2}$ and $\frac{AO}{OI} = \frac{2}{1}$ (page 379).

3. Use Fermat's tangent method to find the relationship between the subtangent and abscissa. Verify the result using modern methods.