

## Reading Assignment 19: The Invention of Calculus

*Required Readings:* Chapter 17 of Morris Kline. *Mathematical thought from ancient to modern times*, volume 1. Oxford University Press, 1990. You may skim pages 365-370 and 376-378. Skip sections 5-7 if you choose.

### Questions:

- Kline enumerates four problems that spurred the development of calculus. Describe two in your own words. Use pictures if you'd like.
- Draw a parallelogram and then divide it by drawing a line segment that connects two diagonal vertices. Explain Cavalieri's proof that the area of a parallelogram has an area that is twice that of one of the triangles formed by dividing the figure. Use pictures if you'd like.
- Explain one of Nieuwentijdt's criticisms of Leibniz's calculus. In your opinion, could similar criticisms be leveled against Newton's methods in "On analysis by means of equations with an infinite number of terms" and in "Methods of Fluxions and Infinite Series"? Why or why not?
- Explain the astronomical metaphor that Bernoulli used to describe infinitesimals.
- **Bonus:** In full detail carry out the calculation that Newton uses to show the area under the curve  $y(x) = mx^{m-1}$  is given by the equation  $Area(x) = ax^m$ . The calculation is described on pages 359-360. Is there anything strange about this calculation?

### References

Morris Kline. *Mathematical thought from ancient to modern times*, volume 1. Oxford University Press, 1990.