

# Mathematics 3010, Summer 2009: Chapter 4 Problems

## History

1. How did Archimedes prove his assertion that he could move any weight by himself to king Hiero?
2. How many books comprise the *Conics*? How many still exist?
3. How many sides did the polygons with which Archimedes estimated pi have?
4. What may have motivated the Greeks to study conic sections?
5. Who first recorded the focal property of parabolas?
6. What was one intended application of the focal property of parabolas?
7. What did Archimedes consider his greatest mathematical achievement?
8. What famous politician/philosopher found Archimedes tomb in 75 BCE?

## Mathematics

1. Where is the center of gravity of a parallelogram? A triangle?
2. Where should the fulcrum be placed along a ten meter lever to balance two weights, one 14 kg and the other 10 kg? (p 127, #1)
3. If a weight of 8 kg is placed 10 m from the fulcrum of a lever, and a weight of 12 kg is placed 8m from the fulcrum in the opposite direction, towards which weight will the lever incline? (p. 127, #2)
4. Find the area of the region bounded by the parabola  $y=x^2$  and the line  $y=1$  using Archimedes result. Check the result using calculus.
5. Find the focus of the parabola  $y=x^2$ . Can you figure it?
6. Given the parabola  $x=y^2$ , find the equation of the tangent line using calculus, and compare with the description of the tangent line given by Apollonius in Conics, I.
7. If a sphere is inscribed in a cylinder (without top and bottom) whose height equals the diameter of the sphere, how do the surface areas of the sphere and cylinder compare?
8. What is the perimeter of a hexagon inscribed in a circle of radius  $r$ ?