

### Math 3010 Exam Information

The exam will have four (multi-part) questions, of roughly equal weight, one drawn from each of the following areas:

- (1) Greek geometry: ruler and compass constructions; the three famous construction problems (doubling the cube, squaring the circle, trisecting the angle) that are not accessible by ruler and compass (but, for instance, we showed how to use the quadratrix to trisect an angle); the regular convex polyhedra (“Platonic solids”); the Eudoxan notion of ratio and the method of exhaustion; the classical approach to conic sections (only the parabola, as in our discussion of the work of Archimedes; you don’t need to know all the arguments, but you should know the focus-directrix definition of the parabola and Archimedes’s results on quadrature).
- (2) Euclid’s algorithm and modular arithmetic: finding gcd’s; finding integer solutions to equations  $ax + by = \gcd(a, b)$  where  $a$  and  $b$  are fixed integers; Chinese remainder theorem.
- (3) Conics and cubic equations: the work of Omar Khayyam, Sharaf al-Din al-Tusi, Cardano/Tartaglia (you are not required to memorize the cubic formula), and the use of “modern” methods of analytic geometry and calculus to analyze the graphs of cubics and conics.
- (4) Basic notions of set theory: definition of bijection and cardinality; interesting examples of bijections (natural numbers and rational numbers, eg); examples of infinite sets with different cardinalities (Cantor diagonalization argument); Russell’s paradox.