

oral exam

math228, classical geometry

fall 2021

Below is a list of "geometrical" topics for the oral exam. Some include references to books that were used during the semester. One can also suggest it's own topic, which will require approval from the instructor. Students will be asked to talk about their chosen topic for 30 minutes during a one-on-one interview.

selected topics

... in books we read

- ★ The Dedekind axiom, Dedekind cuts and the real numbers (2.12 [Hart13])
- ★ Rigid motions and the SAS criterion for congruence of triangles (3.17 [Har13])
- ★ Constructible polygons (6.28, 6.29 [Har13], theorem 29.4) *taken by John Stathopoulos*
 - Hyperbolic geometry and the Poincaré disk (7.40 [Har13])
 - Circle inversion (5.3 [CG67]) *taken by Jaymie Métivier*
 - Hyperbolic trigonometric functions (5.9 [CG67])
 - Projective geometry and reciprocation (6.1, 6.5 [CG67]) *taken by Andrea Jirasek*
 - Conics and reciprocation (6.3 [CG67])

differential geometry

- ★★ Parallel transport and geodesics
- ★★ Differential geometry and analogues of curves and surfaces in $\mathbb{R}^n$
- ★★★ Curvature of surfaces and the Gauss-Bonnet theorem

miscellaneous topics

- ★★ Kepler's laws of planetary motion *taken by Annie Zhou*
- ★ Trilinear coordinates and centers of triangles *taken by Wenwen Tan*
 - The geometry of roots of unity and complex numbers
- ★ The stereographic projection and integer solutions to the equation $x_1^2 + x_2^2 + \dots + x_n^2 = k^2$
 - Fermat's last theorem *taken by Nicholas Derby*
 - Group theory and the geometry of Cayley graphs *taken by Marwa Younis*
 - History of non-Euclidean geometries *taken by Cassandra Thibault-Côté*
 - Dihedral groups

Colored stars are used to indicate (potentially major) dependencies with other branches of mathematics.

- ★ calculus
- ★ linear algebra
- ★ real analysis