Department of Mathematics and Statistics Colloquium

Incidence Relations: Thinking in the Box

William Sanders

Emeritus, James Madison University

Abstract: A cube having edge p is pushed into the corner of a box. Incidence relations for the edges, vertices, and faces of the cube are given. The dual of the cube, an octahedron, is identified. The cube is examined under isometries of the cube. A segment of length p is broken into three parts $\{a, b, c\}$ with $a + b + c = p$. The arrangements of $\{a, b, c\}$ under S_3, the symmetric group of order 3 have consequences in the box; these are examined. The cube can be partitioned into sub-cubes in various ways. A Rubik's partition into 27 sub-cubes is examined. Each cube is assigned its inscribed sphere and its circumscribed sphere. Points selected from the integer lattice in the first octant are selected to serve as poles. The corresponding polars are developed with respect to selected spheres. The original cube has an axis of symmetry through the origin. We project the cube to the subspace perpendicular to this axis. The eight vertices of the cube project into seven points, six on a circle and the seventh serves as the center of this circle. Additional projections are possible including the one onto the plane containing the base face of the cube, $z = 0$.

Monday, October 31 at 3:45 in Roop 103

refreshments at 3:30