Math 199, Fall 2023
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Participation assignment 19 - More volumes

Estimated time: 25-40 minutes.

Point value: 3 points.

Goals: Practice using integrals to compute more volumes.

1) Given a sphere of radius R, a *great circle* is a circle on its surface which is of the largest possible size, i.e. also of radius R. Suppose you are given such a sphere with two great circles drawn on it which are perpendicular to each other. You then shave off four sides of the sphere so that the remaining cross-sections (perpendicular to the great circles) are squares whose corners lie on the great circles. Imagine you are peeling a fruit with four strokes, and you take a little bit too much fruit off in the process. Compute the volume of the remaining solid.
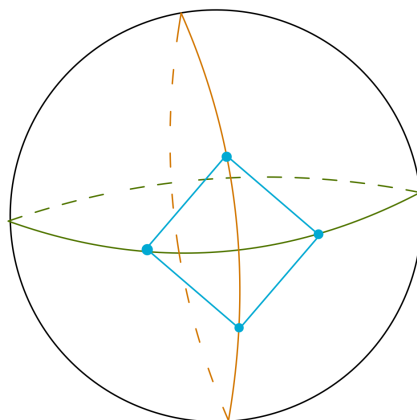
2) The five *platonic solids* are the only polyhedra whose faces are regular polygons of the same shape, and the same number of faces meet at each vertex. You already know how to find the volume of one of these: the cube. Derive formulas for the volume of two more: the tetrahedron (made up of 4 equilateral triangles) and the octahedron (made up of 8 equilateral triangles).

Bonus: If you still have time, think about how you might compute the volume of the other two: the dodecahedron (made up of 12 regular pentagons) and the isocahedron (made up of 20 equilateral triangles).