Math 1118: Second Project
Due: Monday, December 3rd

In this project we will think about problems related to regular convex polyhedra.

Construction
1 (15 pts) Construct each of the 5 regular convex polyhedra.
   - An edge of your tetrahedron should be 5 inches in length.
   - An edge of your octahedron should be 4 inches in length.
   - An edge of your cube should be 4 inches in length.
   - An edge of your dodecahedron should be 2 inches in length.
   - An edge of your icosahedron should be 3 inches in length.

2 (5 bonus pts) For pizazz in the construction/design of each of the solids above—this will be a difficult point to earn.

3 (5 pts) Compute the surface area of the dodecahedron you constructed. Explain your reasoning. Big hint, for the dodecahedron, consider this diagram of the regular pentagon

\[ \phi = \frac{1 + \sqrt{5}}{2} \]

where \( \phi \). Have you seen this number before?

Viewpoints
In this series of questions, we will suppose in turn that you live on a planet that is shaped like each of the regular convex polyhedra—not unlike Le Petit Prince who lives on an asteroid.
4 (15 pts) Considering each of the five regular convex polyhedra in turn, construct a table like the one

<table>
<thead>
<tr>
<th></th>
<th>tetrahedron</th>
<th>octahedron</th>
<th>cube</th>
<th>dodecahedron</th>
<th>icosahedron</th>
</tr>
</thead>
<tbody>
<tr>
<td>middle face</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>middle edge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vertex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

that shows what fraction of the planet’s surface could you see if you stood:

(1) In the middle of a face?
(2) In the middle of an edge?
(3) On a vertex?

In each case, explain your reasoning.

5 (5 pts) Now suppose that you lived on a tetrahedron. If you wished to go on a walk, surveying your polyhedral planet, give the shortest path you can (draw it on a net) that would allow you to observe the entire tetrahedron-planet. Explain your reasoning.

**Grading Rubric**

This assignment is worth 40 points with points assigned as described above.