

# Regular Polyhedra Worksheet

Dr. Sarah's MAT 3610: Introduction to Geometry

goals:

- Geometric Perspectives

I can compare and contrast multiple geometric perspectives.

**Welcoming Environment:** Keep it a safe place to express meaningful ideas and opinions. Actively listen to others and encourage everyone to participate. Part of the welcoming environment is to keep an open mind as you engage in our class activities, explore consensus and employ collective thinking across barriers. Maintain a professional tone, show respect and courtesy, and make your contributions matter.

1. **Building Community:** What are the preferred first names of those sitting near you? If you weren't able to be there write N/A or give reference to anyone you had help from.
  
2. Investigate polyhedral models—nets and the physical models I provide. Roughly sketch each polyhedra and count the vertices  $V$ , edges  $E$ , and faces  $F$ . At the beginning of the 20th century, Felix Klein revolutionized mathematics and physics with the idea of a transformation group. In his Erlangen Program, the properties of a space were now understood by the transformations that preserved them. His ideas became the basis for geometry in the 20th century. So next, consider geometric transformations that are isometric and map the polyhedra onto itself—specifically rotations of a polyhedra that take it back to the same place.

name	rough sketch	$V$	$E$	$F$	symmetries that preserve the polyhedra
tetrahedron					
cube					
octahedron					

name	rough sketch	$V$	$E$	$F$	symmetries that preserve the polyhedra
icosahedron					
dodecahedron					

- Next, look back at all five polyhedra for patterns involving  $V$ ,  $E$ , and  $F$ . Explain what you find.
- Sketch a spherical polyhedra made out of lunes that has no flat equivalent, from the Euclidean and spherical perspectives interactive video.
- What is  $V$ ,  $E$ , and  $F$  for this spherical polyhedra—don't forget to count the outside face that is still bounded by the great circles and sitting on the surface of the sphere too?
- What are symmetries or transformations that preserve this spherical polyhedra?
- If you didn't already, can you find a linear equation involving  $V$ ,  $E$ , and  $F$  that all the polyhedra satisfy? Does the spherical polyhedra satisfy it too?
- Help each other and PDF responses to ASULearn:** If you are finished with the worksheet before I bring us back together, first ensure that your entire group is finished too, and if not, help each other. If your entire group is finished, then split up and pull up chairs so that you can discuss your responses with other groups. Collate your handwritten responses, preferably on this handout, into one full size multipage PDF for submission in the ASULearn assignment. I recommend you turn it in sometime today, but you have until the next class.