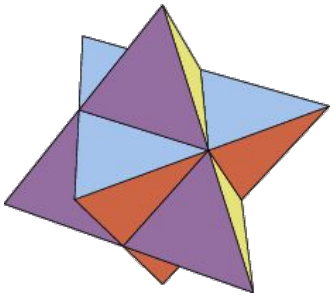
Activity 1: Building Solids

1. Use regular polygons to try building a solid figure. Then, do it again! What kinds of solid figures can you build?

2. In this activity, we wish to focus only on the figures with the following limitations:
   - The figure should have **regular polygons** on all faces
   - The figure should be **convex**, which means there are no 'dents' or 'caves' (technically, it contains all line segments between points on the solid)

   These are called **Johnson Solids**.
   Is the image given below an example of a Johnson Solid? Why or Why Not?



Stella Octangula

3. Try making at one example of all the following:
   a. A ***pyramid*** has triangles for all but one of its faces
   b. A regular ***prism*** has squares for all but two of its faces, with two other faces that are the same and parallel
   c. An ***antiprism*** has triangles for all but two of its faces, with two other faces that are the same, parallel, and rotated
   d. A ***platonic solid*** has all same faces
   e. A ***bipyramid*** is two pyramids glued together at their bases
   f. A ***cupola*** is a figure with two parallel faces, with triangles and squares alternating in a ring around them
4. What other types of Johnson solids can you make? How did you find them?

Activity 2: Analyzing the Solids

1. How many different kinds of pyramids can you find? Can there be a hexagonal pyramid?
2. A solid is said to have **symmetry** if there is a way to rotate or reflect it so that it ends up the same. Which solids have symmetry?
3. Rank your solids by symmetry. What patterns do you observe?

Figure	Number of ways to rotate it	Number of ways to reflect it

4. What are the statistical properties of the different figures you have in front of you? What patterns do you observe?

Activity 3: Naming Johnson Solids

Here are some of the key terms used in naming the solids. This list was taken from Wikipedia.

- **Bi-** means that two copies of the solid in question are joined base-to-base. For cupolae and rotundae, they can be joined so that like faces (ortho-) or unlike faces (gyro-) meet. In this nomenclature, an octahedron would be a square bipyramid, a cuboctahedron would be a triangular gyrobicupola, and an icosidodecahedron would be a pentagonal gyrobirotunda.
- **Elongated** means that a prism has been joined to the base of the solid in question or between the bases of the solids in question. A rhombicuboctahedron would be an elongated square orthobicupola.
- **Gyroelongated** means that an antiprism has been joined to the base of the solid in question or between the bases of the solids in question. An icosahedron would be a gyroelongated pentagonal bipyramid.
- **Augmented** means that a pyramid or cupola has been joined to a face of the solid in question.
- **Diminished** means that a pyramid or cupola has been removed from the solid in question.
- **Gyrate** means that a cupola on the solid in question has been rotated so that different edges match up, as in the difference between ortho- and gyrobicupolae.

1. Can you apply these terms to some of the solids you have made? Turn the page for some hints!

Some Johnson Solids

1. J34 Pentagonal Orthobirotunda
2. J62 Metabidiminished Icosahedron
3. J10 Gyroelongated Square Pyramid
4. J84 Snub Disphenoid
5. J65 Augmented Truncated Tetrahedron
6. J39 Elongated Pentagonal Gyrobicupola
7. J22 Gyroelongated Triangular Cupola
8. J51 Triaugmented Triangular Prism
9. J88 Sphenomegacorona
10. J86 Sphenocorona
11. J30 Pentagonal Orthobicupola