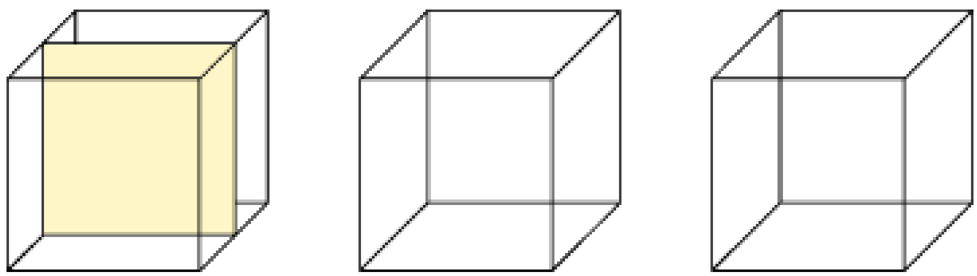
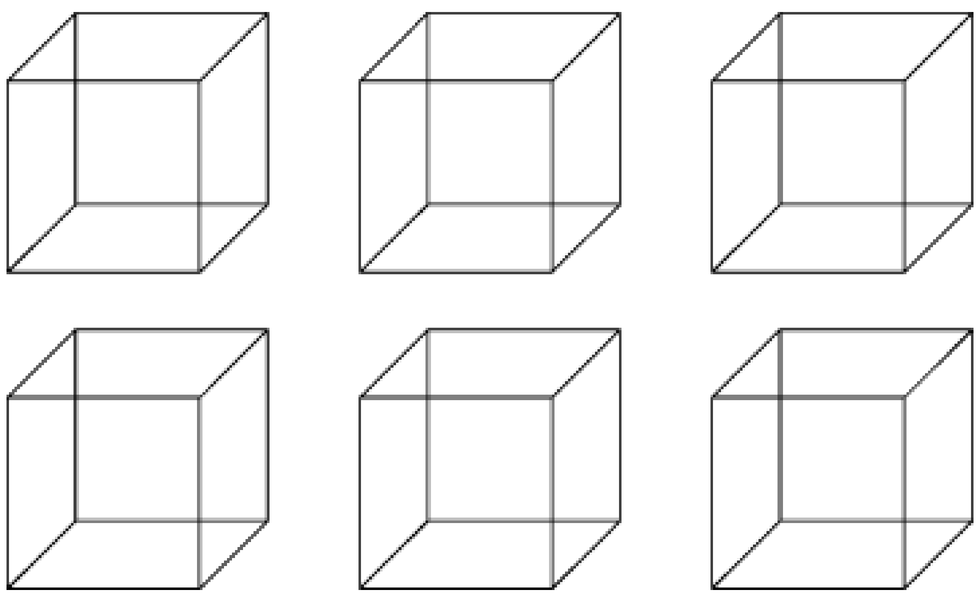
Symmetry in Space

In this activity, we will examine the symmetry of regular polyhedra. Symmetry of plane figures was discussed in Activity 5. Plane figures have *lines* of reflectional symmetry. Rotational symmetry for plane figures is described by the *order* of rotational symmetry about a *point*. The corresponding concept of reflectional symmetry for solids requires a *plane* of reflectional symmetry, whereas rotational symmetry is described by the *order* of rotational symmetry about a *line*.

Take a cube and examine it carefully. Planes of reflectional symmetry can be found by imagining the slicing of a cube into two congruent solids. A hot-wire cutter can be used to cut a styrofoam model into two such solids. The path the hot wire follows describes the plane of reflectional symmetry. The cube below has its intersection with the plane of symmetry shaded. Outline and shade the other two planes of reflectional symmetry that bisect four parallel edges.



Draw and shade the planes of symmetry that include a pair of parallel edges.



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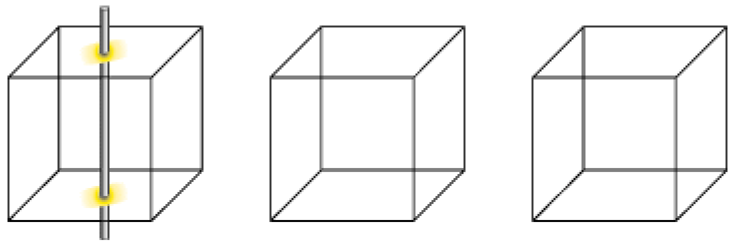
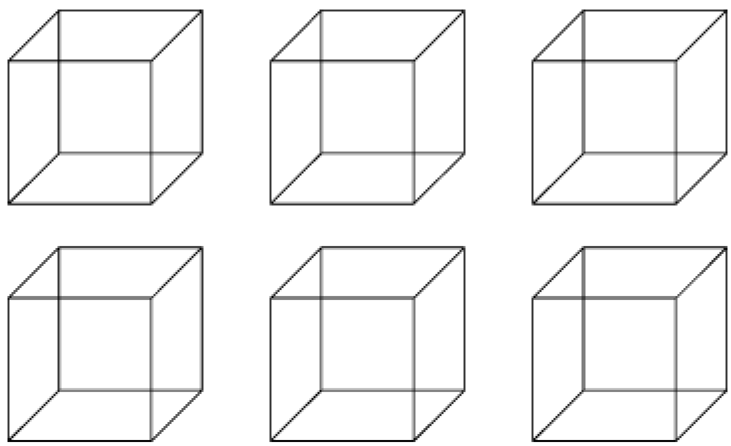
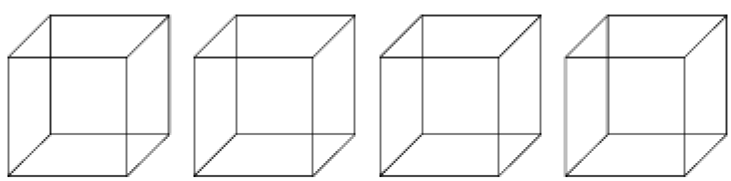
Use your fingers as endpoints of an axis to rotate the cube. Place your fingers in the center of a pair of opposite faces. Rotate 90° and notice that the cube has the same orientation. Repeat this three times to return to the original location. This shows that the cube has an axis of rotational symmetry of order 4. This axis is drawn on the first cube below. Mark the intersection points and draw axes for the remaining cubes.



Draw the axes of rotational symmetry of order 2 on the cubes below.



Draw the axes of rotational symmetry that pass through pairs of opposite vertices. What is the order of rotational smmetry for each of these axes?



The total number of axes of rotational symmetry for the cube is __________.

The total number of planes of reflectional symmetry is __________.

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