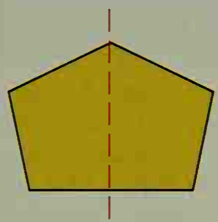
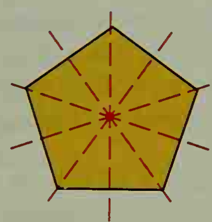
14-8 *Symmetry in the Plane and in Space*

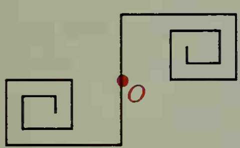
A figure in the plane has **symmetry** if there is an isometry, other than the identity, that maps the figure onto itself. We call such an isometry a *symmetry* of the figure.

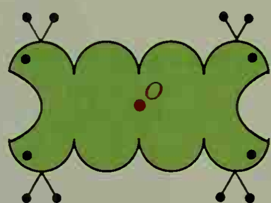
Both of the figures below have **line symmetry.** This means that for each figure there is a symmetry line k such that the reflection R_k maps the figure onto itself. The pentagon at the left has one symmetry line. The regular pentagon at the right has five symmetry lines.

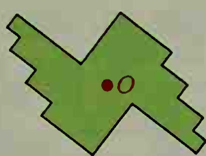




Each figure below has **point symmetry.** This means that for each figure there is a symmetry point O such that the half-turn H_O maps the figure onto itself.



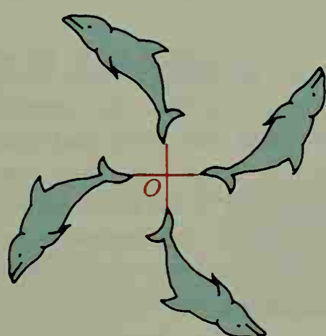




Besides having a symmetry point, the middle figure above has a vertical symmetry line and a horizontal symmetry line.

A third kind of symmetry is **rotational symmetry.** The figure below has the four rotational symmetries listed. Each symmetry has center O and rotates the figure onto itself. Note that 180° rotational symmetry is another name for point symmetry.

(1) 90° rotational symmetry: $\mathcal{R}_{O,\,90}$
(2) 180° rotational symmetry: $\mathcal{R}_{O,\,180}$ (or H_O)
(3) 270° rotational symmetry: $\mathcal{R}_{O,\,270}$
(4) 360° rotational symmetry: the identity I



The identity mapping always maps a figure onto itself, and we usually include the identity when listing the symmetries of a figure. However, we do not call a figure *symmetric* if the identity is its only symmetry.