After the investigation in Problem **1.1**, it becomes apparent that a *straight line* has the following symmetries:

1. **Reflection-in-the-line symmetry** (think of a “mirror” with the line as an axis);
2. **Reflection-perpendicular-to-the-line symmetry** (reflection through any axis perpendicular to the line)
3. **Half-turn symmetry**;
4. **Rigid-motion-along-itself symmetry** (for straight lines in the plane, this is called *translation symmetry*);
5. **3-dimensional rotation symmetry** (in a 3-dimensional space, rotate the line around itself through *any* angle using itself as an axis);
6. **Central symmetry, or point symmetry** (central symmetry through any point *p* sends any point *a* to the point at the same distance from p but on the diametrically opposite side);
7. **Similarity symmetry or self-similarity** (any segment of a straight line is similar to any other segment).

<u>HW Assignment -</u> <u>due Tuesday, January 29</u>

Problem 2.1 What Is Straight on a Sphere?[1]

a. Imagine yourself to be a bug crawling around on a sphere. (This bug can neither fly nor burrow into the sphere.) The bug's universe is just the surface; it never leaves it. What is "straight" for this bug? What will the bug see or experience as straight? How can you convince yourself of this? Use the properties of straightness (such as symmetries) which you talked about in Problem **1.1**.

b. Show (that is, convince yourself, and give an argument to convince others) that the great circles on a sphere are straight with respect to the sphere, and that no other circles on the sphere are straight with respect to the sphere.

c. (Optional question) How would a bug—who experiences only a 2-dimensional world—know that it is on a surface that resides in 3-dimensions? How would these bugs determine that they are actually on the surface of a sphere?

[1] Page 28, in your textbook.