

# Worksheet 7

Math 202

Monday, May 13, 2021

We're continuing to investigate azimuthal map projections centered on the north pole, which take lines of latitude to concentric circles and lines of longitude to radial lines. This week's projections will cover the whole earth in a finite disc, and latitudes near the south pole will end up as big circles near the edge of the map.

The *azimuthal equidistant projection* is not obtained by shining a light; instead, the distance from the center of the map is proportional to the actual distance to the north pole, so there is no stretching of north-south miles. So the parallel at a latitude  $\beta$  is mapped to a circle of what radius? How much is an east-west mile stretched? Plug in some numbers as always.

The defining property of the *Lambert azimuthal projection* is that it preserves areas. Suppose that the circle of latitude  $\beta$  is mapped to a circle of radius  $r(\beta)$ . Write an equation involving  $r(\beta)$  and  $r'(\beta)$  that says that the east-west stretching times the north-south stretching equals 1. Can you find a function  $r(\beta)$  that satisfies this equation? (It might be helpful to notice that  $r(\beta)r'(\beta)$  is the derivative of  $\frac{1}{2}r(\beta)^2$ .)

If you have time to spare, analyze the *orthographic projection*, which just takes every point in the northern hemisphere straight up to a plane, as if we were taking a picture from space a million miles above the north pole.