Worksheet 4

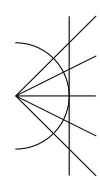
Math 202

Monday, April 22, 2024

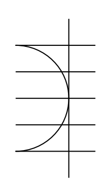
Write down your group members' names and email addresses. What is the coolest map they have ever seen?

This week and next week we're investigating *cylindrical map projections*, which map circles of latitude on the earth to horizontal lines in the plane, and circles of longitude to vertical lines.

In the equirectangular projection, a point on the surface of the earth at a latitude of α radians east and β radians north is mapped to the point (α, β) in the plane. Thus the image of the earth runs from $x = -\pi$ to $x = +\pi$ and from $y = -\pi/2$ to $y = +\pi/2$. As you move from the equator toward the poles, the north-south miles don't get stretched, but the east-west miles get stretched more and more. Discuss this with your group, referring to your globes and your maps. Work out a formula for the east-west stretching at a given latitude β. Plug in some values of β to get a feel for the numbers.



In the central cylindrical projection, that point on the earth is instead mapped to (α, ?) in the plane, where ? is some function of β. Figure out what the function is. Now the image of the earth should run from $x = -\pi$ to $x = +\pi$ and from $y = -\infty$ to $y = +\infty$. Does this make sense in terms of the geometry of the projection, and the function you found? As you move from the equator toward the poles, an east-west mile gets stretched the same as before, but a north-south mile also gets stretched, by a different amount. Work out a formula for the north-south stretching at a given latitude β. How much does a square mile get stretched? (How much did it get stretched before?) Again, plug in some actual numbers.



Same for the Lambert cylindrical projection: What is y as a function of β? What is the range of y-values? How much does a north-south mile get stretched, as a funtion of β? How much does a square mile get stretched?