Worksheet 3

Math 202

Monday, April 15, 2021

We've placed the earth in xyz-space, with the z-axis going through the poles, the equator in the xy-plane, and the prime meridian in the xz-plane. Given a city's the latitude and longitude of a city, we want to find its x-, y-, and z-coordinates.

First take a city on the equator, so the z-coordinate is zero. If the longitude is α degrees east, find the x- and y-coordinates.

Next take a city on the prime meridian, so the y-coordinate is zero. If the latitude is β degrees north, find the x- and z-coordinates.

Next take a general city, at a longitude of α degrees east and a latitude of β degrees north. Convince yourselves that the z-coordinate only depends on β, not on α, and that it's the same one you found a moment ago.

Imagine that you sliced through that circle of latitude at β degrees north, taking a cap off the top of the earth and leaving a flat circle on top. What is the radius of that circle, in terms of β?

So what are the x- and y-coordinates of a city at α degrees east and a latitude of β degrees north?

What if you're in the western hemisphere, or the southern hemisphere?

Last week you found a formula for great circle distance in terms of straight line distance, and a formula for the straight line distance in terms of xyz-coordinates. Combine these with the formulas you found today to get a formula for the great circle distance between a city at α degrees east, β degrees north, and a city at γ degrees east, δ degrees north.

Eugene is located at 44°N, 123°W. Look up the latitude and longitude of the city you chose last Monday, and use the formula you just found to get the great circle distance.