

Worksheet 3

Math 202

Monday, October 11, 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 line 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 on Monday, and use the formula you just found to get the great circle distance.