In-Class Exercise - Measuring Great Circle Distances on the Globe

Definition of Great Circle - a line passing between any two points on the globe, which can form an angle with the vertex at the center of the Earth (e.g. all meridians are great circles, the only parallel that is a great circle in the 0 degree lat parallel, or equator)

Equation for Great Circle Distance on a Sphere Between any Two Points, A and B on a sphere:

\[
\cos(D) = (\sin(a)\sin(b)) + (\cos(a)\cos(b)\cos|\phi|)
\]

where \(D\) = angular distance in degrees between two points (1 degree on great circle = 69 miles), \(a\) and \(b\) are the geographic latitudes of points A and B, \(|\phi|\) = the absolute value of the difference in longitude between pts. A and B

**Problem:** determine the great circle distance in miles between Nome, AK and Miami, Fla. using the following positions.

Nome: lat = 63° 30' N  
long = 165° 20' W  
\(\cos D = (\sin 63.5 \times \sin 25.75) + (\cos 63.5 \times \cos 25.75 \times \cos 85.13)\)

Miami: lat = 25° 45' N  
long = 80° 11' W  
\(\cos D = 0.23\)  
hint: you must convert your lat and long to decimal degrees

\[D = 64.97\times 69 = 4483.33\text{ Mi}
\[D = 7213.69\text{ Km}

Part 2 - Examine the map figure below with pt. locations 1, 2, and 3. The points are located at the following UTM coordinates:

<table>
<thead>
<tr>
<th>Easting (m)</th>
<th>Northing (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pt. 1</td>
<td>481320</td>
</tr>
<tr>
<td>pt. 2</td>
<td>481320</td>
</tr>
<tr>
<td>pt. 3</td>
<td>481490</td>
</tr>
</tbody>
</table>

Use Pythagorean's theorem to determine the distances between the following point combinations (SHOW all of your math work!):

1. Distance 1-2 (meters) = 40 m
2. Distance 1-3 (meters) = 278.03 m
3. Distance 2-3 (meters) = 247.54 m
4. Distance 3-3 (meters) = 565.62 m

\[40^2 + 278.03^2 = 28.900 + 48.400 = 565.62\]

\[247.54^2 = 77.300\times 77.300 = 278.03\]

\[170^2 + 180^2 = 565.62\]

\[170^2 + 180^2 = 77.300\times 77.300 = 278.03\]