

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:

$$\cos(D) = (\sin(a) \cdot \sin(b)) + (\cos(a) \cdot \cos(b) \cdot \cos(|\lambda|))$$

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, $|\lambda|$ = the absolute value of the difference in longitude between pts. A and B

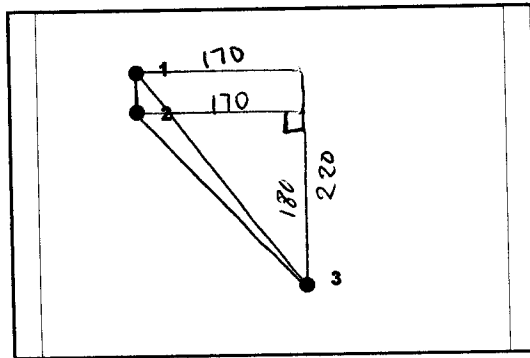
Problem: determine the great circle distance in miles between Nome, AK and Miama, Fla. using the following positions.

	63.5°				
Nome lat =	$63^\circ 30' N$	long =	$165^\circ 20' W$	$\cos D = (\sin 63.5 \times \sin 25.75) + (\cos 63.5 \times \cos 25.75 \times \cos 85.13)$	
Miami lat =	$25^\circ 45' N$	long =	$80^\circ 11' W$	$\cos D = .389$	+ .034
	25.75°		80.18°	$\cos D = .423$	
				$D = 64.97^\circ$	$\times 69 = 4483.33 \text{ Mi}$
					7213.69 Km

hint: you must convert your lat and long to decimal degrees

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

	Easting (m)	Northing (m)
pt. 1	481320	4966620
pt. 2	481320	4966580
pt. 3	481490	4966400



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) = 247.59 m
4. Distance 3-3 (meters) = 565.62 m

$$A^2 + B^2 = C^2$$

$$\begin{aligned} 2. \quad 170^2 + 220^2 &= C^2 \\ 28,900 + 48,400 &= C^2 \\ 77,300 &= C^2 \\ C &= \sqrt{77,300} \\ &= 278.03 \text{ m} \end{aligned}$$

$$\begin{aligned} 4. \quad (40 + 278.03 + 247.59) &= 565.62 \\ 3. \quad 170^2 + 180^2 &= C^2 \\ 28,900 + 32,400 &= C^2 \\ 61,300 &= C^2 \\ C &= \sqrt{61,300} \\ &= 247.59 \end{aligned}$$