TAM 212 Worksheet 1

1. What are the positions of Urbana and Delhi in spherical coordinates \( r, \theta, \phi \) (use \( R_E = 6371 \text{ km} \))?

   Urbana: 40.1097° N 88.2042° W
   Delhi: 28.6100° N 77.2300° E

2. What are the positions of Urbana and Delhi in \( x, y, z \) coordinates?

3. How far is it from Urbana to Delhi in a straight line through the Earth?

4. How far is from Urbana to Delhi along a great circle route?

5. What is the maximum latitude reached as we travel along the great circle between Urbana and Delhi?
6. What is an initial tangent vector to the great circle route from Urbana to Delhi in the \( \hat{i}, \hat{j}, \hat{k} \) basis?

7. What are the spherical basis vectors \( \hat{e}_r, \hat{e}_\theta, \hat{e}_\phi \) at Urbana, written in the \( \hat{i}, \hat{j}, \hat{k} \) basis?

8. When we take off from Urbana to fly to Delhi, which compass direction should we initially head in? Is this compass direction maintained as we fly along the great circle?