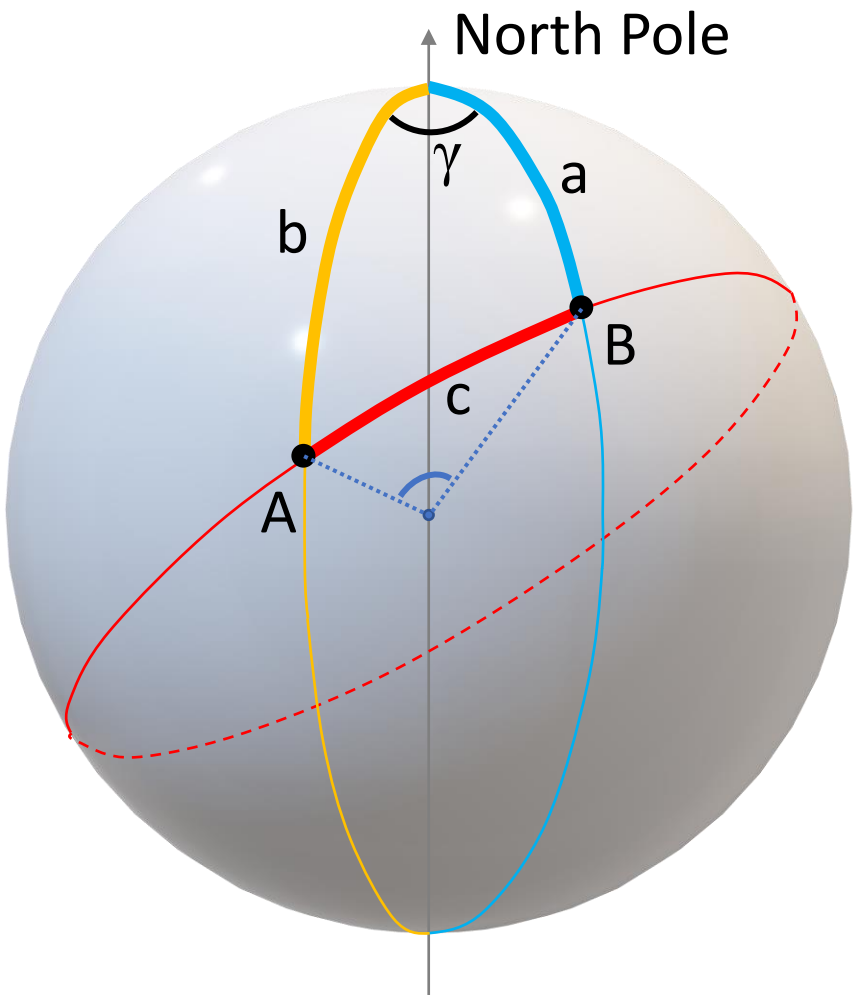
Great circle distance



Given

City A (100°E, 10°N)

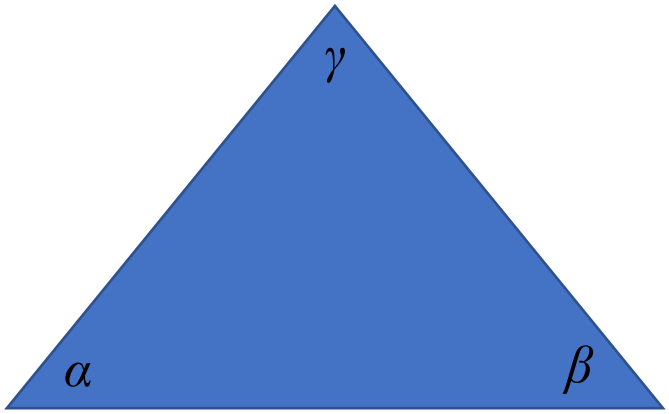
City B (130°E, 25°N)

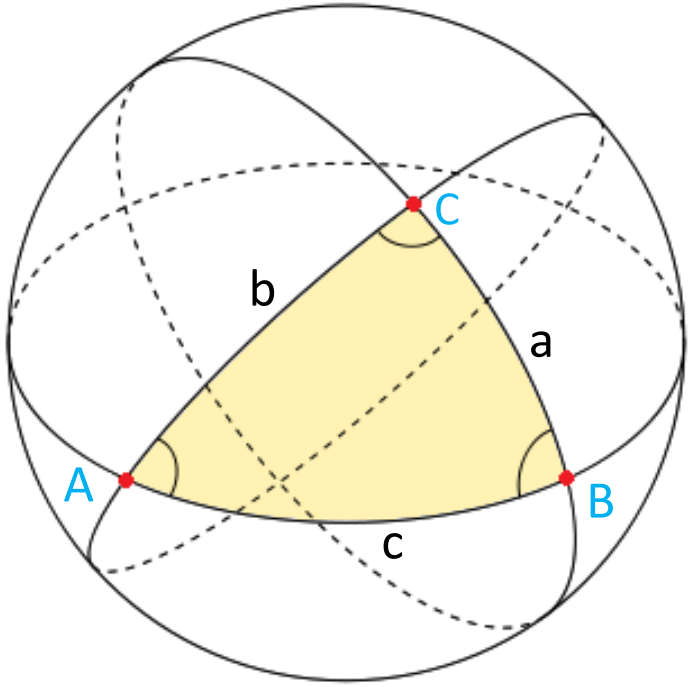
How to calculate AB distance?

- Draw the great circles (half)
- Construct a spherical triangle
- Law of Cosines
  - cos c = cos a cos b + sin a sin b cos γ
  - Use co-latitude to get a and b
  - Use longitude difference to get γ
- Inverse trigonometric functions
- Radius * Radian of angle

Spherical excess

- Surface triangle: $\alpha + \beta + \gamma = 180°$
- Spherical triangle: $\alpha + \beta + \gamma \neq 180°$
- Spherical excess: $\alpha + \beta + \gamma - 180°$





Spherical excess

- E = $\alpha + \beta + \gamma - 180°$?
- Use Law of Cosines to get c
- sin α = sin a * sin γ/sin c
- sin β = sin b * sin γ/sin c