

$$\frac{R + z}{\sin(\alpha)} = \frac{R}{\sin(\beta)} = \frac{d}{\sin(\psi)}$$

Know R, z, and α ($=\text{el}+90^\circ$), solve the first equality for β

$$\alpha + \beta + \psi = 180^\circ$$

This gets you ψ , and then the spherical earth distance is

$$R \cdot \psi = S$$

You can also solve for h, the flat earth distance, using:

$$h = \frac{R + z}{\cotan(\alpha) + \cotan(\beta)}$$

