



A tree is being pulled at point A by a tractor at point B . Find the \overrightarrow{AB} vector and the corresponding unit vector \hat{u}_{AB} .

$$\overrightarrow{AB} = \langle d_3, d_2, -d_1 \rangle$$

$$AB = \sqrt{d_1^2 + d_2^2 + d_3^2}$$

$$\hat{u}_{AB} = \frac{\overrightarrow{AB}}{AB}$$

$$\Rightarrow \hat{u}_{AB} = \left\langle \frac{d_3}{\sqrt{d_1^2 + d_2^2 + d_3^2}}, \frac{d_2}{\sqrt{d_1^2 + d_2^2 + d_3^2}}, \frac{-d_1}{\sqrt{d_1^2 + d_2^2 + d_3^2}} \right\rangle$$

Find the 3 coordinate direction angles α , β , and γ .

$$\alpha = \cos^{-1} \left(\frac{AB_x}{AB} \right)$$

$$\Rightarrow \alpha = \cos^{-1} \left(\frac{d_3}{\sqrt{d_1^2 + d_2^2 + d_3^2}} \right)$$

$$\Rightarrow \beta = \cos^{-1} \left(\frac{d_2}{\sqrt{d_1^2 + d_2^2 + d_3^2}} \right)$$

$$\Rightarrow \gamma = \cos^{-1} \left(\frac{-d_1}{\sqrt{d_1^2 + d_2^2 + d_3^2}} \right)$$

Find the transverse angle θ and azimuth angle ϕ .

$$\phi = \gamma$$

$$\theta = \tan^{-1} \left(\frac{d_2}{d_3} \right)$$