Position Vectors

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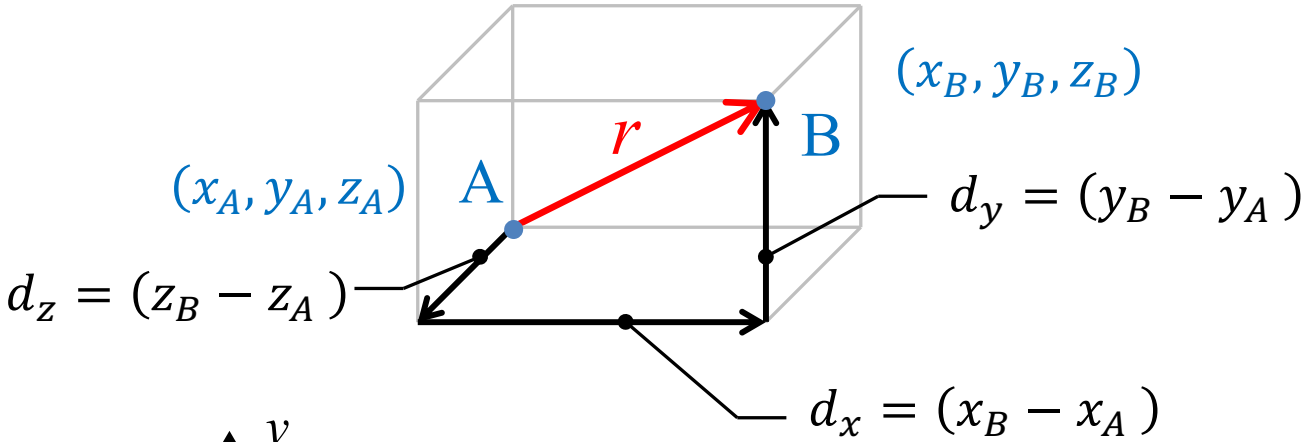
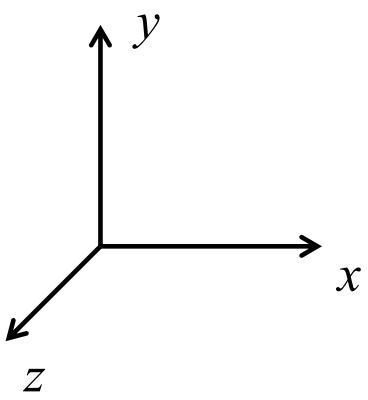
Position Vector from Point A (tail) to Point B (tip) in Three-Dimensional Space



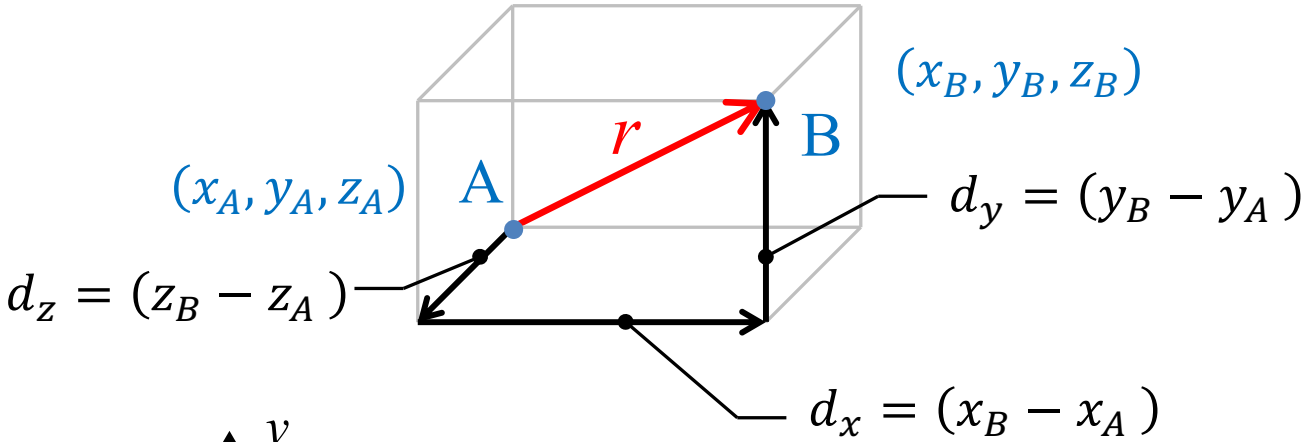


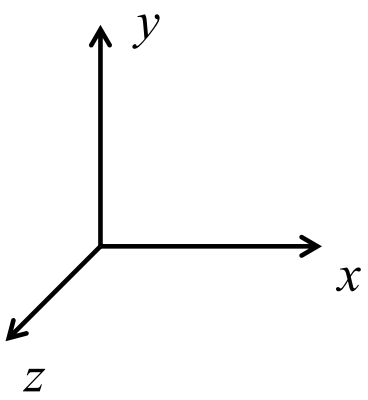
Always subtract the tip coordinate from the tail coordinate

$$\boldsymbol{r} = d_x\hat{\imath} + d_y\hat{\jmath} + d_z\hat{k}$$

$$\boldsymbol{r} = (x_B - x_A)\hat{\imath} + (y_B - y_A)\hat{\jmath} + (z_B - z_A)\hat{k}$$

Length of Position Vector in Three-Dimensional Space





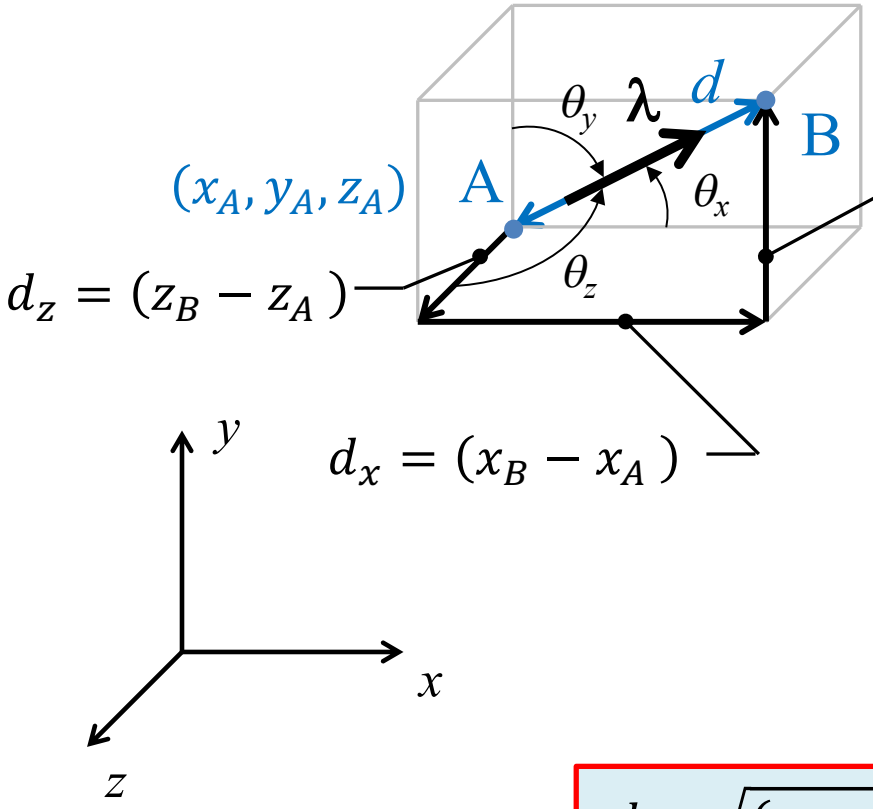
Length of positon vector ***r***

$$d = \sqrt{d_x^2 + d_y^2 + d_z^2}$$

$$d = \sqrt{(x_B - x_A)^2 + (y_B - y_A)^2 + (z_B - z_A)^2}$$

Unit Vector in the Direction of the Position Vector

$$\boldsymbol{\lambda} = (\cos\theta_x)\hat{\imath} + (\cos\theta_y)\hat{\jmath} + (\cos\theta_z)\hat{k}$$



$$\cos\theta_x = \frac{d_x}{d} = \frac{(x_B - x_A)}{d}$$

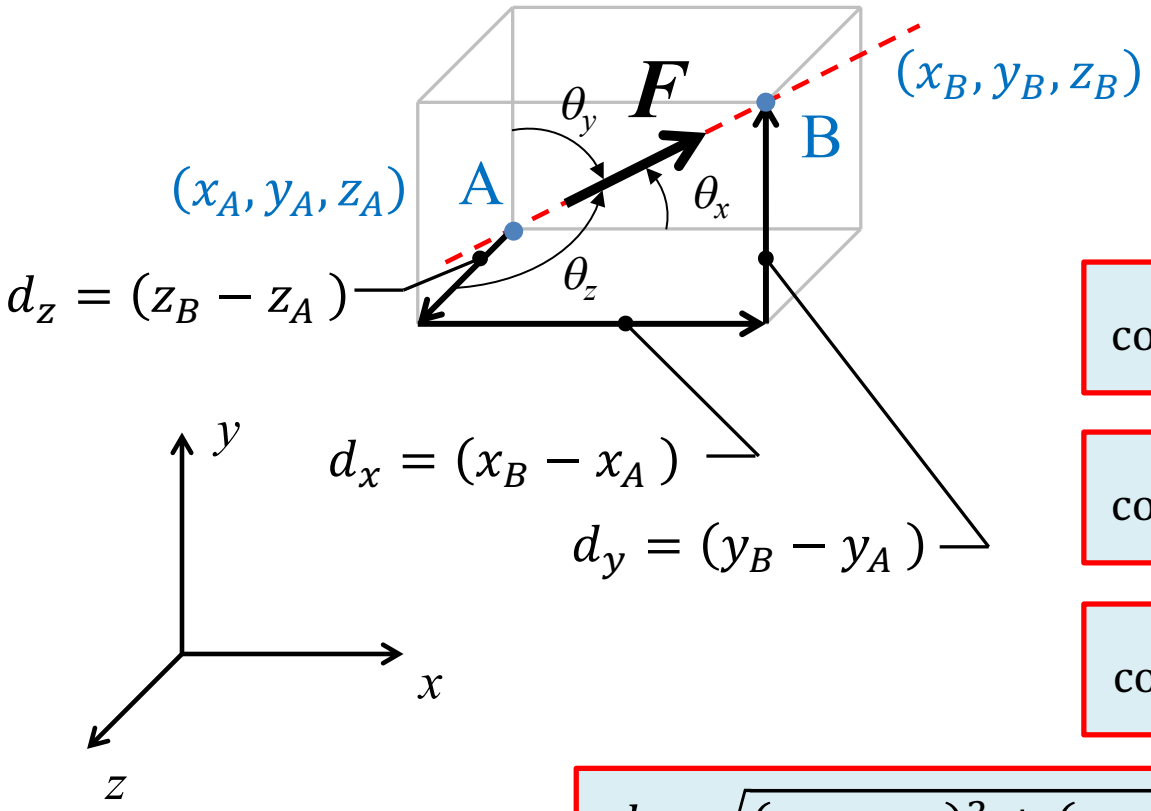
$$\cos\theta_y = \frac{d_y}{d} = \frac{(y_B - y_A)}{d}$$

$$\cos\theta_z = \frac{d_z}{d} = \frac{(z_B - z_A)}{d}$$

$$d = \sqrt{(x_B - x_A)^2 + (y_B - y_A)^2 + (z_B - z_A)^2}$$

Finding the Components of a Force in Three-Dimensional Space

$$\boldsymbol{F} = F(\cos\theta_x)\hat{\imath} + F(\cos\theta_y)\hat{\jmath} + F(\cos\theta_z)\hat{k}$$



Line-of-action of $\boldsymbol{F}$ passes through points A and B

$$\cos\theta_x = \frac{d_x}{d} = \frac{(x_B - x_A)}{d}$$

$$\cos\theta_y = \frac{d_y}{d} = \frac{(y_B - y_A)}{d}$$

$$\cos\theta_z = \frac{d_z}{d} = \frac{(z_B - z_A)}{d}$$

$$d = \sqrt{(x_B - x_A)^2 + (y_B - y_A)^2 + (z_B - z_A)^2}$$