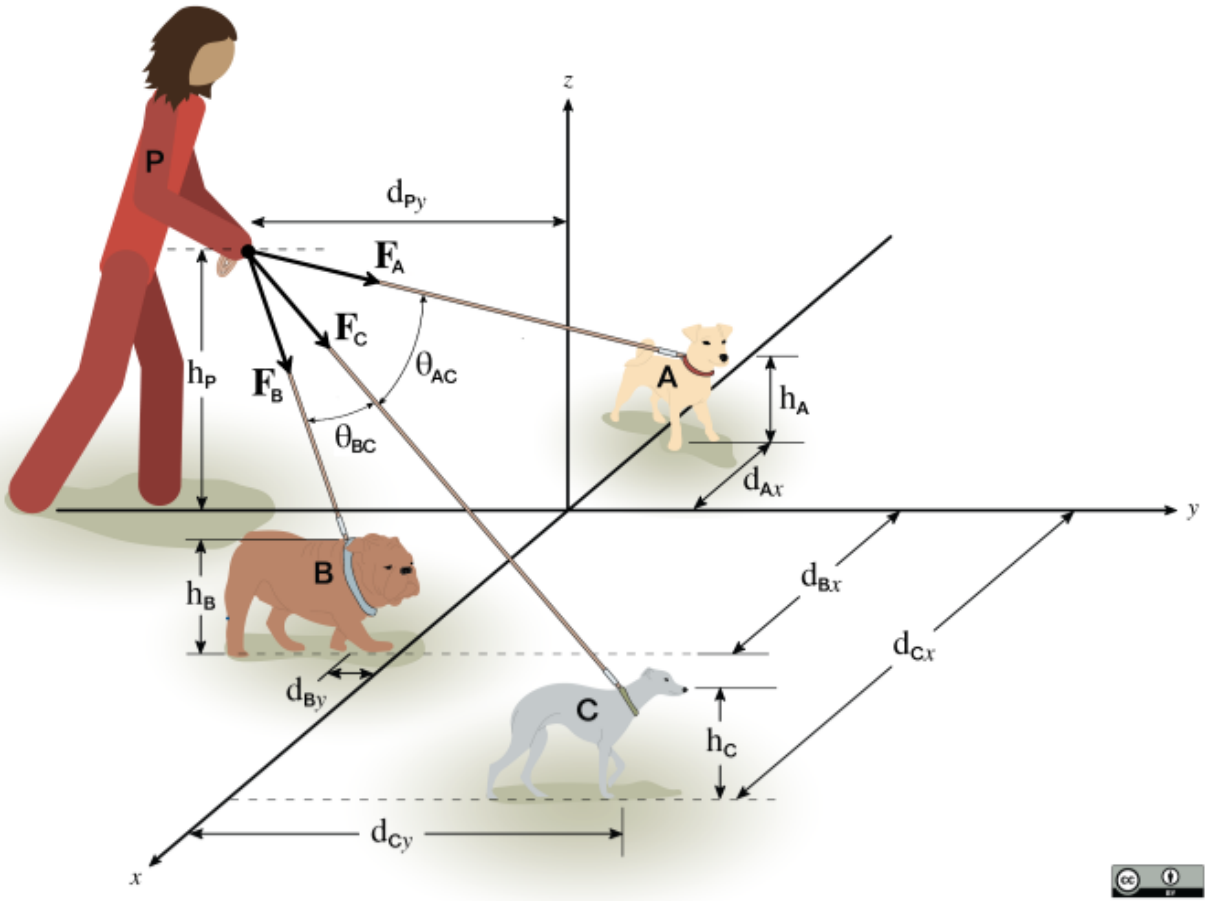
21-5-2-9-GD-002



You are walking 3 dogs which are pulling you along. Their positions can be described with the following measurements: $d_{Ax} = d_{Ax}$ m, $h_A = h_A$ m, $d_{Bx} = d_{Bx}$ m, $d_{By} = d_{By}$ m, $h_B = h_B$ m, $d_{Cx} = d_{Cx}$ m, $d_{Cy} = d_{Cy}$ m, $h_C = h_C$ m, $d_{Py} = d_{Py}$ m, and $h_P = h_P$ m.

If the dogs are pulling with $F_A = F_A$ N, $F_B = F_B$ N, and $F_C = F_C$ N respectively, what are θ_{AC} and θ_{BC}?

What are the magnitudes of the projections of F_A and F_B along leash PC?

To find θ_{AC} & θ_{BC}

Dog A

$$\vec{r}_A = -\underbrace{d_{Ax}\uparrow}_{A_x} + \underbrace{d_{Py}\uparrow}_{A_y} + \underbrace{(h_A - h_p)}_{A_z}\hat{k}$$

$$r_A = \sqrt{A_x^2 + A_y^2 + A_z^2}$$

Dog B

$$\vec{r}_B = \underbrace{d_{Bx}\uparrow}_{B_x} + \underbrace{(-d_{By} - (-d_{Py}))}_{B_y}\uparrow + \underbrace{(h_B - h_p)}_{B_z}\hat{k}$$

$$r_B = \sqrt{B_x^2 + B_y^2 + B_z^2}$$

Dog C

$$\vec{r}_C = \underbrace{d_{Cx}\uparrow}_{C_x} + \underbrace{(d_{Cy} - (-d_{Py}))}_{C_y}\uparrow + \underbrace{(h_C - h_p)}_{C_z}\hat{k}$$

$$r_C = \sqrt{C_x^2 + C_y^2 + C_z^2}$$

$$\vec{r}_A \cdot \vec{r}_C = r_A r_C \cos\theta_{AC}$$

$$A_xC_x + A_yC_y + A_zC_z = r_A r_C \cos\theta_{AC}$$

$$\theta_{AC} = \cos^{-1}\left(\frac{A_xC_x + A_yC_y + A_zC}{r_A r_C}\right)$$

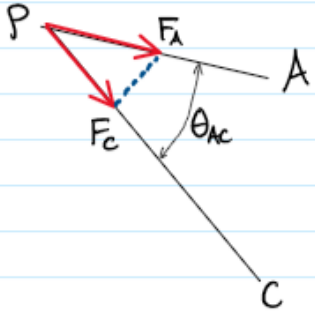
$$\vec{r}_B \cdot \vec{r}_C = r_B r_C \cos\theta_{BC}$$

$$B_xC_x + B_yC_y + B_zC_z = r_B r_C \cos\theta_2$$

$$\theta_{BC} = \cos^{-1}\left(\frac{B_xC_x + B_yC_y + B_zC_z}{r_B r_C}\right)$$

Magnitudes of Projections

$$(F_{APC})_{proj} = F_A \cos\theta_{AC}$$



$$(F_{BPC})_{proj} = F_B \cos\theta_{BC}$$