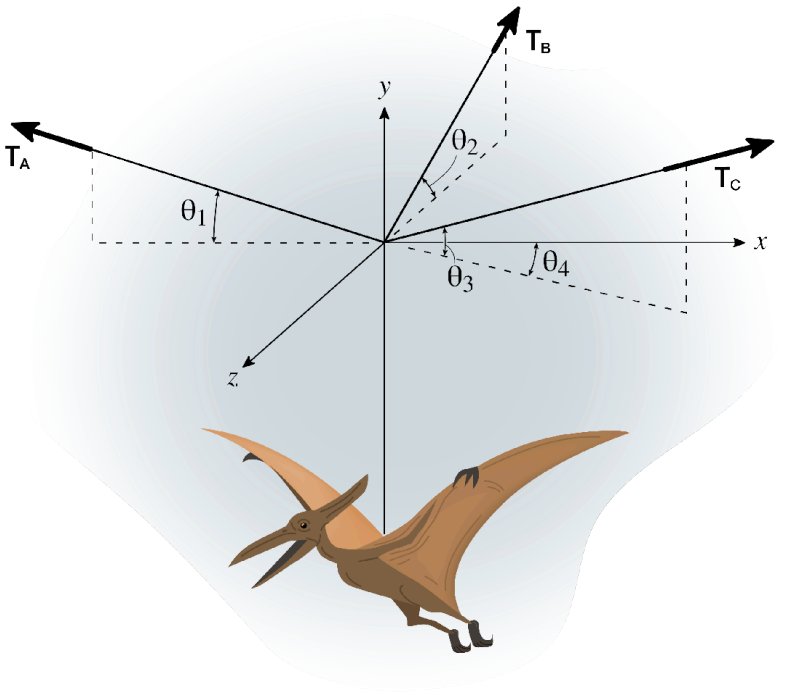
21-S-3.4-RP-05



Pterry the Pterodactyl spreads his wings such that he does not accelerate in any direction. If Pterry has a mass of m and his wings experience wind forces of $\overrightarrow{T_A}$, $\overrightarrow{T_B}$, and $\overrightarrow{T_C}$, calculate the magnitudes of the wind forces. Let $g = 9.81\ \text{N/kg}$.

$$\Sigma F_x = 0 : -T_A \cos\theta_1 + T_C \cos\theta_3 \cos\theta_4 = 0 \rightarrow T_A = T_C \cdot \frac{\cos\theta_3 \cos\theta_4}{\cos\theta_1}$$

$$\Sigma F_z = 0 : -T_B \cos\theta_2 + T_C \cos\theta_3 \sin\theta_4 = 0 \rightarrow T_B = T_C \cdot \frac{\cos\theta_3 \sin\theta_4}{\cos\theta_2}$$

$$\Sigma F_y = 0 : T_A \sin\theta_1 + T_B \sin\theta_2 + T_C \sin\theta_3 - mg = 0 \rightarrow T_C(\cos\theta_3 \cos\theta_4 \tan\theta_1 + \cos\theta_3 \sin\theta_4 \tan\theta_2 + \sin\theta_3) = mg$$

$$\Rightarrow T_C = \frac{mg}{\cos\theta_3 \cos\theta_4 \tan\theta_1 + \cos\theta_3 \sin\theta_4 \tan\theta_2 + \sin\theta_3}$$

$$\Rightarrow T_A = \frac{mg}{\sin\theta_1 + \tan\theta_4 \tan\theta_2 \cos\theta_1 + \dfrac{\tan\theta_3 \cos\theta_1}{\cos\theta_4}}$$

$$\Rightarrow T_B = \frac{mg}{\cot\theta_4 \tan\theta_1 \cos\theta_2 + \sin\theta_2 + \dfrac{\tan\theta_3 \cos\theta_2}{\sin\theta_4}}$$