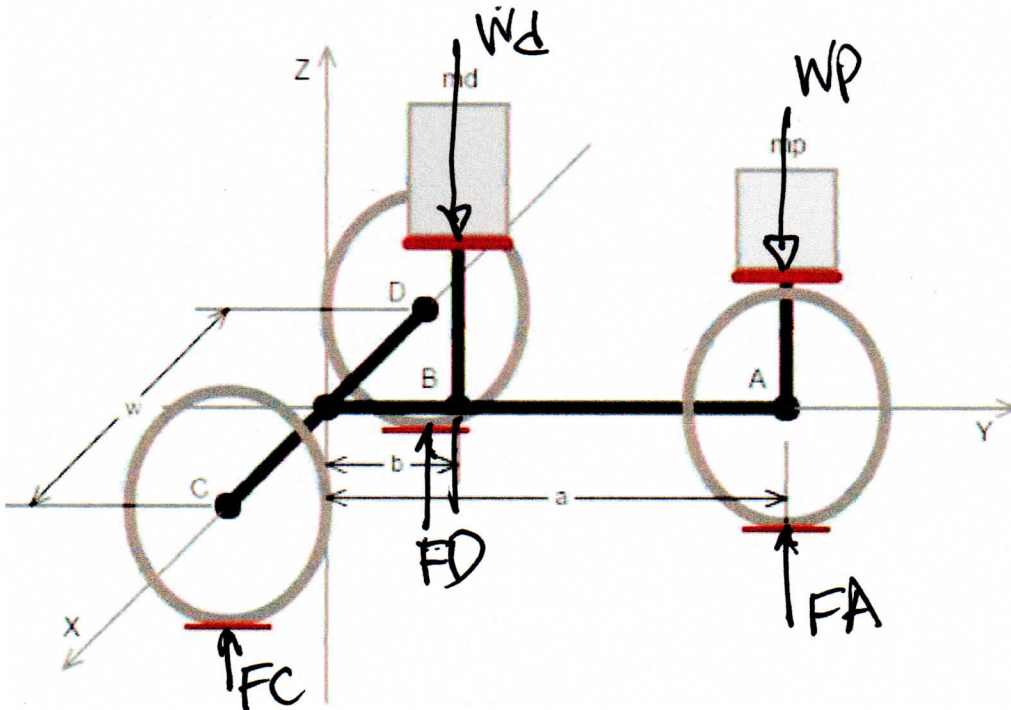


## ip4STATICS Worksheet for U04\_3d\_P07

## SOLUTION

A delivery tricycle is shown in abstracted form below. The wheel centers are at A, C and D. The payload mass is  $m_p$  and the driver mass is  $m_d$ . The frame structure has been simplified and the handlebars for steering are not shown. Units are lbf, lbm and inches.

Instance variables: masses  $m_p$  and  $m_d$  in lbm; lengths  $a$ ,  $b$  and  $w$  in in.



NOTE.

$$W_p = m_p \cdot g$$

$$W_d = m_d \cdot g$$

- (1) What is  $F_A$ , the vertical contact force at the base of wheel A?
- (2) What is  $F_C$ , the vertical contact force at the base of wheel C?
- (3) What is  $F_D$ , the vertical contact force at the base of wheel D?

$$\sum F_z = 0: F_A + F_C + F_D = W_d + W_p$$

$$\sum M_y = 0: \left(\frac{w}{2}\right) F_C = \left(\frac{w}{2}\right) \cdot F_D$$

$$\sum M_x = 0: a \cdot F_A = a \cdot W_p + b \cdot W_d$$

Solve these for  $F_A$ ,  $F_C$  and  $F_D$ .

$$(1) \boxed{F_A = W_p + \left(\frac{b}{a}\right) W_d}$$

$$(2) \boxed{F_C = \frac{W_d}{2} \left(1 - \frac{b}{a}\right)}$$

$$(3) \boxed{F_D = F_C}$$