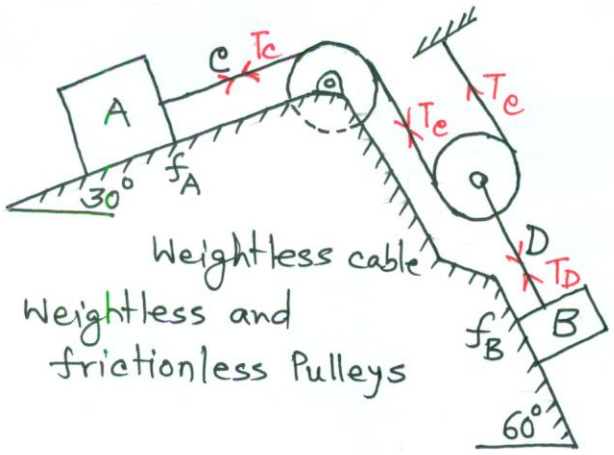
1138/P. 328



$W_A = 200$ lb

$W_B = 100$ lb

$f_A = 1/4$

$f_B = 1/3$

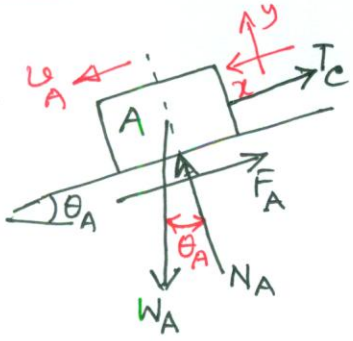
$S_A = ?$ for $t = 30$ s., $v_0 = 0$

Direction ?

$T_C = ?$ and $T_D = ?$

Note: Direct^n of motion not given. It may be assumed and finally obtained from the sign of certain determined quantities. Here it may also be judged/perceived in advance through logic.

Soln Let's assume that A moves down the plane



From the freebody of A

$\Sigma F_y = 0$, +ve y direct^n +ve

$\Rightarrow N_A - W_A \cos\theta_A = 0$

$\therefore N_A = 200 \cos 30^\circ = 173.2$ lb

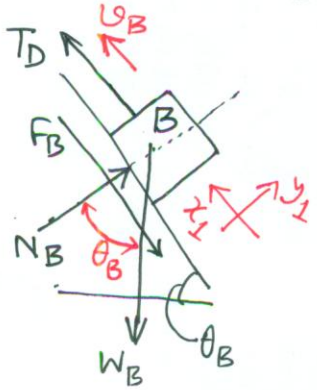
$F_A = f_A N_A = \frac{1}{4} \times 173.2 = 43.3$ lb

Considering $\Sigma F_x = ma$, +ve x direct^n +ve

$\Rightarrow W_A \sin\theta_A - F_A - T_C = \frac{W_A}{g} \cdot a_A$

$\Rightarrow 200 \sin 30^\circ - 43.3 - T_C = \frac{200}{32.2} \times a_A$

$\therefore T_C + 6.21\, a_A = 56.7$ ——— (1)



From the freebody of B

$\Sigma F_{y_1} = 0$

$\Rightarrow N_B - W_B \cos\theta_B = 0$

$\therefore N_B = 100 \cos 60^\circ = 50$ lb

$F_B = f_B N_B = \frac{1}{3} \times 50 = 16.67$ lb

contd...

Also from the freebody of B

$\Sigma F_{x1} = 0$ gives

$$T_D - F_B - W_B \sin\theta_B = \frac{W_B}{g} \cdot a_B$$

$$\Rightarrow T_D - 16.67 - 100 \sin 60^\circ = \frac{100}{32.2} a_B$$

$$\therefore T_D - 3.11 a_B = 103.27 \quad \text{——— (2)}$$

Now $T_D = 2T_C$

also $a_A = 2a_B$ Note: A moves twice the distance moved by B

$\therefore$ From eq^n (2)

$$2T_C - 3.11 \times \frac{a_A}{2} = 103.27$$

$$\text{i.e. } T_C = 0.78 a_A + 51.64 \quad \text{——— (3)}$$

(3) into (1)

$$0.78 a_A + 51.64 + 6.21 a_A = 56.7$$

$\therefore a_A = 0.724$ fps^2, Since a_A is +ve, assumed direct^n of motion is correct, i.e. A moves down

From eq^n (3) $T_C = 0.78 \times 0.724 + 51.64 =$ **52.2 lbs**

$$T_D = 2T_C = 2 \times 52.2 = \boxed{104.4 \text{ lb}}$$

$$S_A = v_0 t + \frac{1}{2} a_A t^2$$

$$= 0 + \frac{1}{2} \times 0.724 \times 30^2$$

$$= \boxed{325.8 \text{ ft}}$$