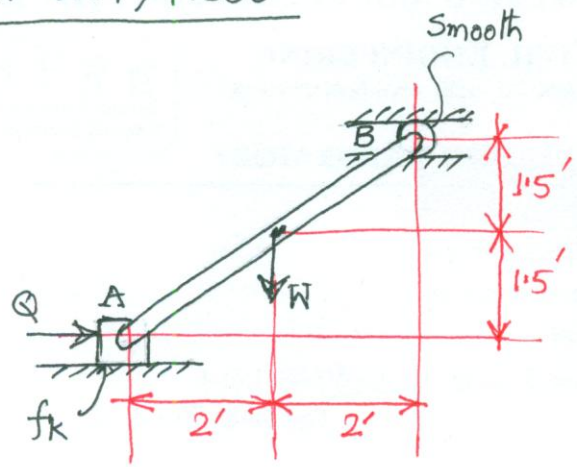
1157/P.330



$W = 100$ lb , $f_k = 0.2$

Reactⁿ at B = 10 lb (↑)

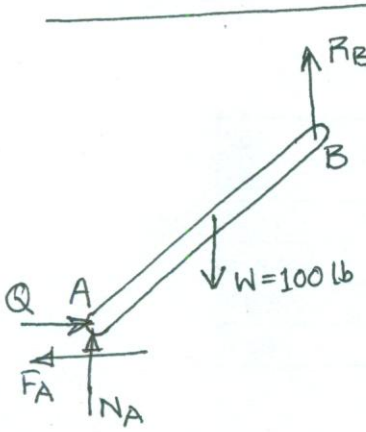
$\bar{a} = ?$ $\bar{a}$ → resultant acclⁿ of mass center

$Q = ?$

Solve (a) without REF

(b) with REF

Solⁿ without REF



From the freebody of bar AB

$\Sigma F_v = 0$ ↑ +ve gives

$10 - 100 + N_A = 0$

$\therefore N_A = 90$ lb

$\therefore F_A = N_A \cdot f_k = 90 \times 0.2 = 18$ lb

Taking $\Sigma M_{c.g} = 0$ ↷ +ve **We can take $\Sigma M_B = 0$ as well**

$-Q \times 1.5 + F_A \times 1.5 + N_A \times 2 - R_B \times 2 = 0$

$\Rightarrow -Q \times 1.5 + 18 \times 1.5 + 90 \times 2 - 10 \times 2 = 0$

$\therefore Q = \boxed{124.67 \text{ lb}}$

$\Sigma F_h = m\bar{a}$ → +ve

$\Rightarrow Q - F_A = \frac{W}{g} \times \bar{a}$

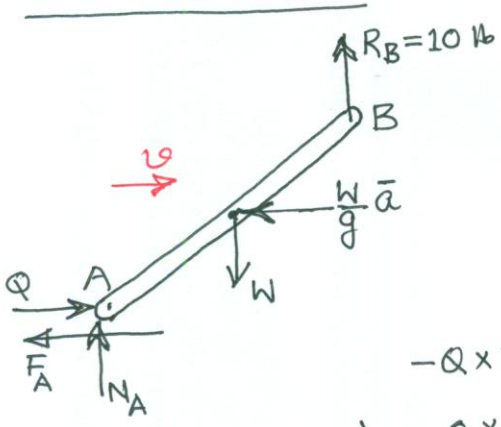
$\Rightarrow 124.67 - 18 = \frac{100}{32.2} \times \bar{a}$

$\therefore \bar{a} = \boxed{34.35 \text{ fps}^2}$

contd...

#1157/P.330 Contd..

Sol^n with REF



$N_A = 90$ lb
$F_A = 18$ lb
[Similar as done for sol^n without REF]

$\Sigma M_B = 0$ ↷ +ve

$-Q\times 3 - W\times 2 + F_A \times 3 + N_A \times 4 + \frac{W}{g}\bar{a}\times 1.5 = 0$

$\Rightarrow -Q\times 3 - 100\times 2 + 18\times 3 + 90\times 4 + \frac{100}{32.2}\bar{a}\times 1.5 = 0$

$\Rightarrow 3Q - 4.66\bar{a} = 214$

$\therefore Q = 71.33 + 1.55\bar{a}$ ——— (1)

$\Sigma F_h = 0$ → +ve

$\Rightarrow Q - F_A - \frac{W}{g}\cdot\bar{a} = 0$

$\Rightarrow 71.33 + 1.55\bar{a} - 18 - \frac{100}{32.2}\times\bar{a} = 0$ [Substituting Q from (1)]

$\Rightarrow 1.55\bar{a} = 53.33$

$\therefore \bar{a} = \boxed{34.41 \text{ fps}^2}$

Now from eq^n (1)

$Q = 71.33 + 1.55 \times 34.41 = \boxed{124.67 \text{ lb}}$