STAEDTLER® No. 937 811E Engineer's Computation Pad

•10 In about 1915, Henry Sincosky of Philadelphia suspended himself from a rafter by gripping the rafter with the thumb of each hand on one side and the fingers on the opposite side (Fig. 6-22). Sincosky's mass was 79 kg. If the coefficient of static friction between hand and rafter was 0.70, what was the least magnitude of the normal force on the rafter from each thumb or opposite fingers? (After suspending himself, Sincosky chinned himself on the rafter and then moved hand-over-hand along the rafter. If you do not think Sincosky's grip was remarkable, try to repeat his stunt.)

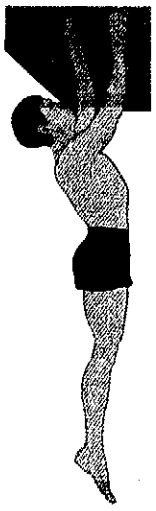
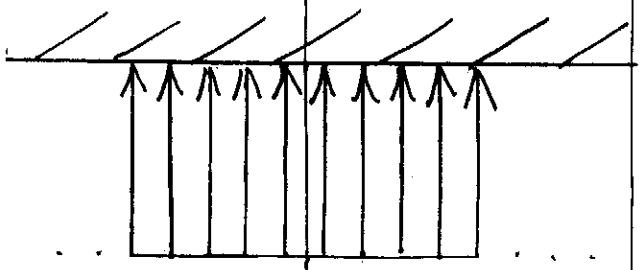


FIG. 6-22 Problem 10.



STATIC FRICTION FORCES FROM RAFTERS EXERTED ON 10 FINGERS

THERE IS A RANGE FOR STATIC FRICTION DEPENDING ON THE VALUE OF N IE $f_s \le f_{s,max} = \mu_s N$

$$\vec{F}_{net\ on\ HENRY} = \vec{mg} + 10\vec{f}_s = m\vec{a}_{HENRY} \equiv 0$$

$$\Rightarrow \vec{f}_s = \frac{-\vec{mg}}{10} = \text{force of static friction exerted by rafters on each of 10 fingers}$$

$$= -\frac{79}{10}(-9.80\,\hat{y})$$

$$= 77.4\ \text{Newtons}\ \hat{y}$$

THE MAXIMUM FORCE OF STATIC FRICTION IS ALWAYS $\mu_s N$, IT DOES NOT MATTER WHAT N IS

$$f_{static} \le f_{s,max} = \mu_s N_{normal} \longleftrightarrow$$

$f_s = 77.4\,N$ = static friction force exerted by each finger on rafter, by NEWTON'S 3rd Law

OBVIOUSLY: IF HE IS EXERTING THE LEAST NORMAL FORCE, THEN HE IS ON THE VERGE OF SLIPPING:

$\Rightarrow f_s$ HE EXERTS IS $f_{s,max} = \mu_s N$

$$\Rightarrow N = (f_s = f_{s,max})/\mu_s = \frac{mg}{10}/\mu_s$$

$$\Rightarrow N = \frac{mg}{10\mu_s} = \frac{77.4}{0.7}\ N$$

$$= 111\ \text{Newtons}$$

