



Megan is skiing down a slope as shown above. If she weighs  $W$  lbs, find the largest angle of the slope,  $\theta$ , such that she remains in static equilibrium and the angle in which she skis at constant velocity assuming she uses her ski poles to propel herself initially.

$$+\nearrow \Sigma F_y = 0 \rightarrow N - W \cos(\theta) = 0$$

$$\Rightarrow N = W \cos(\theta)$$

At static equilibrium,  $F \leq \mu_s N$

$$+ \nearrow \Sigma F_x = 0 \rightarrow F - W \sin(\theta) = 0 \rightarrow F = W \sin(\theta) \leq \mu_s N \rightarrow W \sin(\theta) \leq \mu_s W \cos(\theta)$$

$$\Rightarrow \theta \leq \tan^{-1}(\mu_s)$$

$$\Rightarrow \theta_{S \max} = \tan^{-1}(\mu_s)$$

At dynamic equilibrium,  $F = \mu_k N$

$$+ \nearrow \Sigma F_x = 0 \rightarrow F - W \sin(\theta) = 0 \rightarrow F = W \sin(\theta) = \mu_k N = \mu_k W \cos(\theta)$$

$$\Rightarrow \theta_K = \tan^{-1}(\mu_k)$$