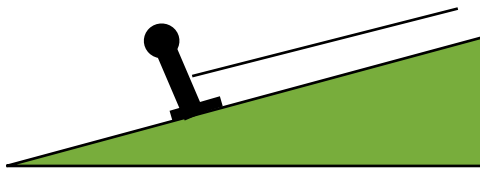


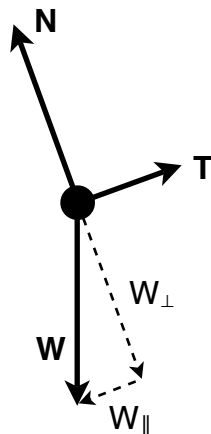
Pulling a skier up a slope

A 50 kg skier is pulled up a frictionless ski slope that makes an angle of 8° with the horizontal, by holding onto a ski rope that moves parallel to the slope. Determine the magnitude of the force of the rope on the skier at an instant when:

- a) the rope is moving with constant speed of 2.0 ms^{-1} , and
- b) the rope is moving with a speed of 2.0 ms^{-1} , but that speed is increasing at a rate of 0.10 ms^{-2} .



The free-body diagram for the skier is



Resolve into components perpendicular and parallel to the slope:

perpendicular to slope $W_{\perp} = W \cos 8^\circ = 50 \times 9.8 \times \cos 8^\circ = 485 \text{ N}$

parallel to slope $W_{\parallel} = W \sin \theta = 50 \times 9.8 \times \sin 8^\circ = 68 \text{ N}$

No net force perpendicular to the slope, so

$$N - W_{\perp} = 0$$

so $N = W_{\perp} = 485 \text{ N}$

(a) Constant velocity means no net force parallel to slope

so $T - W_{\parallel} = 0$

Hence $T = W_{\parallel} = 68 \text{ N}$

(b) If rope is accelerating, then

$$F_{\text{net}} = T - W_{\parallel} = ma = 50 \times 0.1 = 5 \text{ N}$$

so $T = W_{\parallel} + 5 \text{ N} = 73 \text{ N}$