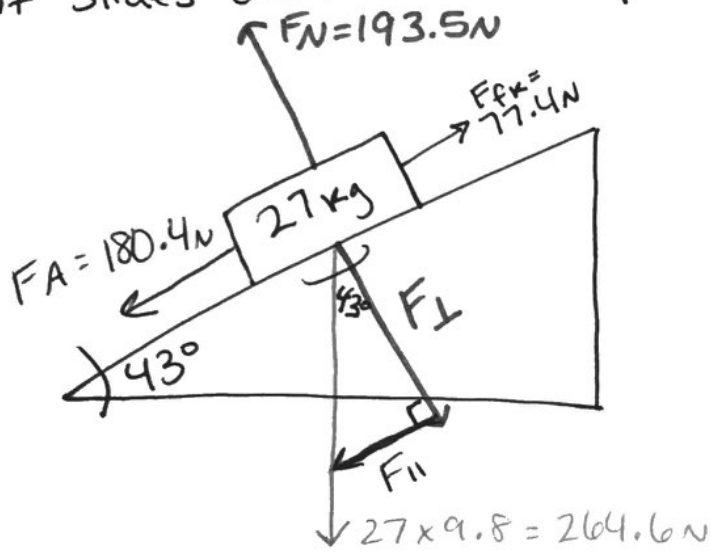


# Forces on an incline example:

A box with a mass of 27kg is sitting on a ramp with a slope of  $43^\circ$  above the horizontal. If the ramp has a coefficient of friction of 0.8 (static) and 0.4 (kinetic), what is the acceleration of the box as it slides down the ramp?



$$F_w = mg$$

$$F_{net} = ma$$

$$F_L = F_w \cos \theta$$

$$F_{||} = F_w \sin \theta$$

Step 1: Find the weight ( $F_w = mg$ )

Step 2: Find  $F_L$  and  $F_{||}$

$$F_L = F_w \cos \theta \quad F_{||} = F_w \sin \theta$$

$$264.6 \cos 43^\circ \quad 264.6 \sin 43^\circ$$

$$F_L = 193.5N \quad F_{||} = 180.4N$$

$$F_L = F_N = 193.5N \quad F_{||} = F_A = 180.4N$$

Step 3: Find out if box is moving by solving for static friction

$$F_{fs} = \mu_s F_N$$

$$F_{fs} = (0.8)(193.5N)$$

180.4N is greater than 154.8N

$$F_{fs} = 154.8N$$

$$F_{fk} = \mu_k F_N$$

$$F_{fk} = (0.4)(193.5N)$$

$$F_{fk} = 77.4N$$

← if this is less than  $F_{||}$ , the box is moving. (solve for  $F_{fk}$ )  
 ← if this is greater than  $F_{||}$ , the box is not moving. (No acceleration)

Step 4: Find  $F_{\text{net}}$  ( $F_A - F_{fk}$ )

$$180.4\text{N} - 77.4\text{N} = 103\text{N}$$

Step 5: Solve for acceleration

$$F_{\text{net}} = ma$$

$$\frac{103\text{N}}{27} = \frac{(27\text{kg})(a)}{27}$$

$$\boxed{3.8\text{ m/s}^2 = a}$$