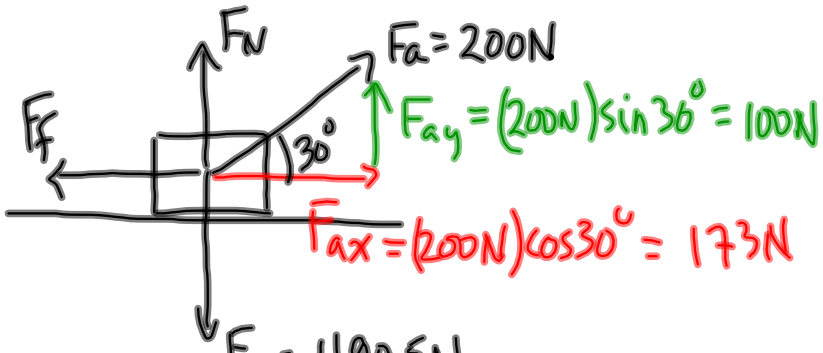
Forces at Angles (PP)

3.



$m = 50kg$

$\mu_k = 0.30$

a) vertically:

$F_g = F_N + F_{ay}$

$F_N = F_g - F_{ay}$

$F_N = 490.5N - 100N$

$F_N = 390.5N$

$3.9 \times 10^2 N$

b) $F_f = \mu F_N$

$F_f = 0.30(390.5N)$

$F_f = 117N$

$1.2 \times 10^2 N$

c) $\vec{F}_{net} = m\vec{a}$

$F_{ax} - F_f = ma$

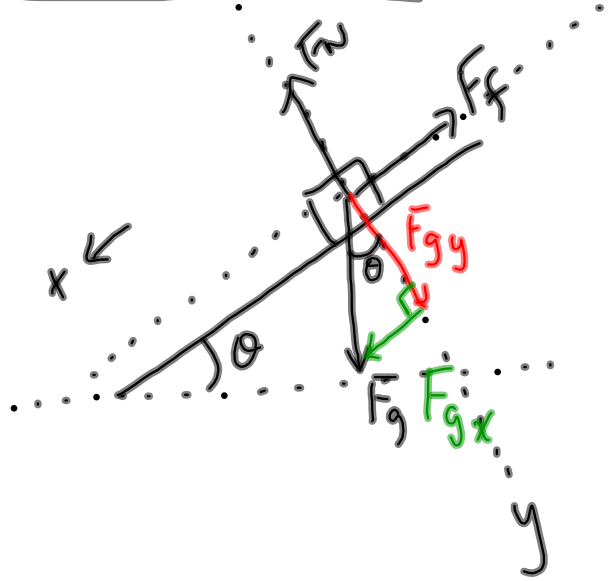
$173N - 117N = (50kg)a$

$55.85N = (50kg)a$

$a = 1.1 m/s^2$

$\vec{a} = 1.1 m/s^2 [R]$

Incline Problems



x ← line the x-axis up with the incline (the motion is now along the x-axis)

If there is no friction:

$$\vec{F}_{net} = m\vec{a}$$

$$F_{gx} = ma$$

$$F_g \sin\theta = ma$$

$$mg\sin\theta = ma$$

$$a = g\sin\theta$$

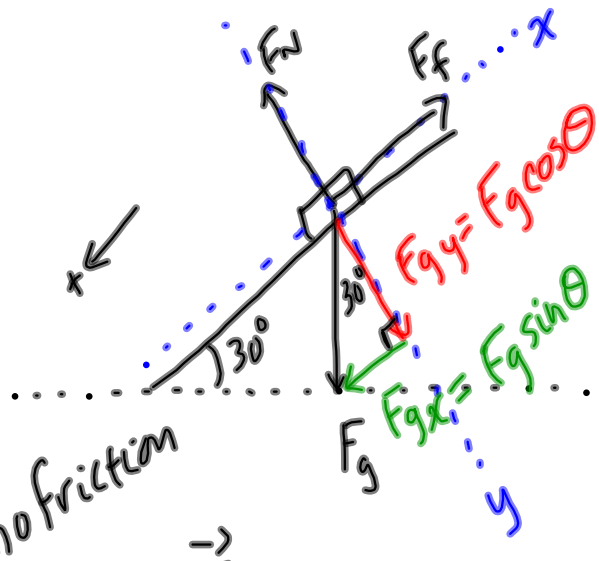
SP

$m = 50\,kg$

$\theta = 30°$

$a = ?$ (no friction)

$a = ?$ ($\mu_k = 0.15$)



a) no friction

$\vec{F}_{net} = m\vec{a}$

$F_{gx} = ma$

$F_g \sin\theta = ma$

$mg \sin\theta = ma$

$a = (9.81\,m/s^2)(\sin 30°)$

$\boxed{a = 4.9\,m/s^2}$

b) friction:

$\vec{F}_{net} = m\vec{a}$

$F_{gx} - F_f = ma$

$mg\sin\theta - \mu F_N = ma$

$mg\sin\theta - \mu F_{gy} = ma$

$mg\sin\theta - \mu F_g \cos\theta = ma$

$mg\sin\theta - \mu mg\cos\theta = ma$ ← mass doesn't matter

$a = g\sin\theta - \mu g\cos\theta$

$a = 4.9\,m/s^2 - (0.15)(9.81\,m/s^2)(\cos 30°)$

$a = 4.9\,m/s^2 - 1.27\,m/s^2$

$\boxed{a = 3.6\,m/s^2}$