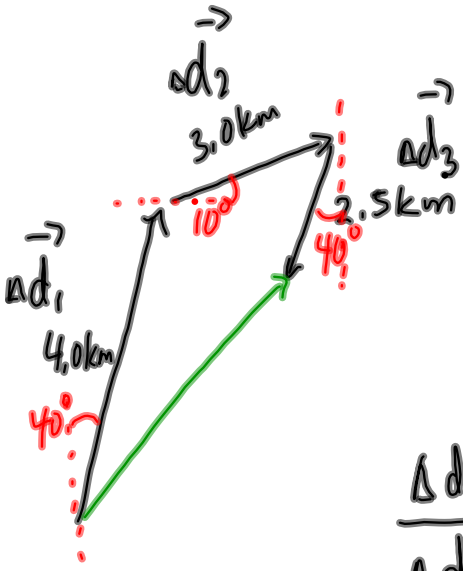
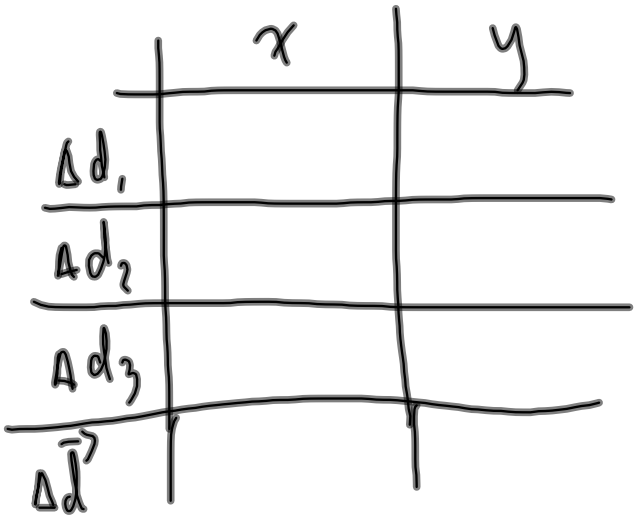
PP 110

26.

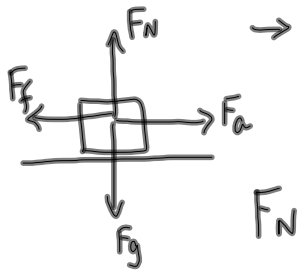

N


$\vec{\Delta d_2}$
3.0km
$\vec{\Delta d_3}$
2.5km
10°
40°
$\vec{\Delta d_1}$
4.0km
40°


x
y
Δd_1
Δd_2
Δd_3
$\vec{\Delta d}$

Forces at Angles

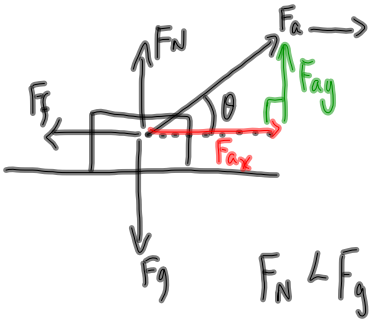
Horizontal Force
Horizontal Surface



$F_N = F_g$

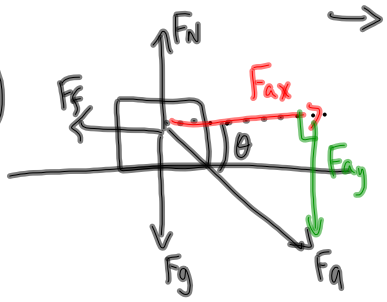
F_N is always perpendicular to the surface.

Horizontal Surface
Force is upward at an angle (pulling) a toboggan



$F_N < F_g$

Horizontal Surface
Force is downward at an angle (pushing a lawn mower)

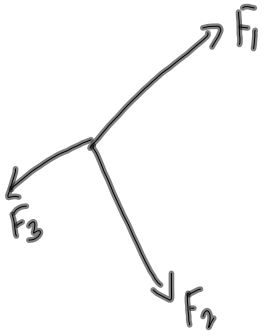


$F_N > F_g$

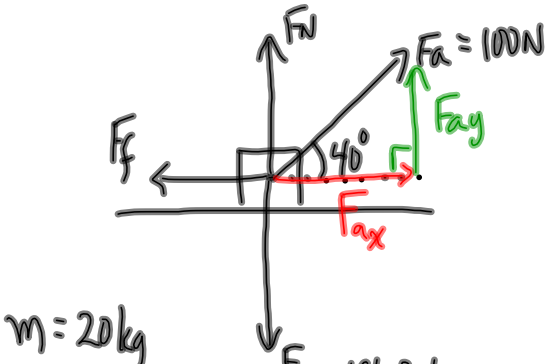
Three Way Tug of War

Bird's Eye View:

$F_g = F_N$ as long as all 3 forces are parallel to the plane.



SP



$m = 20kg$

$\mu_k = 0.32$

$\rightarrow$

$(\vec{F}_N + \vec{F}_{ay} + \vec{F}_g = 0)$

Vertically $(\vec{F}_{Net} = 0)$

$F_N + F_{ay} = F_g$

$F_N = F_g - F_{ay}$

$F_N = 196.2N - 64.28N$

$\boxed{F_N = 131.92N}$

$\cos\theta = \frac{adj}{hyp}$ $\sin\theta = \frac{opp}{hyp}$

$\cos 40° = \frac{F_{ax}}{100N}$ $\sin 40° = \frac{F_{ay}}{100N}$

$\boxed{F_{ax} = 100N \cos 40°}$ $\boxed{F_{ay} = 100N \sin 40°}$

76.60N 64.28N

Horizontally:

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

$F_{ax} - F_f = ma$

$F_{ax} - \mu F_N = ma$

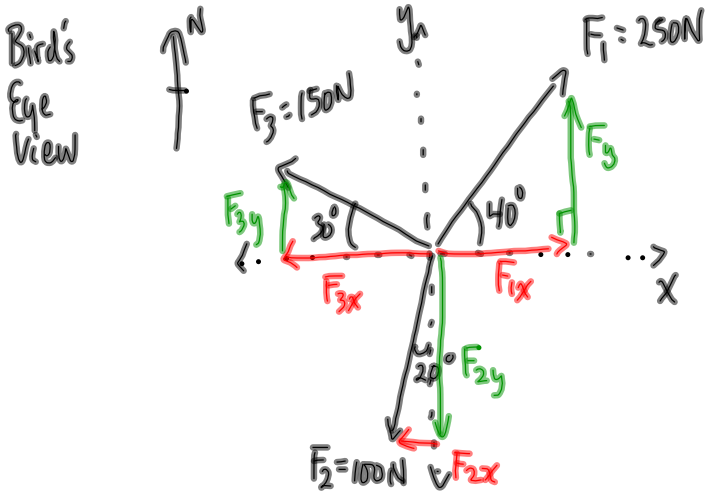
$76.60N - 0.32(131.92N) = (20kg)a$

$34.39N = (20kg)a$

$\boxed{a = 1.7 m/s^2}$

Three-Way Tug of War

Bird's Eye View

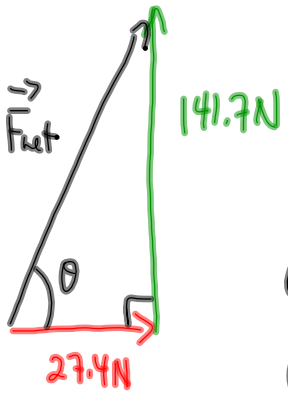


This is a FBD

NOT

A vector addition diagram (head-tail)

	x	y
F_1	$(250N)\cos 40°$ 191.5	$(250N)\sin 40°$ 160.7
F_2	$-(100N)\sin 20°$ -34.2	$-(100N)\cos 20°$ -94.0
F_3	$-(150N)\cos 30°$ -129.9	$(150N)\sin 30°$ 75
F_{net}	27.4 N	141.7N



$c^2 = a^2 + b^2$

$c^2 = (27.4)^2 + (141.7)^2$

$c \doteq 144$ N

$\tan\theta = \frac{141.7N}{27.4N}$

$\theta \doteq 79°$

$\vec{F}_{net} = 144N\ [E\ 79°\ N]$