Static Equilibrium

Dynamic equilibrium - the forces are balanced in a moving object; constant velocity

Static equilibrium - the forces are all balanced in a stationary object.

$\sum \vec{F} = 0$ (the sum of all the forces is zero)

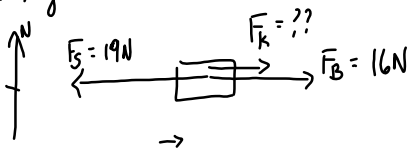
$\vec{F}_{net} = 0$

$\vec{F}_{x\,net} = 0$ (all forces balance horizontally)

$\vec{F}_{y\,net} = 0$ (all forces balance vertically)

SP (205 - FOP)

Bird's Eye View



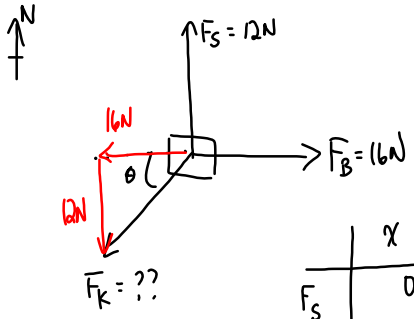
$\vec{F}_{net} = 0$

$F_K + F_B - F_S = 0$

$F_K + 16N - 19N = 0$

$F_K = 3N$

$\vec{F}_K = 3N[E]$



	x	y
F_S	0	12N
F_B	16N	0
F_K	-16N	-12N
F_{net}	0	0

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

$c = (12N)^2 + (16N)^2$

$\boxed{c = 20N}$

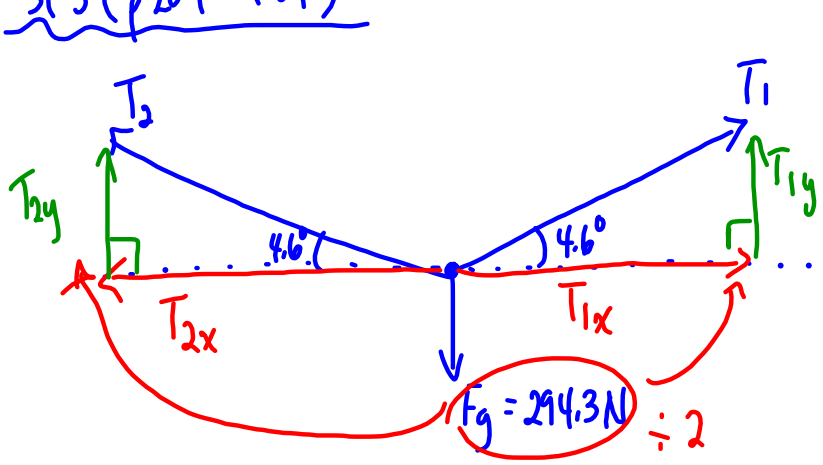
$\tan\theta = \frac{opp}{adj}$

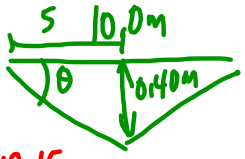
$\tan\theta = \frac{12N}{16N}$

$\boxed{\theta = 37°}$

$\vec{F}_K = 20N[W37°S]$

SP3 (p207 - FOP)





$\tan\theta = \frac{0.40m}{5.0m}$

$\theta = 4.6°$

Vertically:

$$T_{1y} + T_{2y} = F_g$$

$$T_1 \sin 4.6° + T_2 \sin 4.6° = 294.3N$$

Horizontally:

$$T_{1x} = T_{2x}$$

$$T_1 \cos 4.6° = T_2 \cos 4.6°$$ (cancel $\cos 4.6°$ due symmetry)

$$T_1 = T_2$$

$$T_2 \sin 4.6° + T_2 \sin 4.6° = 294.3N$$

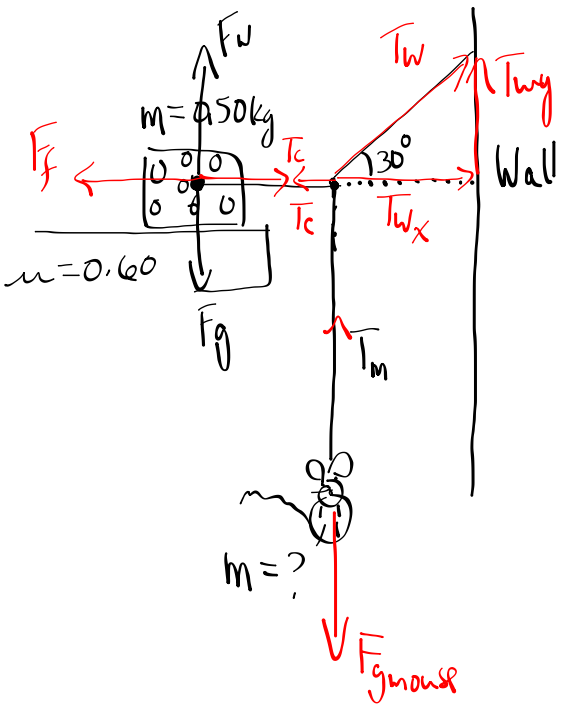
$$2T_2 \sin 4.6° = 294.3N$$

$$T_2 = \frac{294.3N}{2 \sin 4.6°}$$

$$T_2 = 1.8 \times 10^3 N$$

$$T_1 = 1.8 \times 10^3 N$$

SP (FOP - p211)



If the cheese is in static equilibrium:

$$T_C = F_f$$

$$T_C = \mu F_N$$

$$T_C = \mu m_c g$$

also $T_C = T_{Wx}$

$$T_{Wx} = (0.60)(0.50kg)\left(9.81 \frac{m}{s^2}\right)$$

$$T_{Wx} = 2.943\,N$$

$$\tan 30^\circ = \frac{T_{Wy}}{T_{Wx}}$$

$$T_{Wy} = T_{Wx} \tan 30^\circ$$

$$T_{Wy} = (2.943N)(\tan 30^\circ)$$

$$T_{Wy} = 1.699N$$

Vertically

$$F_{gmouse} = T_{Wy}$$

$$F_{gmouse} = 1.699N$$

$$m(9.81 m/s^2) = 1.699N$$

$$m = 0.17\,kg$$

170g mouse.