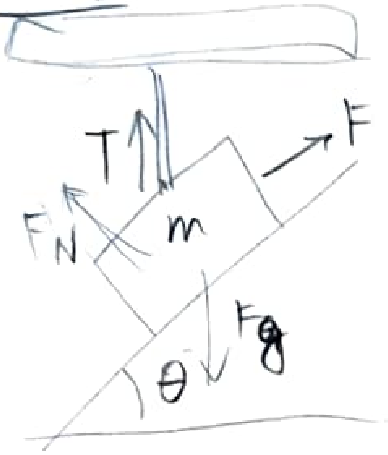
Q 2.1



$m = 10\,kg$

$\theta = 20°$

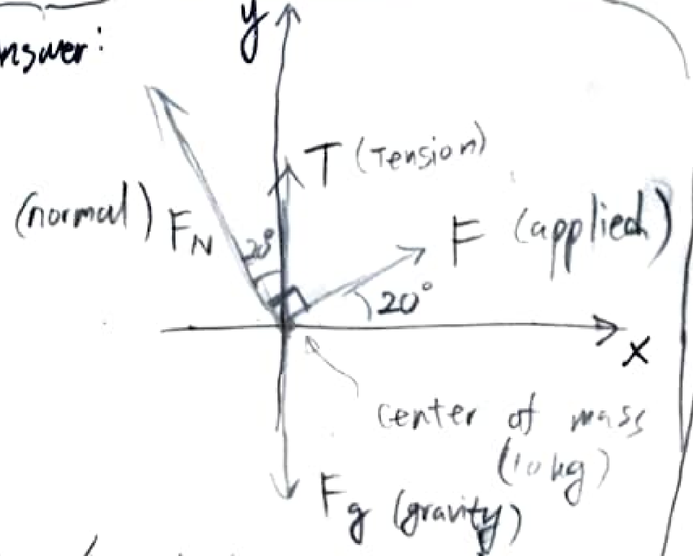
$T = 50\,N$

$F = ?$

$F_g = mg$

$F_N = ?$ (normal force)

Answer:



⟨Free-body Diagram⟩

Q 2.2

For the block to be at rest, $F_{net} = \langle 0,0,0 \rangle\,N$

According to the free-body diagram,

$F_{net} = \vec{F} + \vec{T} + \vec{F}_N + \vec{F}_g$ where

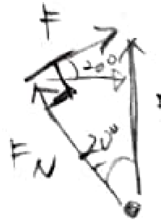
$F = \langle \underbrace{x}_{\text{unknown } x} \cos 20°, x \sin 20°, 0 \rangle\,N$

$T = \langle 0, 50, 0 \rangle\,N$

$F_N = \langle -2.75x \sin 20°, 2.75x \cos 20°, 0 \rangle\,N$

$F_g = \langle 0, -98, 0 \rangle\,N$

☆ ∵ $F_N + F$ should be pallel to y axis.



Let F_N be y.

$F_N + F = \langle -y\sin\theta, y\cos\theta, 0 \rangle N + \langle x\cos\theta, x\sin\theta, 0 \rangle N$

$= \langle x\cos\theta - y\sin\theta, x\sin\theta + y\cos\theta, 0 \rangle N$

$x\cos\theta - y\sin\theta = 0$. Thus, $y = \frac{x}{\tan\theta} N = \frac{1}{\tan 20°} x\, N = 2.75x\, N$

∴ $F_{net} = \langle 0, (x)\sin 20° + 2.75(x)\cos 20° + 50 - 98, 0 \rangle\,N = 0\,N$

Thus, $|F| = x = 48/(2.75\cos 20° + \sin 20°) = 16.4\,N$

Answer: $|F| = 16.4\,N$