Midterm #1, 141, Q3 Schwartz Name

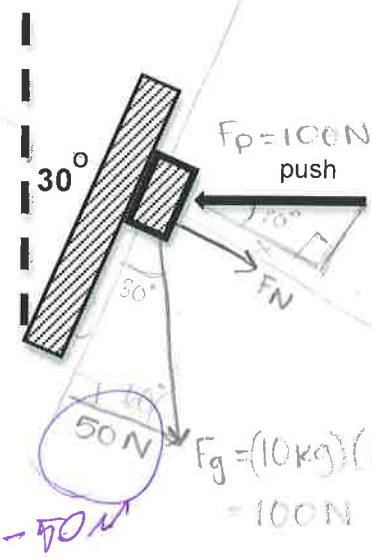
From the syllabus: In order to achieve an "A": Consistently

- correctly identifies underlying physics concepts,
- sets up problem with good drawing and reasons,
- formulates method to solve problem,
- correctly uses units and
- verifies whether answer makes sense.

An answer alone is worth no credit. Please estimate answers: don't leave them in roots, trig., fractions.

good work - be careful, mindful of sign!

SOH-CAH-TOA



A 10 kg object is shown against a frictionless wall that is leaning at an angle of 30° as shown.

a) If I push horizontally on the box as shown with a force of 100 N, what is the box's acceleration? – please include direction and magnitude

dynamics: because there is a force causing an acceleration.

$\Sigma \vec{F}_x = 0$ no acceleration in x-direction

$\Sigma \vec{F}_y = m \cdot \vec{a}_y$ These forces are oriented in $-\hat{y}$ direction!

$86N + -50N = (10kg)(a_y)$

$\frac{136N}{10kg} = \frac{10kg(a_y)}{10kg}$

$13.6 m/s^2 = a_y$

acceleration is $13.6 m/s^2$ in the y-direction

$F_{gx} = F_g \sin\theta = 100N \sin 30° = 50N$

$F_{px} = F_p \cos\theta = 100N \cos 30° = 86N$

$F_{gy} = F_g \cos\theta = 100N \cos 30° = 86N$

$F_{py} = F_p \sin\theta = 100N \sin 30° = 50N$

-50N

positive?

b) What is the normal force acting on the box? – please include direction and magnitude

$\Sigma \vec{F}_x = 0 = -50N + 86N + F_N$

$F_N = 136N$ → 36 N

dynamics because $\Sigma F_x = ma_x = 0$ (statics)

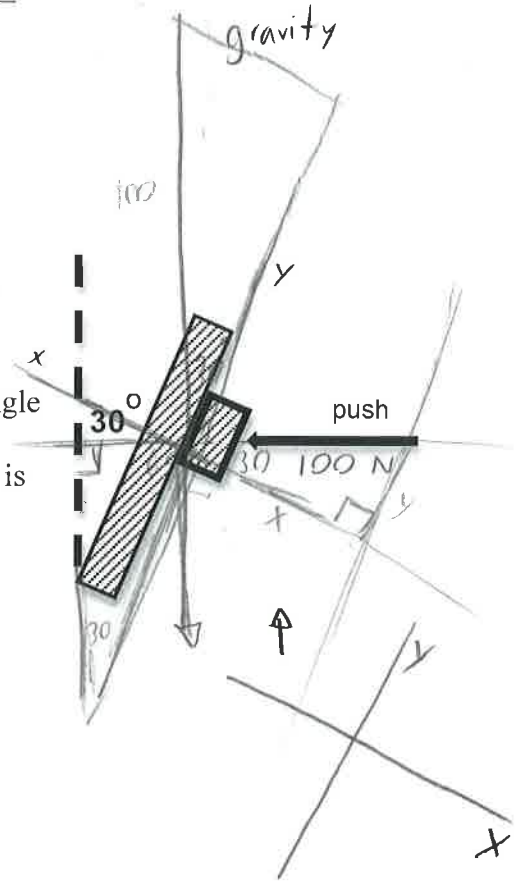
normal force would be 136N in the positive x-direction, since there is no acceleration in the x-direction, the normal force is equal & opposite to the sum of the forces in the x-direction. But gravity has a negative component in $\hat{x}$, pulling block away from surface

Midterm #1, 141, Q3 Schwartz Nam

From the syllabus: In order to achieve an "A": Consistently

- correctly identifies underlying physics concepts,
- sets up problem with good drawing and reasons,
- formulates method to solve problem,
- correctly uses units and
- verifies whether answer makes sense.

An answer alone is worth no credit. Please estimate answers: don't leave them in roots, trig., fractions.



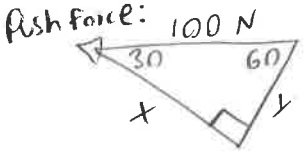
A 10 kg object is shown against a frictionless wall that is leaning at an angle of 30° as shown.

a) If I push horizontally on the box as shown with a force of 100 N, what is the box's acceleration? – please include direction and magnitude

nice start :)

Dynamics: forces $\Sigma \vec{F} = m\vec{a}$

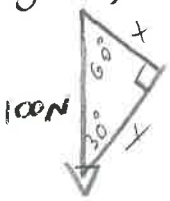
Push force: 100 N



$\cos 60° = \frac{y}{100\,N} = y = 50\,N$

$\sin 60° = \frac{x}{100\,N} = x = 50\sqrt{3} \approx 87\,N$

gravity = 10 kg (10 m/s²) = 100 N



$\cos 60° = \frac{x}{100\,N} = x = 50\,N$

$\sin 60° = \frac{y}{100\,N} = y \approx 87\,N$

for acceleration: Add up y-components: 50N + 87N = Result 137 N

$a = \frac{F}{m} = \frac{137\,N}{10\,kg} = \boxed{13.7\,m/s^2}$ Down

$\Sigma F_y = ma_y$

b) What is the normal force acting on the box? – please include direction and magnitude

for Normal force: use my x-components (work above)

$\Sigma F_x = ma_x = 0$

87N + 50N = Result 37 N

The normal force must be just enough to counteract the force on the surface, so $\boxed{37\,N}$