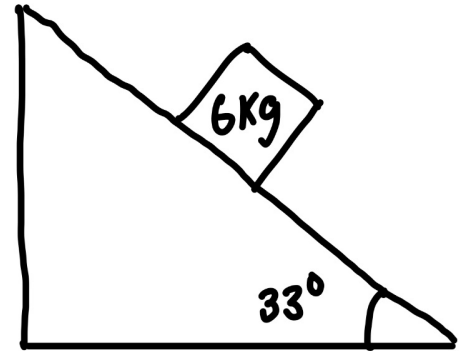


Forces at an Angle

1. A 6kg block is moving down a 33° ramp.

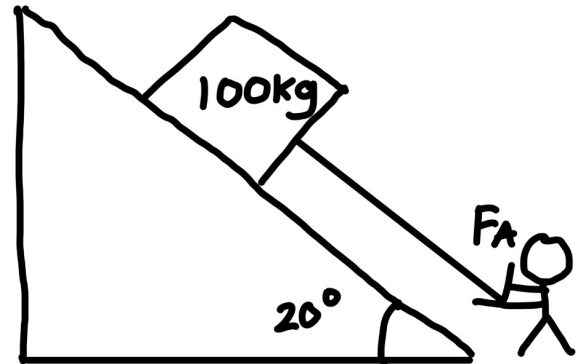
- a) Calculate the acceleration if the surface was frictionless
- b) Calculate the acceleration if the surface had $\mu=0.2$.



2. A 10kg block moves down a 40° ramp with an acceleration of 2m/s^2 . Calculate the coefficient of friction between the block and the ramp.

3. A 100kg box is on a 20° ramp with $\mu_s=0.8$ and $\mu_k=0.5$. A man attaches a rope and pulls parallel to the ramp with an applied force.

- a) What force is needed to get the block to start moving down the ramp?
- b) Once the block is moving, what force is needed to keep the box moving down the ramp at a constant velocity?

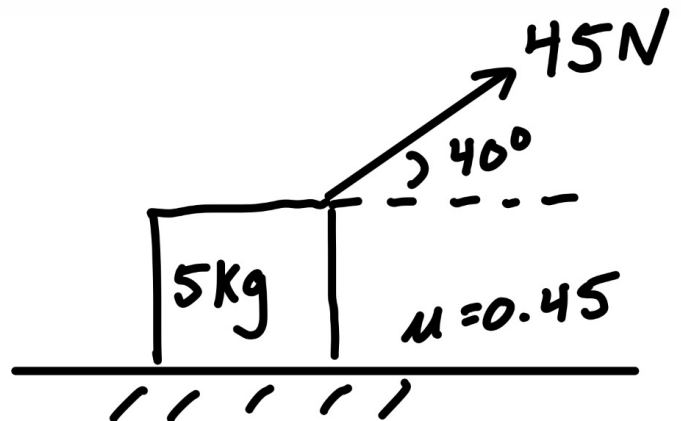


4. A magician uses magic to attempt to push a 500kg piano up a 60° ramp with $\mu=0.25$.
For this question, think about the direction of friction.

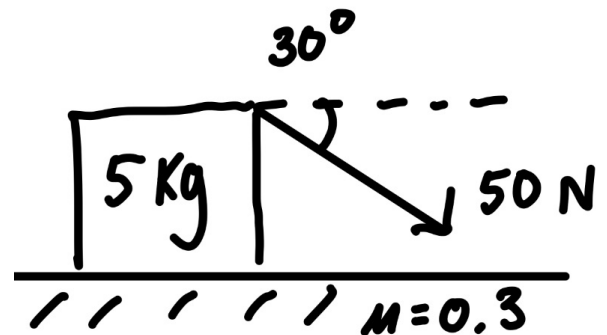
- a) If his magic force is 6000N, what will be the acceleration of the piano?
- b) If his magic force weakened and became 3000N, what would be the acceleration of the piano?

5. A 5kg box is pulled with a 45N applied force 40° above the horizontal. The coefficient of friction is 0.45.

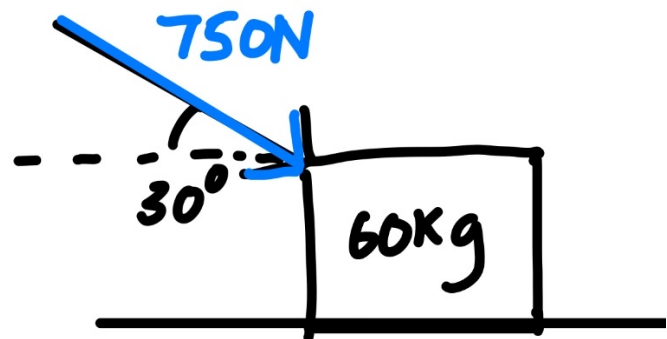
- Separate the applied force to its x and y components.
- Calculate the normal force on the block
- Calculate the friction force on the block
- Calculate the acceleration of the block



6. A 5kg box is pulled with a 50N applied force 30° below the horizontal. The coefficient of friction is 0.3. Calculate the acceleration of the block.



7. A student pushes down on a 60kg box with a 750N at 30° above the horizontal. If the box moves at a constant velocity, find the coefficient of friction between the box and the ground.



8. A student pulls a 60kg box with an applied force at 15° above the horizontal. If the box moves at a constant velocity and $\mu_k = 0.8$, what applied force is needed to keep the box moving at constant velocity?