

## Applications of Newton's Laws

### Atwood Machines

#### Atwood Machines

Any device containing masses/pulleys and inclined planes.

You will be expected to solve problems of up to 3 masses, one pulleys, 1 incline, and with or without friction.

#### Steps to solving Atwood machine problems:

1. Determine direction of motion of system

May be obvious, may require a calculation, in worse cases scenario, guess, as the sign will tell you if you are wrong

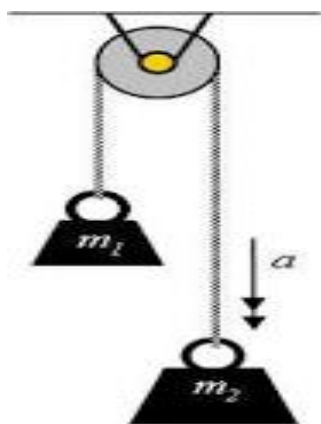
2. Do  $F_{\text{NET}}$  statement for entire system, ignoring Tensions.

\* warning...  $m$  will be mass of system, and we will set up a coordinate system of  $F_{\text{WITH MOTION}}$  and  $F_{\text{AGAINST MOTION}}$

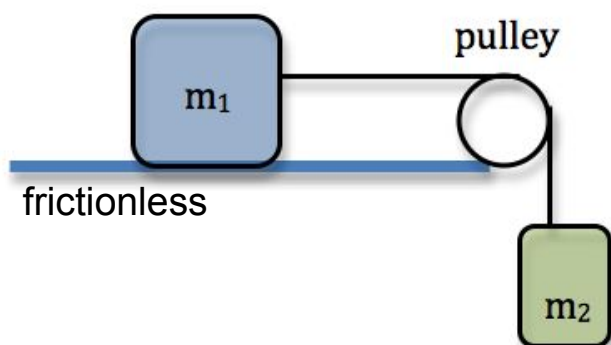
3. Calculate acceleration from Newton's second Law

4. Do FBD of single mass in order to determine tension in string

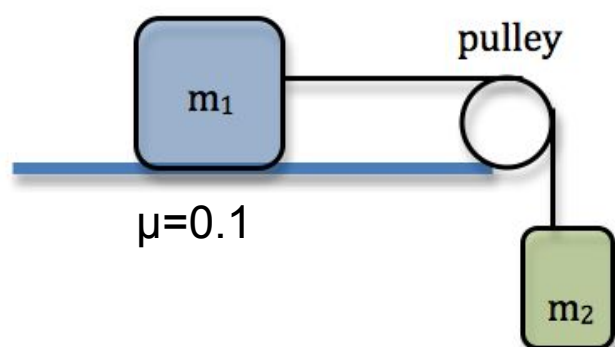
Ex 1. Hanging box from p. 197.



Find the acceleration and the tension in the string.

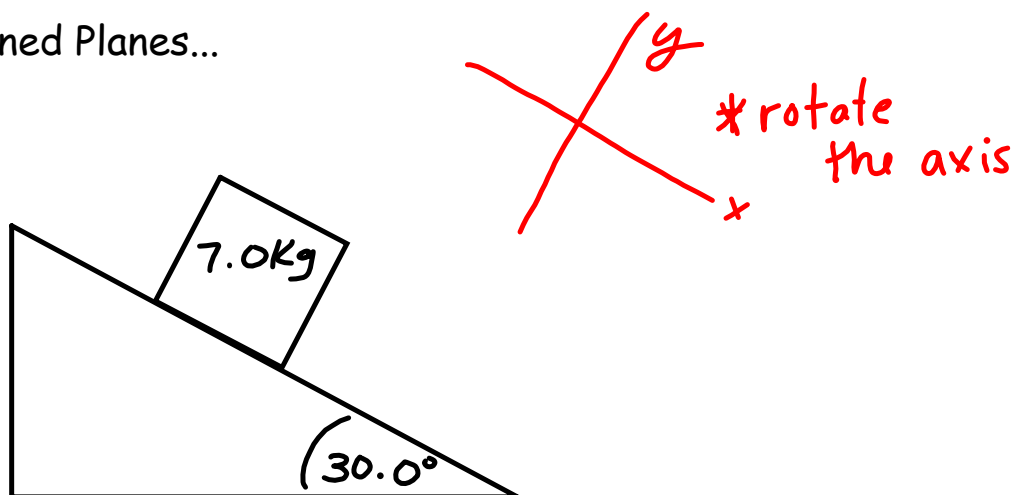


Find the acceleration and the tension in the string.



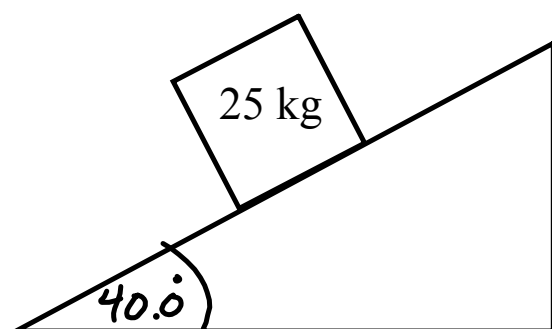
Find the acceleration and the tension in the string.

Inclined Planes...



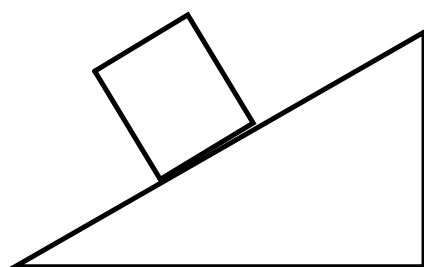
Frictionless Incline

 $a =$



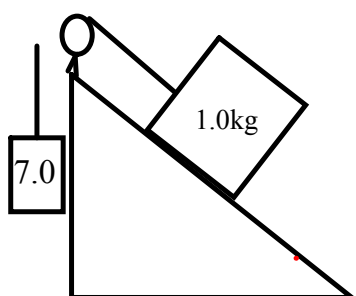
Coefficient of friction = 0.10

What is the acceleration of the box?



The coefficient of static friction between the box and the inclined plane is 0.35. What is the minimum angle required for the box to just begin to slide down the incline?

**Frictionless Incline**

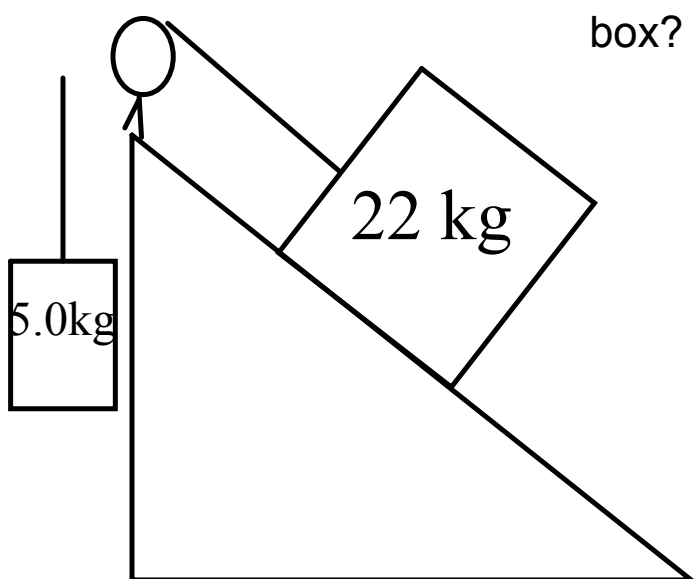


What is the acceleration of the box?

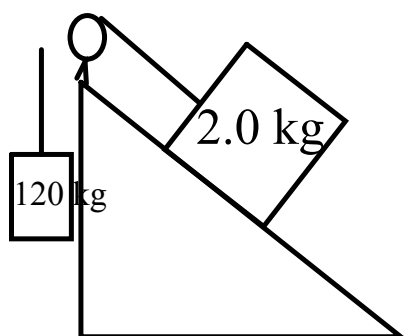


Frictionless Incline

What is the acceleration of the box?

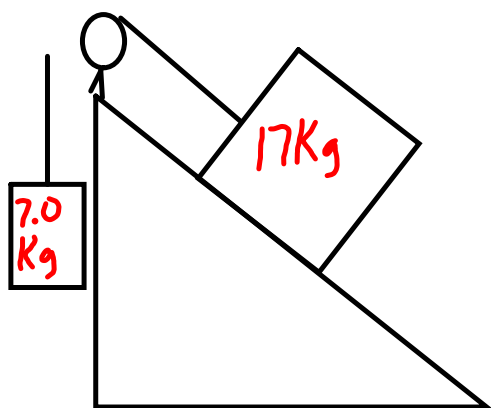


Coefficient of friction - 0.11



What is the acceleration of the box?

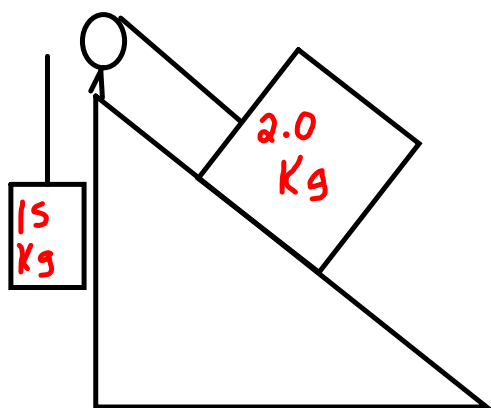
Frictionless Incline



What is the acceleration of the box?

What is the tension in the string?

Coefficient of friction = 0.09



What is the acceleration of the box?

What is the tension in the string?

Ex 2. Hanging Jane problem from p. 200, but add friction to  $m_1$ ,

p. 202 #1a & b without friction then with friction  
Part c - BONUS!!!

Next: Horizontal & incline with pulley (with & w/out friction)