NEWTON'S SECOND LAW PROBLEMS: MULTIPLE OBJECTS
Problems document

These problems build on the skills covered in my video series "Newton's Second Law problems, explained step by step".

Answers to these problems are available in the Answers document.

Brief solutions to the problems are available in the Brief Solutions document.

Step-by-step solutions to the problems are available in the Step-by-Step Solutions document, and in the YouTube videos.

You can find links to these resources at my website:
www.freelance-teacher.com

Links to the documents are also in the video description boxes for the YouTube videos.

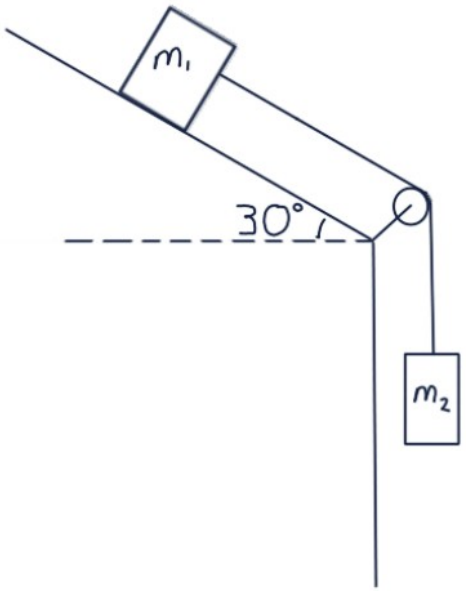
If you find that the video explanations move too slowly, you can simply try the problems in this Problems document, study the solutions in the Solutions document, and skip to any particular parts of the videos that cover parts of the solutions that you find confusing. Each video has a table of contents, to make it easier to skip to particular topics.

If you find a particular problem to be difficult, then, after studying the solution, *before* you try the next problem, you should take a blank piece of paper and retry that problem from scratch. Don't move on to the next problem in the series until you are comfortable with the solution for the current problem.

Problems begin on next page.

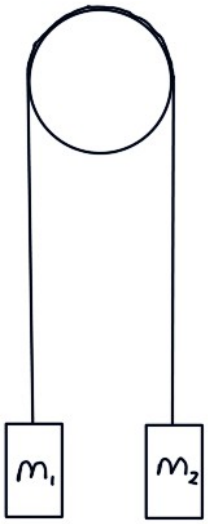
Video (1)

In the diagram, m_1 = 3.0 kg and m_2 = 2.0 kg. The pulley is massless and frictionless. Mass 1 is sliding down the incline; mass 2 is falling. There is a coefficient of kinetic friction μ_k = 0.40 between mass 1 and the incline. Find the acceleration of the masses, and the tension in the rope.



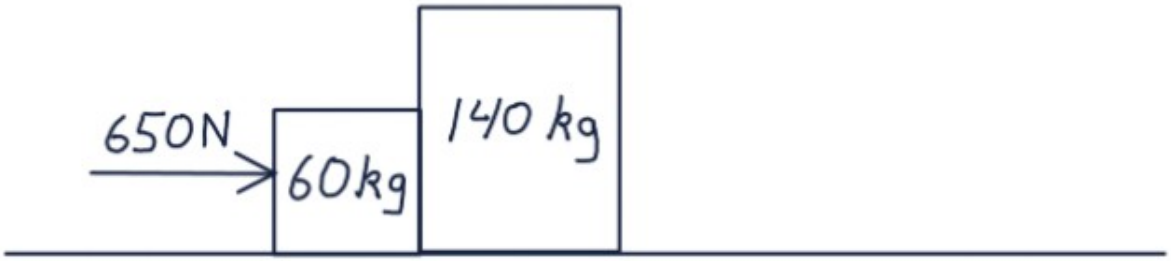
Video (2)

Two masses, m_1 = 30 kg and m_2 = 50 kg, are connected by a massless rope that has been slung over a massless pulley. The two masses are initially held at the same height, and then they are released. What is the difference in the heights of the two masses at a time t = 1.5 s after they are released?



Video (3)

Two boxes, with masses 60 kg and 140 kg, are resting on a horizontal floor. Then a 650 N force is applied to the 60 kg box, so that the boxes slide to the right. The coefficient of kinetic friction is 0.10.
(a) Draw a free-body diagram for the 60 kg box, and a free-body diagram for the 140 kg box.
(b) Find the acceleration of the boxes.
(c) Find the force that each box exerts on the other.



Video (4)

A 12 kg block is placed on a frictionless table, and a 4.0 kg block is stacked on top of the 12 kg block. Then a steady horizontal force $\vec{F}$ is exerted on the 12 kg block. The coefficient of static friction between the two blocks is 0.40; the coefficient of kinetic friction between the blocks is 0.20.
(a) Assuming that the 4 kg block does not slide relative to the 12 kg block, draw a free-body diagram for the 4 kg block, and a free-body diagram for the 12 kg block.
(b) What is the magnitude of the maximum horizontal force $\vec{F}$ that can be exerted without the 4 kg block sliding relative to the 12 kg block?