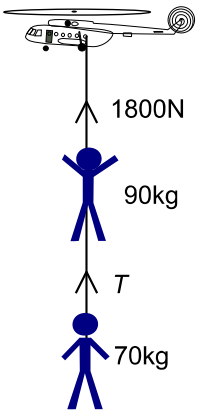
# Newton's Laws – 2 – Tutorial

1. A stationary helicopter is raising two people of masses 90 kg and 70 kg as shown. The force applied to the 90 kg person is 1800 N.

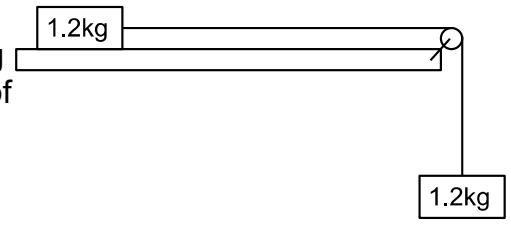



   Calculate:
   (i) the acceleration of both people, *(1.45 m/s$^2$)*
   (ii) the tension, *T*, in the lower rope. *(788 N)*

2. A car of mass 1000 kg tows a caravan of mass 750 kg along a horizontal road. The engine of the car exerts a forward force of 2500 N. The resistances to the motion of the car and caravan are each *k* × their masses, where *k* is a constant. The car accelerates at 1.0 m/s$^2$. Calculate the tension in the tow-bar. *(1.07 kN)*

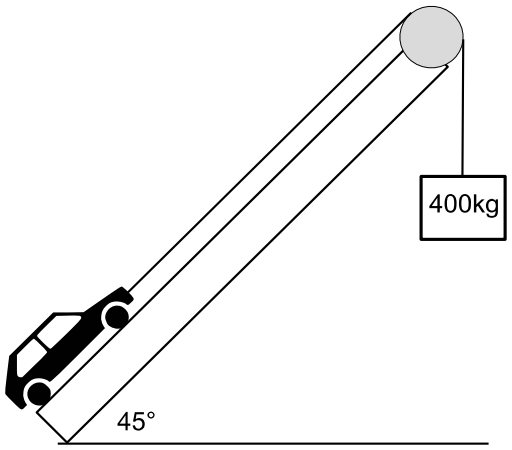
3. A car, mass 1400 kg, is pulling a trailer, mass 200 kg, and accelerating at 0.6 m/s$^2$.
   (a) Calculate the tractive force of the engine. (960 N)
   (b) A load L is placed in the trailer, which reduces the acceleration to 0.48 m/s$^2$. Assuming the tractive force remains the same, calculate the mass of L. *(400 kg)*
   (c) The load is removed but, because the trailer has an under-inflated tyre, there is a drag force on the trailer of 160 N. Calculate the acceleration of the car now (assuming the same tractive force as before). *(0.5 m/s$^2$)*

4. A box, of mass 1.2 kg, is sliding along a rough horizontal table. It is connected by a light string passing over a smooth pulley, to another box of mass 1.2 kg, as shown.
The force of friction between the table and the box is 5.2 N.




   Calculate:
   (i) the acceleration of each box, (2.7 m/s$^2$)
   (ii) the tension in the string. *(8.5 N)*

5. A car, of mass 450 kg, is on a slope which is inclined at 45° to the horizontal. It is attached, using a light string passing over a smooth light pulley, to a box of mass 400 kg, which is accelerating downwards.
A resistive force of 450 N acts on the car.




Calculate:

(i) the acceleration of the car, *(0.41 m/s$^2$)*

(ii) the tension in the string. *(3.8 kN)*