Newton's Laws – 1 – Tutorial

1. Three spies, Delta, mass 90 kg, Echo, mass 80 kg. and Foxtrot are on board a hot air balloon, whose mass, including the basket, is 110 kg. The balloon is floating in equilibrium when, after a struggle, Delta and Echo eject Foxtrot from the basket. The balloon begins to accelerate upwards at, a rate of 2.1 m/s^2.
   Calculate the mass of spy Foxtrot. *(60 kg)*

2. A jet airliner, mass 300 tonnes, has three engines, each of which produces a nearly constant thrust of 240 kN during takeoff.
   The takeoff speed is 220 km/hr.
   The runway is inclined at an angle of 0.5°.
   Neglect air and running resistance.

   Calculate the minimum length of runway required for:
   (i) an uphill takeoff (as shown in the diagram), *(807 m)*
   (ii) a downhill takeoff (in the opposite direction). *(751 m)*

3. A car driver, mass 90 kg, puts his foot down on the accelerator. The car has a mass of 1110 kg and the driving force supplied by the engine is 2.4 kN.
   (a) Calculate the acceleration of the car. (Allow for the mass of the driver, who is inside the car). *(2.0 m/s^2)*
   (b) 100 m further down the road, the car reaches a speed of 100 km/hr. Calculate the initial speed. *(19 m/s)*
   (c) Calculate the forward force (horizontal) exerted on the driver by the car seat while the car maintains this acceleration. *(180 N)*