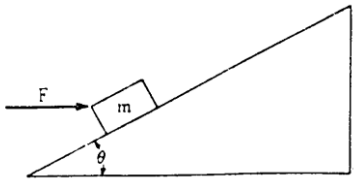
Newton Test Redux Optional: Complete both of these questions...I will average the two scores and replace your lowest FR question score on your test with the average of these two.



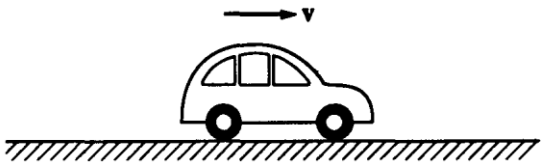
1. A block of mass m, acted on by a force of magnitude F directed horizontally to the right as shown above, slides up an inclined plane that makes an angle θ with the horizontal. The coefficient of sliding friction between the block and the plane is μ.

a. On the diagram of the block below, draw a dot to represent the box and then make a free-body diagram of all the forces acting on the block.

b. Develop an expression in terms of m, θ, F, μ, and g for the normal force acting on the block.

c. Develop an expression in terms of m, θ, F, μ, and g, for the block's acceleration up the plane.

d. Develop an expression for the magnitude of the force F that will allow the block to slide up the plane with constant velocity.



2. A car of mass m, initially at rest at time $t = 0$, is driven to the right, as shown above, along a straight, horizontal road with the engine causing a constant force F_o to be applied. While moving, the car encounters a resistance force equal to $-kv$, where v is the velocity of the car and k is a positive constant.

a. The dot below represents the center of mass of the car. On this figure, draw and label vectors to represent all the forces acting on the car as it moves with a velocity v to the right.

b. Determine the horizontal acceleration of the car in terms of k, v, F_o, and m.

c. Determine the terminal velocity of the car in terms of given quantities and fundamental constants.

d. Derive the equation expressing the velocity of the car as a function of time t in terms of k, F_o, and m. Show all your steps.