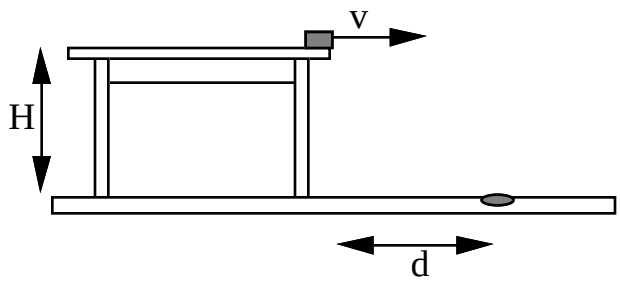
PHYS1189/1199 Midsession test, 2001

QUESTION 1 **[Marks 16]**

i) At what horizontal speed v should an object leave the top of a table of height H so that the object falls onto a target on the floor that is a horizontal distance d from the edge of the table?

ii) What is the angle of travel of the object when it hits the target?

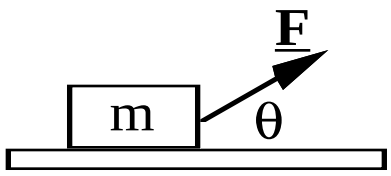


QUESTION 2 **[Marks 14]**

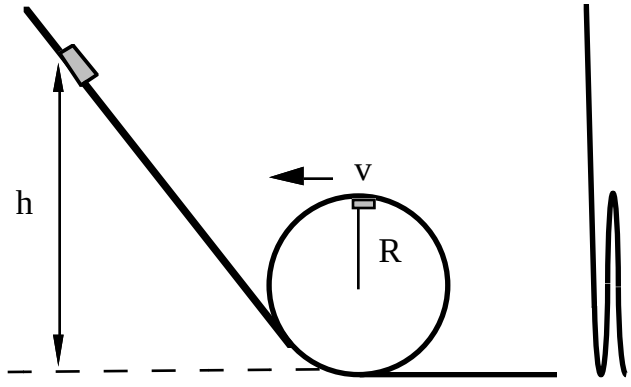
An object of mass m is being dragged along the floor, at constant speed, by a rope that makes an angle θ, as shown. The coefficient of kinetic friction between mass and floor is μ_k.

i) Draw a labelled diagram showing all of the forces acting.

ii) Derive an expression for the magnitude of the required force **F**.



QUESTION 3 **[Marks 18]**



A mass m, of negligible size, slides down a track with the shape shown in the diagram that allows it to "loop-the-loop". The radius of the loop is R. The friction is negligible, and you may treat the mass as a point mass. (The diagram at right is an end view and shows that the loop does not cross itself.)

What is the minimum starting height h for which the sliding object maintains contact with the loop throughout the trip?

QUESTION 4 **[Marks 14]**

i) A charge q is located at (x,y) = (0,a) and a charge −2q is located at (2a,0). Give an expression for the electric field *at the origin* in terms of Coulomb's constant, q, a and the unit vectors **x** and **y**.

ii) What is the magnitude of the electric field at the origin?

iii) What is the direction of the electric field at the origin?

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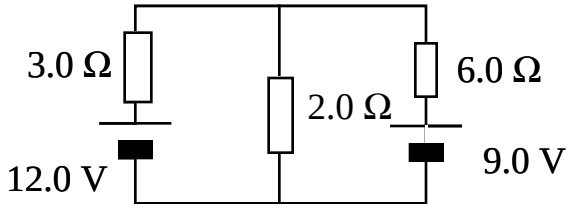
QUESTION 5 **[Marks 18]**

In the circuit shown at left, there are 2 ideal emfs and 3 resistors, as shown. Determine:



i) the current in the 2.0 Ω resistor

ii) the rate at which the 9.0 V emf is losing energy

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