Laws of motion and Friction
Assignment 2

Question: 1
A body of Mass m moves along the X-axis such that a time t its position is given by following expression

$x=at^{3/2} - bt + c$

Where a, b and c are constant
a) Calculate the acceleration of the body
b) What is the force acting on it
c) What is the force at t=1 sec
d) What are the dimension of a

Question: 2
An 8 Kg object is subjected to three forces

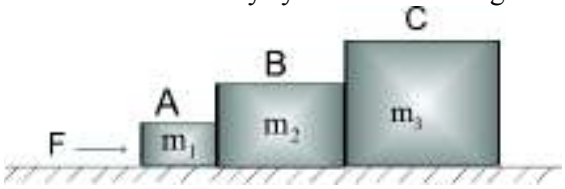
$\mathbf{F}_1 = 20\mathbf{i} + 30\mathbf{j}$ N

$\mathbf{F}_2 = 22\mathbf{i} - 10\mathbf{j}$ N

$\mathbf{F}_3 = 6\mathbf{i} + 4\mathbf{j}$ N

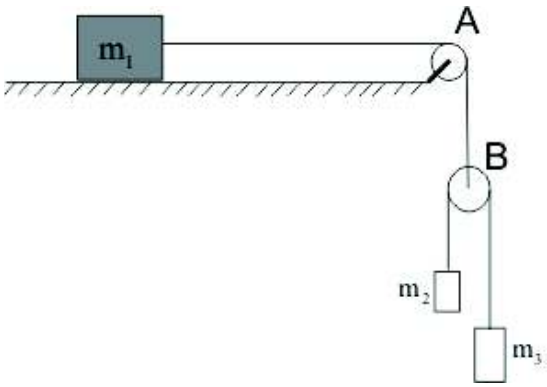
a) Find the acceleration of the object.
b) If the object start from rest from origin, what will be the location after 4 sec
c) what is the magnitude of resultant force and its direction
d) What fourth force $\mathbf{F}_4$ should be applied on the body to make the net resultant force zero

Question: 3
Consider a three body system shown in figure below



1) Find the acceleration of the each object
2) Find the contact force between all the objects

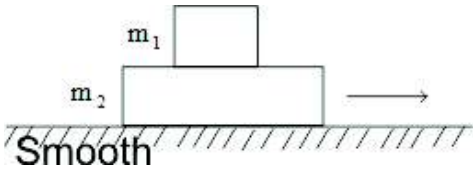
Question: 4
Three Block of mass m_1 ,m_2 and m_3 are connected as shown in the figure below.
All the surfaces are frictionless and strings and pulley are light .



Find the acceleration of all the masses

Question: 5

A small block of mass m_1= 3 kg is placed at rest on a larger block of mass m_2=5 kg .The situation is given in the figure below



The coefficient of friction between the two block is $\mu = .3$

And the horizontal surface is smooth.A constant Force F is applied on the block

Find out the following

a) Find the value of limiting friction between the two blocks

b) What is the maximum acceleration by which the upper block can move

c) What is the maximum value of F at which both the block move together

d) if F=20 N,what is the acceleration of each block and what frictional force is acting between the block

e) What is the normal contact force between the blocks

f) what is the normal contact force between the larger block and the smooth surface

g) if F=40 N,what is the acceleration of each block and what frictional force is acting between the block

h) If the force is applied to the upper block,what will be the minimum force required so that there is relative motion between the block

Given g=10 m/sec^2

Question: 6

A object of mass M is standing in a stationary lift. What pressure force N exerted by the object on the floor of the lift

a)If the lift is stationary

b) if the lift is moving upward with acceleration a

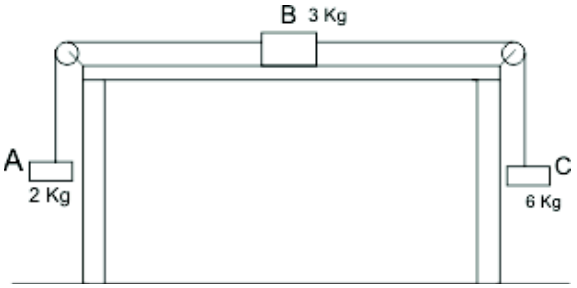
c) if the lift is moving downward with acceleration a

d) if the lift is falling freely

e) if the lift is moving upward with constant velocity
f) if the lift is moving downward with constant velocity

Question: 7
A piece of uniform strings hangs vertically so that its free end just touches the horizontal surface of the .The upper end of the strings is now released. Show that at any instant during the falling of string, the total force on the surface of the table is three times the weight of the part of the string lying on the surface

Question: 8
Three blocks A, B,C are such as
M_1=2 kg , M_2=3 kg , M_3=6 kg
They are connected as shown in the below figure.



The coefficient of friction between the block M_2 and table is 0.2
Find out the following
a) Draw all the forces acting on the system
b) The acceleration of the system
c) Frictional force between the block M_2 and table
d) Tension in the cord on the left and tension in the cord on the right
Given g=10 m/sec^2
The pulley are light and friction less

Question: 9
A boxcar is moving such that Initial velocity v=0
And Acceleration= (4 m/sec^2) **i.** Two objects A and B of mass 2 kg is kept in the boxcar. Take g=10m/sec^2
Find out following
a) If the object A slid along the frictionless floor with the velocity v= (10m/s) **i**. Find out the equation of the motion of object from the frame of reference of Boxcar. Also what time would it take to reach it original position relative to box car
b) The object B slid along the rough floor with the velocity v= (10m/s) **i**. Find out the equation of the motion of object from the frame of reference of Boxcar.Coefiicent of sliding friction =.3, Coefficient of static friction >0.5