EP547 Computational QM with MATLAB (HW1)
Deadline 21/03/2013

Q1

Write a function named **v = primeList(n)** that returns list (vector) of prime numbers less than or equal to n.

Example function call in MATLAB command line:

```
>> p = primeList(20)
>> p =  2  3  5  7  11  13  17  19
```

Q2

Series expansion of the sin(x) function is:

$$\sin(x) = x - x^3/3! + x^5/5! - x^7/7! + \ldots$$

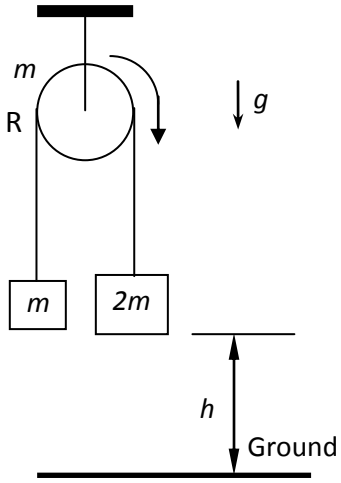
Write a function named **y = mySin(x)** that takes real angle x (in radians) returns the result of the sum of the first 15 terms of the expansion. Plot built-in sin(x) function and mySin(x) function on the same axes for the range [-10, 10].

Q3

Figure shows a uniform pulley mounted on a fixed horizontal axis. Two blocks of mass *m* and 2*m* respectively hangs from a light cord that is wrapped around the rim of the pulley. The blocks are initially at rest and their height is *h* from the ground. Moment of inertia of the pulley is $I = mR^2/2$. Write MATLAB script, to perform a simulation and animation of the system for

m = 1 kg, h = 2 m, R = 10 cm and g = 9.8 m/s^2.

The system must stop when the heavy block hits the ground or the lighter block hits the pulley.



Q4

Evaluate the integral $\int_0^3 \int_0^{\pi} \int_0^{2\pi} r^2 \sin(\theta) d\phi d\theta dr$ by MATLAB **`int()`** function.

Q5

Groud state wave function of a particle in an infinite quantum well as shown in figure is given by:

$$\Psi(x) = A\sin(\pi x / L)$$

Determine the normalization constant *A*

(a) in terms of *L* by using MATLAB `int()` function.

(b) by using Simpson' Method if L = 1 nm.