UNIVERSITI MALAYSIA PAHANG

ORDINARY DIFFERENTIAL EQUATIONS
BUM2133

QUESTION NO.	MARKS
1	
2	
3	
TOTAL	

FACULTY OF INDUSTRIAL SCIENCES & TECHNOLOGY	**SUBJECT:** ORDINARY DIFFERENTIAL EQUATIONS		**MARKS**:
	CODE:	**TOPIC:** CHAPTER 1, 2, 3	
	ASSESSMENT: ASSIGNMENT	**DUE/DURATION:**	**/50**

QUESTION 1

An object of mass m moving in a viscous medium with resistive force that is proportional to velocity $-Rv$ which satisfies the differential equation below:

$$m\frac{dv}{dt} = -Rv$$

where $m = 2kg$, $R = 1.2Ns/m$ and initial velocity is $100m/s$.

(a) What type of first order differential equation that satisfies the equation above?
(b) Find its general solution.
(c) By using Microsoft Excel, complete the data in **Table 1**.
(d) Plot in the same graph (time vs velocity) for the exact data and estimate data.
(e) Give your comment based on the result you get from (c) and (d).

Table 1: The velocity of object as a function of time.

t (s)	Exact velocity	Estimate velocity
0	100	
0.01	99.4000	
0.02	98.8036	
0.03	98.2108	
0.04	97.6215	
0.05	97.0358	
0.06	96.4536	
0.07	95.8748	
0.08	95.2996	
0.09	94.7278	
0.1	94.1504	

QUESTION 2

Find the solution of an undamped system governed by

$$m\frac{d^2y}{dt^2}+ky=5\sin\frac{\omega}{2}t$$

Where $\omega=\sqrt{\frac{k}{m}}$ and he initial conditions $y(0)=0$ and $y'(0)=0$.

QUESTION 3

Tank T_1 and T_2 initially contain $100gal$ of water each. In T_1 the water is pure, whereas $50lb$ of fertilizer are dissolved in T_2. By circulating liquid at a rate of $1gal/\min$ and stirring (to keep the mixture uniform) the amount of fertilizer $y_1(t)$ in T_1 and $y_2(t)$ in T_2 in change with time t. The mixing problem can be modeled by the system of first-order differential equations below.

$$\begin{pmatrix} y_1' \\ y_2' \end{pmatrix}=\begin{pmatrix} -0.01 & 0.01 \\ 0.01 & -0.01 \end{pmatrix}\begin{pmatrix} y_1 \\ y_2 \end{pmatrix}$$

At time $t=0$, $y_1=0$ and $y_2=50$. Find the particular solution of $y_1(t)$ and $y_2(t)$ using the Laplace Transform method.