國立雲林科技大學 110 學年度 碩士班招生考試試題

系所：機械系

科目：工程數學(1)

Prob. 1 **(25%)**

Consider the ordinary differential equation (O.D.E.) shown below, and y is a function of x

$$xy' + y - y^3 = 0.$$

Please find the general solution of the O. D. E.

Prob. 2 **(25%)**

Please solve the O.D.E. with initial conditions shown below, and y is a function of t:

$$y'' + y = f(t), \quad y(0) = 1, y'(0) = 0$$

$$\text{where } f(t) = \begin{cases} t, & for\ 0 \le t < 10 \\ 1, & for\ 10 \le t \end{cases}$$

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Prob. 3 (20%)

Three vectors in R^4 are given as below.

$$\vec{e}_1 = \begin{bmatrix} 3 \\ 0 \\ 2 \\ 3 \end{bmatrix}, \quad \vec{e}_2 = \begin{bmatrix} -6 \\ 42 \\ 24 \\ 54 \end{bmatrix} \text{ and } \vec{e}_3 = \begin{bmatrix} 21 \\ -21 \\ 0 \\ -15 \end{bmatrix}$$

Are those vectors linearly independent? Why?

(Hint: If they are not linearly independent, one may find x and y, such that $\vec{e}_3 = x\vec{e}_1 + y\vec{e}_2$.)

Prob. 4 (30%)

Given two straight lines and a vector A in R^3 space：

$$\begin{cases} x = t \\ y = -t \\ z = 2t \end{cases} \text{ 與 } \begin{cases} x = 2s \\ y = s \\ z = -s \end{cases} \text{ 以及 } A = \begin{bmatrix} 2 \\ 2 \\ 2 \end{bmatrix}$$

(i) Please find the equation of plane which contains the given two straight lines. (15%)

(ii) Then, find the vector which is projected from vector A onto the plane obtained in (i). (15%)