1. Solve the following systems of differential equations.

$$t\frac{dy}{dt} = -4x + \ln t$$

$$t^2\frac{d^2x}{dt^2} = y + 4x \qquad (20)$$

2. Find the derivative of velocity field $V(x, y, z) = x + 3y^2 + 4z^3$ at the point P : $(0.5, 0.5, 2.0)$ in the normal direction of a surface $z = 4x^2 + 4y^2$.

(15)

3. Calculate the following integral

$$I = \int_C \vec{V} \bullet d\vec{r}, \qquad (15)$$

from point P_1 : $(0, \pi/2)$ to point P_2 : $(1, 0)$. Where $\vec{V} = 3x^5y^2\vec{i} + x^6y\vec{j}$, $\vec{r} = x\vec{i} + y\vec{j}$, and C denote a path $x = \cos y$

4. " If A is an orthogonal matrix, and B is similar to A, then B is also an orthogonal one ".
Is the above statement true ? why ?

(10)

5. Find the value of the following integral

$$I = \int_{-\infty}^{\infty} \frac{xe^{-ix}}{x^2 + ix + 2}dx, \qquad (20)$$

where i denote the pure imaginary number (0,1).

6. Solve the following partial differential equation

$$\frac{\partial^2\phi}{\partial x^2} + \frac{\partial^2\phi}{\partial y^2} = 1, \qquad (20)$$

with boundary conditions $\phi(0, y) = \phi(a, y) = \phi(x, 0) = \phi(x, b) = 0$.