



1. Assumed that the uniform ice ball has a volume 1000 cm^3 , its melting rate is proportional to its surface area. After one minute, the volume of the ice ball decreased to be 729 cm^3 . How long will it takes that the volume is 125 cm^3 . (15%)
2. The given equation: $(-xy \sin x + 2y \cos x)dx + 2x \cos x dy = 0$
 - (a) Verify the D.E. is not exact. (3%)
 - (b) Find the integrating factor $u(x,y)$. (6%)
 - (c) Find the solution of the D.E. (6%)
3. Given the equation $x^2y'' - 3xy' + 3y = 2x^4e^x$ find the general solution.(10%)
4. If the equation $f(t) = -1 + \int_0^t f(t - \alpha)e^{-3\alpha} d\alpha$, find $f(t)$ by Laplace Transformer. (10%)
5. Perform the indicated operation, give that

$$A = \begin{bmatrix} 1 & 0 & -1 \\ 2 & 3 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 4 & 3 \end{bmatrix} \quad C = \begin{bmatrix} 0 & 1 \\ -1 & 0 \\ 2 & 1 \end{bmatrix}$$
 - (a) $(2A+B)C$ (b) If $2X+3(A-B)=0$, Find X . (10%)
6. If $A = \begin{bmatrix} 4 & 0 \\ 2 & -4 \end{bmatrix}$, Please find A^2 and A^n . (10%)
7. $A = \begin{bmatrix} 2 & 0 & -2 \\ 0 & 4 & 0 \\ -2 & 0 & 5 \end{bmatrix}$
 - (a) Find eigenvalues and eigenvectors of A .
 - (b) Prove that these eigenvector are independent and orthogonal.
 - (c) compute $-A^3 + 11A^2 - 34AI + 30$ (15%)
8. If $\vec{A} = 2\vec{i} + 3\vec{j} - \vec{k}$, $\vec{B} = -\vec{i} + 3\vec{j} + \vec{k}$, Find (a) $\vec{A} \cdot \vec{B}$ (b) $\vec{A} \times \vec{B}$ (c) The projection of \vec{A} on \vec{B} (15%)