CAMBRIDGE INSTITUTE OF TECHNOLOGY

Department of Basic Sciences

Question bank

1. Find the matrix of the linear transformation $T:V_2(R)\to V_3(R)$ such that $T(-1,1)=(-1,\ 0,\ 2)$ and $T(2,1)=(1,\ 2,\ 1)$.

2. Verify the Rank-nullity theorem for the linear transformation $T:V_3(R)\to V_2(R)$ defined by $T(x,y,z)=(y-x,y-z)$.

3. Determine the dimension and basis of the subspace spanned by the vectors $\{(0,1,-3,-1)(1,0,1,1)(3,1,0,2)(1,1,-2,0)\}$ in R^3.

4. Prove that T: $R^3\to R^3$ be defined by $T(a,b,c)=(3a,a-b,2a+b+c)$ is a linear transformation.

5. Prove that in $V_3(R)$, the vectors $\{(1,2,1)\quad(2,1,0)\quad(1,-1,2)\}$ are linearly independent.

6. If W is the set of all points in R^3 satisfying the equation $lx+my+nz=0$ then prove that W is subspace of R^3.

7. Express the vector $(3,5,2)$ as a linear combination of the vectors $\{(1,1,0)(2,3,0)(0,0,1)\}$ of V^3.

9. Determine the dimension and basis of the subspace spanned by the vectors $\{(2,4,2)(1,-1,0)(1,2,1)(0,3,1)\}$ in R^3.

10. Express the polynomial $f(x)=x^2+4x-3$ as a linear combination of polynomials $f_1(x)=x^2-2x+5, f_2(x)=2x^2-3x, f_3(x)=x+3.$

11. Verify the Rank-nullity theorem $T(e_1)=(0,1,0,2);T(e_2)=(0,1,1,0);T(e_3)=(0,1,-1,4)$

12. Show that the vectors are mutually orthogonal,

$$a=(2,1,3);b=\left(\frac{-6}{7},\frac{15}{14},\frac{3}{14}\right),c=\left(\frac{1}{3},\frac{1}{3},\frac{-1}{3}\right)$$

13. Show that the vectors are mutually orthogonal,

$$a=(1,1,0,0);b=\left(\frac{-1}{2},\frac{1}{2},2,0\right),c=\left(\frac{2}{3},\frac{-2}{3},\frac{1}{3},4\right)$$