SARDAR VALLABHBHAI PATEL INSTITUTE OF TECHNOLOGY
VASAD
B. E. Second Semester (All Branch)
Subject: Vector Calculus and Linear Algebra (2110015)
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Tutorial: 05

1 Assume that v_1, v_2 and v_3 are vectors in R^3 that have their initial points at the origin. Determine whether the three vectors lie in a plane.
$v_1 = (2,-2,0), v_2 = (6,1,4), v_3 = (2,0,-4)$

2. Which of the following set of functions are linearly independent or linearly dependent?
i) $1, x, e^x$
ii) $\cos 2x, \sin^2 x, cos^2 x$

3 Determine whether the given set of vectors forms basis for R^3.
$(a) v_1 = (2,-3,1), v_2 = (4,1,1), v_3 = (0,-7,1)$
$(b) v_1 = (1,6,4), v_2 = (2,4,-1), v_3 = (-1,2,5)$

4 Show that the following set of vectors is a basis for M_{22}.
$\begin{bmatrix} 3 & 6 \\ 3 & -6 \end{bmatrix}, \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & -8 \\ -12 & -4 \end{bmatrix}, \begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}$

5 Let S= $\{v_1, v_2, v_3\}$ be the basis for R^3
(a) Find the coordinate vector of v= (5,-1,9) with respect to S.
(b) Find the vector v in R^3 whose coordinate vector with respect to the basis S is $(v)_s$=(-1,3,2)
where $v_1 = (1,2,3), v_2 = (-4,5,6), v_3 = (7,-8,9)$

6 Determine the dimension and basis for the solution space of the given systems.

$x_1 - 4x_2 + 3x_3 - x_4 = 0$
$2x_1 - 8x_2 + 6x_3 - 2x_4 = 0$

$x_1 - 3x_2 + x_3 = 0$
$2x_1 - 6x_2 + 2x_3 = 0$
$3x_1 - 9x_2 + 3x_3 = 0$

7 Find the basis for row space, column space and null space of $A =$
$\begin{bmatrix} 1 & 4 & 5 & 6 & 9 \\ 3 & -2 & 1 & 4 & -1 \\ -1 & 0 & -1 & -2 & -1 \\ 2 & 3 & 5 & 7 & 8 \end{bmatrix}$

8 Determine whether $\boldsymbol{b}$ is in the column space of A, and if so, express $\boldsymbol{b}$ as a linear combination of the column space of A.
$A = \begin{bmatrix} 1 & -1 & 1 \\ 1 & 1 & -1 \\ -1 & -1 & 1 \end{bmatrix}; b = \begin{bmatrix} 2 \\ 0 \\ 0 \end{bmatrix}$

9 Verify the dimension theorem $A = \begin{bmatrix} -1 & 2 & 0 & 4 & 5 & -3 \\ 3 & -7 & 2 & 0 & 1 & 4 \\ 2 & -5 & -2 & 4 & 6 & 1 \\ 4 & -9 & 2 & -4 & -4 & 7 \end{bmatrix}$

10 Find a basis for the orthogonal complement of the subspace of R^3 spanned by the vectors $v_1 = (1,-1,3), v_2 = (5,-4,-4), v_3 = (7,-6,2)$