

TRANSPOSE MATRICES AND THEIR APPLICATIONS

**DEFINITION:** The **transpose** of a matrix is obtained by interchanging its rows and columns - i.e. the first row of the matrix becomes the first column in the transpose, etc. The transpose of matrix A is indicated by  $A^T$ .

Example:  $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$       $A^T = \begin{bmatrix} a & c \\ b & d \end{bmatrix}$

Name the transpose of the following matrices:

1.  $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ -5 & 6 & 0 \end{bmatrix}$       $A^T = \begin{bmatrix} 1 & 4 & -5 \\ 2 & 5 & 6 \\ 3 & 6 & 0 \end{bmatrix}$      2.  $B = \begin{bmatrix} -2 & 1 \\ 4 & -3 \\ 7 & 1 \end{bmatrix}$       $B^T = \begin{bmatrix} -2 & 4 & 7 \\ 1 & -3 & 1 \end{bmatrix}$

3.  $C = \begin{bmatrix} 2 & -3 & 5 \\ 0 & 4 & -6 \end{bmatrix}$       $C^T = \begin{bmatrix} 2 & 0 \\ -3 & 4 \\ 5 & -6 \end{bmatrix}$      4.  $D = \begin{bmatrix} 1 & 0 & 5 & 7 \\ -2 & 4 & -3 & 8 \\ 0 & 0 & 6 & -9 \end{bmatrix}$       $D^T = \begin{bmatrix} 1 & -2 & 0 \\ 0 & 4 & 6 \\ 5 & -3 & 8 \\ 7 & 8 & -9 \end{bmatrix}$

The following problems are solved using the transpose of a matrix and matrix multiplication:

5. An outbreak of chicken pox hits the local high school and concerned health authorities have taken a survey of the students to determine the numbers that are sick, well, or carriers. The results are presented in matrix A below. The distribution of the school population is in matrix B.

	Junior	Senior	
Well	15%	25%	= A
Sick	35%	30%	
Carrier	50%	45%	
	$\left[ \begin{array}{cc} & \end{array} \right]$		
	3x2		

	Junior	Senior	
Male	104	80	= B
Female	107	103	
	$\left[ \begin{array}{cc} & \end{array} \right]$		
	2x2		