# Math 1050 ~ College Algebra

# 25 System of Linear Equations

## Inverse Matrix

If $A$ and $B$ are square matrices, $n \times n$, such that $AB = BA = I_n$, then $B$ is the inverse matrix of $A$ and can be denoted as $A^{-1}$.

## EX 1

Show that $B$ is $A^{-1}$. $A = \begin{bmatrix} 2 & 1 \\ 5 & 3 \end{bmatrix}$ $B = \begin{bmatrix} 3 & -1 \\ -5 & 2 \end{bmatrix}$

Process for finding an inverse matrix.

1. Augment $A$ with $I$.
2. Perform row operations until the left side looks like $I$.
3. The right side will be $A^{-1}$.

## EX 2

Determine the inverse of each matrix, if it exists.

### 2a)

$$\begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$$

### 2b)

$$\begin{bmatrix} 1 & -1 & 0 \\ 1 & 0 & -1 \\ 6 & -2 & -3 \end{bmatrix}$$

Let's derive a formula for the inverse of a $2 \times 2$ matrix.

We can write a system of linear equations as a matrix equation $AX = C$, where $A$ is a matrix of coefficients, $X$ is the matrix of variables and $C$ is the matrix of constants.

## EX 3

Write this system of equations as a matrix equation.
$2x + y = 4$
$5x + 3y = 6$

## EX 4

Using this fact from Ex. 1, $A = \begin{bmatrix} 2 & 1 \\ 5 & 3 \end{bmatrix}$ $A^{-1} = \begin{bmatrix} 3 & -1 \\ -5 & 2 \end{bmatrix}$ find the solution to Ex. 3.

## EX 5

Refer back to example 2 to solve these systems of equations.

**5a)**

$$2x + 3y = 0$$
$$x + 4y = -5$$

**5b)**

$$x - y = 2$$
$$x - z = 3$$
$$6x - 2y - 3z = 15$$

## EX 6

Solve this system using the techniques of this lesson.

$$\begin{aligned} 2x - 3y &= 8 \\ -4x + 6y &= -5 \end{aligned}$$