

## Math 204 Day 1 Answers Using Maple

You should consult the Maple handout and the YouTube videos for instructions on using Maple.

Any time you are doing linear algebra work in Maple be sure to start your document with the command

**with(LinearAlgebra):** which loads many more additional Linear Algebra commands into Maple.

*with(LinearAlgebra) :*

**Problem 4 (a).** Define matrix A using the matrix palette:

$$A := \begin{bmatrix} 0 & 1 & -4 & 8 \\ 2 & -3 & 2 & 1 \\ 5 & -8 & 7 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 1 & -4 & 8 \\ 2 & -3 & 2 & 1 \\ 5 & -8 & 7 & 1 \end{bmatrix} \quad (1)$$

Now we are ready to do some row reduction using Maple commands. Interchange row 1 and row 2.

$B := \text{RowOperation}(A, [2, 1])$

$$\begin{bmatrix} 2 & -3 & 2 & 1 \\ 0 & 1 & -4 & 8 \\ 5 & -8 & 7 & 1 \end{bmatrix} \quad (2)$$

To row 3 add  $-5/2$  row 1

$C := \text{RowOperation}\left(B, [3, 1], \frac{-5}{2}\right)$

$$\begin{bmatrix} 2 & -3 & 2 & 1 \\ 0 & 1 & -4 & 8 \\ 0 & -\frac{1}{2} & 2 & -\frac{3}{2} \end{bmatrix} \quad (3)$$

**NOTE:** You cannot use D as a variable name. D is a reserved symbol in Maple to indicate differentiation.

$E := \text{RowOperation}\left(C, [3, 2], \frac{1}{2}\right)$

$$\begin{bmatrix} 2 & -3 & 2 & 1 \\ 0 & 1 & -4 & 8 \\ 0 & 0 & 0 & \frac{5}{2} \end{bmatrix} \quad (4)$$

The system is inconsistent.

**Problem 4 (b).** Row reduce in a single step:

$\text{ReducedRowEchelonForm}(A)$

$$\begin{bmatrix} 1 & 0 & -5 & 0 \\ 0 & 1 & -4 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (5)$$

*GaussianElimination(A)*

$$\begin{bmatrix} 2 & -3 & 2 & 1 \\ 0 & 1 & -4 & 8 \\ 0 & 0 & 0 & \frac{5}{2} \end{bmatrix} \quad (6)$$

The difference between the two matrices is that the first in is reduced row echelon form and the second is just in echelon form.

**Problem 4 (d)** Section 1.1, #14.

$$G := \begin{bmatrix} 2 & 0 & -6 & -8 \\ 0 & 1 & 2 & 3 \\ 3 & 6 & -2 & -4 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 0 & -6 & -8 \\ 0 & 1 & 2 & 3 \\ 3 & 6 & -2 & -4 \end{bmatrix} \quad (7)$$

Multiply Row 1 by 1/2

$$H := \text{RowOperation}\left(G, 1, \frac{1}{2}\right)$$

$$\begin{bmatrix} 1 & 0 & -3 & -4 \\ 0 & 1 & 2 & 3 \\ 3 & 6 & -2 & -4 \end{bmatrix} \quad (8)$$

Add -3 times Row 1 to Row 3:

$$K := \text{RowOperation}(H, [3, 1], -3)$$

$$\begin{bmatrix} 1 & 0 & -3 & -4 \\ 0 & 1 & 2 & 3 \\ 0 & 6 & 7 & 8 \end{bmatrix} \quad (9)$$

Add -6 times Row 2 to Row 3:

$$L := \text{RowOperation}(K, [3, 2], -6)$$

$$\begin{bmatrix} 1 & 0 & -3 & -4 \\ 0 & 1 & 2 & 3 \\ 0 & 0 & -5 & -10 \end{bmatrix} \quad (10)$$

Multiply Row 3 by -1/5:

$$M := \text{RowOperation}\left(L, 3, -\frac{1}{5}\right)$$

$$\begin{bmatrix} 1 & 0 & -3 & -4 \\ 0 & 1 & 2 & 3 \\ 0 & 0 & 1 & 2 \end{bmatrix} \quad (11)$$

Add -2 times Row 3 to Row 2:

$$N := \text{RowOperation}(M, [2, 3], -2)$$

$$\begin{bmatrix} 1 & 0 & -3 & -4 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 2 \end{bmatrix} \quad (12)$$

Add 3 times Row 3 to Row 1:

$$P := \text{RowOperation}(N, [1, 3], 3)$$

$$\begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 2 \end{bmatrix} \quad (13)$$

The solution is (2, -1, 2).