**Colorado Technical University**

**Course:** MATH116 – Foundations for Calculus

**Unit 9 Part 18 Readings: Matrices**

**Matrices**

Matrices (singular: **matrix**)

Matrices can be used as a shorthand way of writing a system of equations

consist of rows and columns

each row is one of the equations

each column is a variable

a vertical bar represents the equals sign

the constants are on the right

called an “**augmented matrix**”

The original list of equations is written in what is called “**algebraic notation**”

Rewriting them in the form of an augmented matrix is called “**matrix notation**”

A matrix including only the coefficients of the variables is called a **coefficient matrix**

Augmented matrices are used by computers to find solutions for large systems

**Matrix Row Operations**

Interchange the elements between two rows: *R*1<-> *R*2

Multiply each element in the row by a scalar constant: 3*R*2

Add the corresponding elements in one row to those in another row: *R*1+ *R*2

You can combine these operations: 5*R*1+ *R*2

**Gaussian Elimination** - use row operations to get zeroes in the lower triangle (called “**row-**

**echelon form**”)

Gauss-Jordan Elimination - use row operations to get:

zeroes in the lower triangle

zeroes in the upper triangle

ones on the diagonal

As we go through the steps of solving a linear system by the method of **elimination**, the rows

of coeﬃcient matrix will change.

These changes in the coeﬃcient matrix are called **elementary row operations**

The operation to do this is called “**row reduction**”

Gaussian elimination is constantly used to solve large systems of equations

For small systems, it is not much faster than determinants, but for large systems the increase

in efficiency is clear

Whether a linear system can have more than one solution or not depends on whether the row

echelon form of the coeﬃcient matrix has more columns than non-zero rows

The row echelon form cannot have fewer columns than non-zero rows

If the original coeﬃcient matrix has more columns than rows, then the system could never have only one solution

**Online Gaussian elimination calculator:**

<http://onlinemschool.com/math/assistance/equation/gaus/>

**Or use wolframalpha.com:**

**Row reduce: {(6,3,2,19),(0,5,4,15),(0,0,1,5)}**

**Today we will be learning about the matrix…**

**Expectation:**

A group of men wearing sunglasses

Description automatically generated

**Reality:**

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A = │ 7 4 5 │ B = │ 7 4 5 │ 62 │

│ 5 3 2 │ │ 5 3 2 │ 47 │

│ 3 7 8 │ │ 3 7 8 │ 63 │

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D = │ 62 5 4 7 │

│ 47 2 3 5 │

│ 63 8 7 3 │