**Colorado Technical University**

**Course:** MATH116 – Foundations for Calculus

**Unit 9 Part 17 Readings: Systems of Equations and Matrices**

**Systems of Equations**

a set of two equations containing two variables or three equations containing

three variables or …

A lot of equations come in groups – all the conditions must be met for a process

A true solution to a system of equations must be true for all of the equations in the

system

To solve a system, you must have at least as many equations as you have variables

**Solving simple linear systems:**

Use substitution and addition

Eliminate one of the variables in the system in order to obtain a linear equation containing only one variable

After solving one of the variables, substitute the solution into the original equation

to obtain the solution for the second variable.

Check the solution in the original system’s given equations.

**The solution to a system of equations is the point**

**where all the curves for each equation cross**

**Graphs of systems**

Use Excel or a graphing calculator to solve systems of equations

The solution is where the lines of each function cross

If they never cross… there is no real solution!

Equation 1

Equation 2

Solution of both equations

**Break–even point** is a business concept referring to the point when the cost of

producing a product equals the revenue it generates

The revenue function is the total amount generated by selling the product:

R(*x*) = (price per unit sold) × *x*

*x* is the quantity sold

The cost function is the total cost of producing x units of the product:

C(*x*) = fixed cost + (cost per unit produced) × *x*

*x* is the quantity produced

The profit function is the difference between the cost and the revenue

functions: P(*x*) = R(*x*) – C(*x*)

**Terms for Systems of Equations**

A **solution** to a system is a set of values for each variable which makes all of the equations

true

Systems of equations do not always have unique solutions

They may also have infinitely many solutions, or no solution at all!

A system is called **consistent** if it has a solution

If a system does not have a solution, it is called **inconsistent**

An equation within a system is called **dependent** if

1) it is the same as any other equation in the system

2) it is a scalar multiple of another equation in the system

3) it is the sum of any other equations

For a dependent system ,

Chart

Description automatically generated with low confidence1) the system has more than one solution

An equation within a system is called

**independent** if it cannot be derived

algebraically from the other equations

For an independent system ,

1) the system has a single

(unique) solution

You don’t have to have the same number

of equations as the number of variables

A system is considered **overdetermined** if there are more equations than unknowns

A picture containing outdoor object, clipart, sport kite

Description automatically generatedFor an overdetermined system, either

1) the system has a single (unique) solution

2) the system has more than one solution

3) the system has no solution at all

Shape

Description automatically generatedAn **underdetermined system** is one with fewer equations than unknowns

For an underdetermined system, either

1) the system has no solution at all

2) the system has more than one solution

If the number of equations equals the number of variables, the system is **balanced** or **square**

A picture containing outdoor object, clipart, sport kite

Description automatically generated For a balanced system, either

1) the system has a single (unique) solution

2) the system has more than one solution

3) the system has no solution at all

A system of linear equations is called **homogeneous** if all of the constants in the equations are zero

For a **homogeneous** system, either

1) the system has only one solution, the trivial one

2) the system has more than one solution

For a **non-homogeneous** system, either

1) the system has a single (unique) solution

2) the system has more than one solution

3) the system has no solution at all

A system solution is called **trivial** if all the values for the variables are 0

**Online System Solver:** use wolframalpha.com

solve the system: x + 3y + 4z = –14 and 6x + 4y + 2z = –22 and 3x + 7y – z = –1



