



Division of  
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UNIVERSITY OF GEORGIA

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## MATH 1101 Chapter 4 Review

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### Topics Covered

Section 4.1 Systems of Linear Equations

Section 4.2 Applications of Linear Equations

### How to get the most out of this review:

1. Watch the video and fill in the packet for the selected section. (Video links can be found at the two web addresses at the top of this page)
2. After each section there are some 'Practice on your own' problems. Try and complete them immediately after watching the video.
3. Check your answers with the key on the last page of the packet.
4. Go to office hours or an on-campus tutoring center to clear up any 'muddy points'.

## Section 4.1 Systems of Linear Equations

### What is a system of linear equations?

A system of equations consists of the minimum number of equations required to solve for multiple variables. The rule of algebra is that to solve for  $n$  variables, you need no less than  $n$  well defined equations.

### How do we solve a system of equations?

There are two main methods

1. Algebra (a.k.a. brute force). This can be done for a small system of 2 variables without much too much trouble. However, as the number of variables increase, this can be unnecessarily cumbersome.
2. Matrix Algebra. This is the most efficient method and allows you to solve for all variables simultaneously!

### What is a matrix?

A matrix is an array of values. Matrices are described by their dimensions. An  $n \times m$  matrix has  $n$  rows and  $m$  columns.

### How to solve a system of equations using matrices

We solve them using the following formula:

$$[A][X] = [B]$$

where  $[A]$  is the variable coefficient matrix,  $[X]$  is the variable matrix and  $[B]$  is the matrix of constants. Solving the above equation for  $[X]$  yields the following:

$$[X] = [A]^{-1}[B] = [C]$$

where  $[C]$  is the resultant matrix that gives the solution to the system.

### **Example 1**

Solve the following system of equations

$$\begin{aligned} 2x - y &= 10 \\ 3x + 2y &= 5 \end{aligned}$$

$[A]=$

$[X]=$

$[B]=$

### Calculator

1. Go to 2nd  $\rightarrow$  MATRIX  $\rightarrow$  EDIT  $\rightarrow$  [A]
2. Enter the dimensions 2x2 and fill in values
3. Go to 2nd  $\rightarrow$  MATRIX  $\rightarrow$  EDIT  $\rightarrow$  [B]  $[C]=$
4. Enter the dimensions 2x1 and fill in values
5. Go to 2nd  $\rightarrow$  QUIT
6. Go to 2nd  $\rightarrow$  MATRIX  $\rightarrow$  [A]  $\rightarrow$   $x^{-1}$
7. Go to 2nd  $\rightarrow$  MATRIX  $\rightarrow$  [B]  $\rightarrow$  Enter (Verify you see  $[A]^{-1}[B]$  before you hit enter)
8. A 2x1 matrix should come out

What are the values of  $x$  and  $y$ ? Round to 2 decimal places.

**Example 2**

Solve the following system of equations.

$$\begin{aligned}x &= 7 + 3z - 2y \\3z &= 11 - 2x \\2z + x + 2y &= 12\end{aligned}$$

[A]=

[X]=

[B]=

[C]=

What are the values of  $x$ ,  $y$  and  $z$ ?

### Practice on Your Own

1. Use this matrix for the following questions:

$$\begin{bmatrix} 1 & 3 & 0 \\ 4 & 2 & 2 \\ 0 & -1 & 1 \end{bmatrix}$$

(a) What is the dimension of this matrix?

(b) What is element  $a_{1,2}$ ?

(c) Does this have an inverse? If so, what is element  $a_{1,3}$ ?

2. Use this matrix for the following questions:

$$\begin{bmatrix} 1 & 3 & 0 \\ 4 & 2 & 2 \\ 0 & -1 & 1 \\ 7 & 3 & 1 \end{bmatrix}$$

(a) What is the dimension of this matrix?

(b) What is element  $a_{4,1}$ ?

(c) Does this have an inverse? If so, what is element  $a_{2,3}$ ?

3. Solve the following systems of equations,

(a) What is  $x$  and  $y$ ?

$$\begin{aligned} 3x - y &= 7 \\ 2x + 3y &= 1 \end{aligned}$$

(b) What is  $x$ ,  $y$  and  $z$ ?

$$\begin{aligned} x + 2y - z &= 4 \\ 2x + y + z &= -2 \\ x + 2y + z &= 2 \end{aligned}$$

## Section 4.2 Applications of Linear Equations

### **Example 3**

You clean your house and find 1036 coins totaling \$18.52 in loose change. If you only find quarters and pennies, how many of each type of coin did you find?

### **Example 4**

Your bake sale for charity was very successful this year. On day 1, you sold 56 chocolate chip cookies, 30 muffins and 23 slices of cake. On day 2, you sold 23 chocolate chip cookies, 61 muffins and 42 slices of cake. On day 3, you sold 75 chocolate chip cookies, 16 muffins and 75 slices of cake. Your revenue totals were \$231, \$355 and \$482. What price did you charge for each item?



## Answers to the Practice on Your Own Problems

### Section 4.1

- $3 \times 3$
  - 3
  - yes,  $-0.75$
- $4 \times 3$
  - 7
  - no
- $x = 2, y = -1$
  - $x = -1.67, y = 2.33, z = -1$

### Section 4.2

- 16 roses, 2 tulips and 6 lilies
- 25 gallons of 12%, 75 gallons of 20%

Answers:

3. (a)  $3 \times 3$   
(b) 3  
(c) yes,  $-0.75$
4. (a)  $4 \times 3$   
(b) 7  
(c) no
5. (a)  $x = 2, y = -1$   
(b)  $x = -1.67, y = 2.33, z = -1$
6. 16 roses, 2 tulips and 6 lilies
7. 25 gallons of 12%, 75 gallons of 20%