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MATH 1101 Chapter 4 Review - Gentry

Spring 2018

Topics Covered

Section 4.1 Systems of Linear Equations
Section 4.2 Applications of Linear Equations

Note: This review content is online only. You can find the video on the exam 4 Gentry playlist.

What's in this review?

1. **Review Packet**
   The packet is filled in along with the instructor during the live review. If you missed the live review, see the video link at either web address at the top of the title page for the video link to watch the review.
2. **Useful Formulas**
   For your convenience, selected screen shots are available as a quick reference. The video shows the calculator screen for specific problems in the packet.
3. **Practice Problems**
   The problems are meant for you to try at home after you have watched the review. The answers are provided on the last page. There are tutors in Milledge Hall and Study Hall to help you if needed.

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 17

Solve the following system of equations

$$2x - y = 10$$
$$3x + 2y = 5$$

[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 18

Solve the following system of equations.

$$x = 7 + 3z - 2y$$
$$3z = 11 - 2x$$
$$2z + x + 2y = 12$$

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

[C]=

What are the values of x, y and z?

Section 4.2 Applications of Linear Equations

Example 19
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 20
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?

Useful Formulas

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

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

Additional Practice Problems

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?

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

4. A florist receives an order for 5 identical bridesmaids bouquets. The bride has a total budget of $610 and wants 24 flowers in each bouquet. Roses cost $6 each, tulips cost $4 each and lilies cost $3 each. She wants twice as many roses than lilies and tulips combined in each bouquet. How many roses, lilies and tulips should be in each bouquet?

5. A chemistry lab needs to make 100 gallons of an 18% acid solution by mixing a 12% acid solution with a 20% solution. Find the number of gallons needed of the 12% and 20% solutions required.

Answers:

1. (a) 3x3
   (b) 3
   (c) yes, -.75
2. (a) 4x3
   (b) 7
   (c) no
3. (a) $x = 2, y = -1$
   (b) $x = -1.67, y = 2.33, z = -1$
4. 16 roses, 2 tulips and 6 lilies
5. 25 gallons of 12%, 75 gallons of 20%