

# MA162: Finite mathematics

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## SCHEDULE:

- Exams were still being adjusted today.
- HW B1 is due Monday, Feb 22nd, 2010.
- HW B2 is due Monday, Mar 1st, 2010.
- HW B3 is due Sunday, Mar 7th, 2010.
- Exam 2 is Monday, Mar 8th, 5:00pm-7:00pm.
- My office hours are Tuesday and Thursday, 2:30pm-4:00pm in CB63

Today we will cover 3.1 and review 2.6: graphing inequalities

## Exam 2: Overview

- Most math classes focus on solving equations
- I have \$100 and I can buy jelly beans for \$1 a bag, and chocolate for \$2 a bar, I want twice as many bars as bags, how many of each do I buy?
- Wait: why do I need to spend **all** my money?
- Real business decisions are not (usually) about spending the budget down to the last penny
- We want to maximize profit while staying **under** budget
- Chapters 3 and 4 (this upcoming exam) focus on solving small, but realistic problems like this
- Matrix arithmetic is also on the exam

## 2.6: Review from last week

- Quiz answers:

$$C = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{bmatrix} \quad C^{-1} = \begin{bmatrix} 1 & -2 & 5 \\ 0 & 1 & -4 \\ 0 & 0 & 1 \end{bmatrix}$$

- Solve  $AX = B$  for  $X$  when

$$A = \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \quad X = \begin{bmatrix} 2 & 1 & 0 \\ 1 & 2 & 3 \end{bmatrix}$$

- $A + B$ ,  $A - C$ ,  $A \cdot C$  are all **not** defined.

$$A \cdot B = \begin{bmatrix} 18 & 21 & 24 \\ 29 & 34 & 39 \end{bmatrix} \text{ is defined.}$$

## Review of 2.6: Work shown

- Finding the inverse:

$$\begin{bmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & 1 & 4 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 \end{bmatrix} \xrightarrow{R_2 - 4R_3} \begin{bmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & -4 \\ 0 & 0 & 1 & 0 & 0 & 1 \end{bmatrix} \xrightarrow{R_1 - 3R_3}$$

$$\begin{bmatrix} 1 & 2 & 0 & 1 & 0 & -3 \\ 0 & 1 & 0 & 0 & 1 & -4 \\ 0 & 0 & 1 & 0 & 0 & 1 \end{bmatrix} \xrightarrow{R_1 - 2R_2} \begin{bmatrix} 1 & 0 & 0 & 1 & -2 & 5 \\ 0 & 1 & 0 & 0 & 1 & -4 \\ 0 & 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$

- Solving the matrix equation:

$$\begin{bmatrix} 1 & 2 & 4 & 5 & 6 \\ 2 & 3 & 7 & 8 & 9 \end{bmatrix} \xrightarrow{R_2 - 2R_1} \begin{bmatrix} 1 & 2 & 4 & 5 & 6 \\ 0 & -1 & -1 & -2 & -3 \end{bmatrix} \xrightarrow{-R_2}$$

$$\begin{bmatrix} 1 & 2 & 4 & 5 & 6 \\ 0 & 1 & 1 & 2 & 3 \end{bmatrix} \xrightarrow{R_1 - 2R_2} \begin{bmatrix} 1 & 0 & 2 & 1 & 0 \\ 0 & 1 & 1 & 2 & 3 \end{bmatrix}$$

## 3.1: Our first inequality

- Suppose each bag of jelly beans costs \$1, each bar of chocolate costs \$2
- We have \$100 to spend, and plan on buying  $J$  bags and  $C$  bars
- If we want to stay under budget, then we need  $J + 2C \leq 100$
- Maybe I like chocolate more than colored sugar, and I want 500 bars of chocolate.
- Setting  $C = 500$ , we solve  $J \leq 100 - 2C = 100 - 1000 = -900$
- Ok, I just need to buy -900 bags of Jelly beans.
- Wait...

## 3.1: Our standard inequalities

- In a realistic scenario we cannot “sell jelly beans short”
- Not only must we stay under budget,  $J + 2C \leq 100$ ,
- We must also stay sane:  $J \geq 0$ ,  $C \geq 0$
- These are the **standard inequalities** are are almost always in effect
- Are these the only inequalities affecting us?

## 3.1: More inequalities

- Unfortunately, the local convenience store is run by old man Charlie
- Charlie hates chocolate bars and barely stocks them
- Today he only has 20 bars
- Apparently we have a new inequality:  $C \leq 20$
- All told that is:

$$J + 2C \leq 100$$

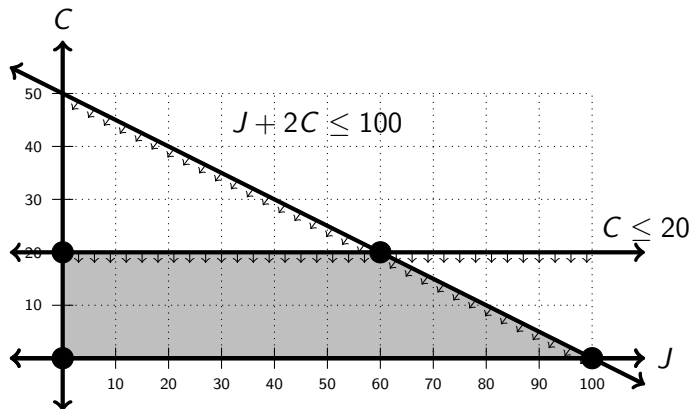
$$C \leq 20$$

$$J \geq 0, C \geq 0$$

## 3.1: Summarizing the inequalities

- It is a little tricky to summarize the possibilities:
- We could buy nothing,  $(J = 0, C = 0)$
- We could buy all the chocolate,  $(J = 0, C = 20)$ ,
- and we could spend the rest of the money on jelly beans  $(J = 60, C = 20)$
- We could buy only jelly beans  $(J = 100, C = 0)$
- If we actually need to bring a bunch of candy, it's not really clear whether we should do one of these extremes or something in between

## 3.1: Graphing the inequalities



The **feasible region** is shaded. One has to be on the correct side of **all** of the four lines. Notice how important the **corners** are to understanding the region.

# Homework: Tricky homework type

- Struggling is good; don't worry, don't give up
- You should be able to do all of B1 (and should be almost done)  
Today we learned to do HW B2 #s 1-5
- Most of the problems are easy; you can do them today
- I am just waiting to help my students with homework  
Tuesday and Thursday, 2:30pm-4:00pm, CB63  
8 other MA162 instructors also want to help