Unit 2 Day 3
MATRICES

Matrix Multiplication Applications

With Word Problems involving Systems of Equations

Warm-Up Day 3

(1st slide on power point Slide Handout)

#1) Last year at Green Hope, there were 214 senior girls, 243 senior guys, 245 junior girls, 233 junior guys, 258 sophomore girls, 288 sophomore guys, and 345 freshman girls, and 303 freshman guys. At Cary, there were 223 senior girls, 252 senior guys, 250 junior girls, 200 junior guys, 260 sophomore girls, 248 sophomore guys, and 352 freshman girls, and 333 freshman guys.

a) Write matrices G and C that represent the population of each school.

b) Add these two together. What does this new matrix represent?

Warm-Up Day 3 Continued
(on power point slide handout)

Last year at Green Hope, there were 214 senior girls, 243 senior guys, 245 junior girls, 233 junior guys, 258 sophomore girls, 288 sophomore guys, and 345 freshman girls, and 303 freshman guys.

2) Use the matrix of Green Hope students from the last example. If a college claims it is 5 times as large as our school, with students being distributed the same by year and gender, create a new matrix that shows the number of students at the college.

#1 Answers

Application Example 1

Ex 1) Last year at Green Hope, there were 214 senior girls, 243 senior guys, 245 junior girls, 233 junior guys, 258 sophomore girls, 288 sophomore guys, and 345 freshman girls, and 303 freshman guys. At Cary, there were 223 senior girls, 252 senior guys, 250 junior girls, 200 junior guys, 260 sophomore girls, 248 sophomore guys, and 352 freshman girls, and 333 freshman guys.

a) Write matrices G and C that represent the population of each school.

$$G = \begin{matrix} \\ F \\ M \end{matrix}\begin{matrix} \begin{matrix} Sr & Jr & So & Fr \end{matrix} \\ \begin{bmatrix} 214 & 245 & 258 & 345 \\ 243 & 233 & 288 & 303 \end{bmatrix} \end{matrix} \qquad C = \begin{matrix} \\ F \\ M \end{matrix}\begin{matrix} \begin{matrix} Sr & Jr & So & Fr \end{matrix} \\ \begin{bmatrix} 223 & 250 & 260 & 352 \\ 252 & 200 & 248 & 333 \end{bmatrix} \end{matrix}$$

b) Add these two together. What does this new matrix represent?

$$G + C = \begin{matrix} \\ F \\ M \end{matrix}\begin{matrix} \begin{matrix} Sr & Jr & So & Fr \end{matrix} \\ \begin{bmatrix} 447 & 495 & 518 & 697 \\ 495 & 433 & 536 & 636 \end{bmatrix} \end{matrix}$$

This represents the amount of each grade and gender for high school students in Cary.

#2 Answers

Application Example 2

Last year at Green Hope, there were 214 senior girls, 243 senior guys, 245 junior girls, 233 junior guys, 258 sophomore girls, 288 sophomore guys, and 345 freshman girls, and 303 freshman guys.

Ex 2) Use the matrix of Green Hope students from the last example. If a college claims it is 5 times as large as our school, with students being distributed the same by year and gender, create a new matrix that shows the number of students at the college.

$$5G = 5\begin{bmatrix} 214 & 245 & 258 & 345 \\ 243 & 233 & 288 & 303 \end{bmatrix} = \begin{matrix} F \\ M \end{matrix}\begin{bmatrix} 1070 & 1225 & 1290 & 1725 \\ 1215 & 1165 & 1440 & 1515 \end{bmatrix}$$

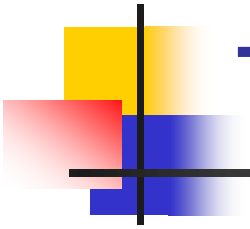
Sr: 5·214, 5·243

Questions About last night's HW?

Mixed Matrix Applications Handout

AND

Finish Packet p. 2



Tonight's Homework

Finish Slides Handout

Start Quiz 1 Review

Unit 2 Day 3
NOTES

More MATRIX Applications:

Solving Word Problems involving Systems of Equations with Matrices

Hints for Applications:

1. Read the problem and see if there are any "totals" given.
2. Write equations with these first.
3. See if there is anything else you can make an equation out of.
4. From your equations, set up your coefficient, variable, and constant matrix. Then solve!

Inverse Matrices and Systems

(on power point Slide Handout)

Ex 1) A linen shop has several tables of sheets and towels on special sale. The sheets are all priced the same as each other, and so are the towels. Mario bought 3 sheets and 5 towels at a cost of $137.50. Marco bought 4 sheets and 2 towels at a cost of $118.00. Find the price of each item.

Relate:  cost

 cost

Define: Let x = the price of one sheet.

Let y = the price of one towel.

Write: $\begin{bmatrix} \square \\ \square \end{bmatrix} \begin{bmatrix} \ \ \end{bmatrix} = \begin{bmatrix} \square \\ \square \end{bmatrix}$

Let A = coefficient matrix and B = constant matrix. Do $A^{-1} * B$

Interpret:

ANSWERS Inverse Matrices and Systems (on power point slide handout)

Ex 1) A linen shop has several tables of sheets and towels on special sale. The sheets are all priced the same, and so are the towels. Mario bought 3 sheets and 5 towels at a cost of $137.50. Marco bought 4 sheets and 2 towels at a cost of $118.00. Find the price of each item.

Relate: 3 sheets and 5 towels cost $137.50.
4 sheets and 2 towels cost $118.00.

Define: Let x = the price of one sheet.
Let y = the price of one towel.

Write: $\begin{bmatrix} 3 & 5 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 137.50 \\ 118.00 \end{bmatrix}$

Let A = coefficient matrix and B = constant matrix. Do $A^{-1} * B$

The price of a sheet is $22.50. The price of a towel is $14.00.

Example 2
(on power point slide handout)

The sum of three numbers is 12. The first is five times the second and the sum of the first and third is 9. Find the numbers.

Let x = first number, y = second number, z = third number

Example 2 Answers

The sum of three numbers is 12. The first is five times the second and the sum of the first and third is 9. Find the numbers.

Let x = first number, y = second number, z = third number

$$x + y + z = 12$$
$$x = 5y$$
$$x + z = 9$$

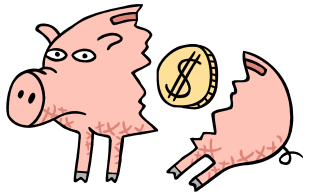
$$x + y + z = 12$$
$$x - 5y = 0$$
$$x + z = 9$$

$$(15, 3, -6)$$

You try:

1. My mom has three brothers. Together, their ages total 108. The youngest is 8 years less than the oldest. The middle one is four years older than the youngest. How old is each brother?

2. I have nickels, dimes, and quarters in my piggy bank. When I totaled it up last weekend, I had $12.60. I remember I had 110 coins, and that there were only two more dimes than quarters. How many of each type did I have?



You try Answers:

1. My mom has three brothers. Together, their ages total 108. The youngest is 8 years less than the oldest. The middle one is four years older than the youngest. How old is each brother?

$x + y + z = 108$

$x = z - 8$

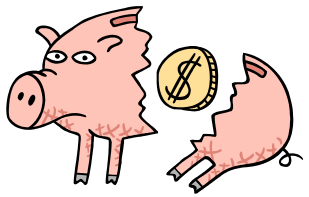
$y = x + 4$

The youngest is 32 years old, Middle is 36 years old, and the oldest is 40 years old

coefficient matrix: A = $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & -1 \\ -1 & 1 & 0 \end{bmatrix}$

Do $A^{-1} \bullet B$ in calc! ☺

constant matrix: B = $\begin{bmatrix} 108 \\ -8 \\ 4 \end{bmatrix}$



You try Answers:

2. I have nickels, dimes, and quarters in my piggy bank. When I totaled it up last weekend, I had $12.60. I remember I had 110 coins, and that there were only two more dimes than quarters. How many of each type did I have?

$$n + d + q = 110$$

$$.05n + .10d + .25q = 12.60$$

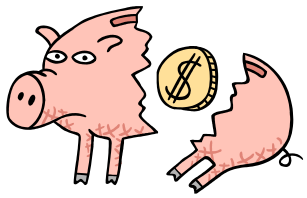
$$d = q + 2$$

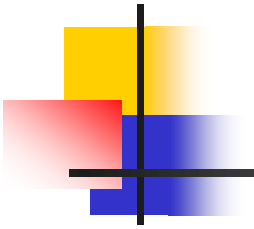
I have 52 nickels,
30 Dimes, and
28 Quarters

coefficient matrix: $A = \begin{bmatrix} 1 & 1 & 1 \\ .05 & .10 & .25 \\ 0 & 1 & -1 \end{bmatrix}$

Do $A^{-1} \bullet B$ in calc! ☺

constant matrix: $B = \begin{bmatrix} 110 \\ 12.60 \\ 2 \end{bmatrix}$





Extra Applications Practice Up Next

Practice #1

Tracey, Danica, and Sherri bought snacks for a girls' sleepover. They each bought the items shown in the following table at the local convenience store. Calculate the unit price of each snack purchased by the girls.

Number of bags of potato chips	Number of bottles of pop	Number of chocolate bars	Cost ($)
4	4	6	21.00
3	2	10	20.88
2	3	4	13.17

a. Define the variables.
b. Express the problem as a system of linear equations
c. Solve the problem using matrices
d. Express the solution as a complete sentence.

Practice #1 ANSWERS

Tracey, Danica, and Sherri bought snacks for a girls' sleepover. They each bought the items shown in the following table at the local convenience store. Calculate the unit price of each snack purchased by the girls.

Number of bags of potato chips	Number of bottles of soda	Number of chocolate bars	Cost ($)
4	4	6	21.00
3	2	10	20.88
2	3	4	13.17

a. Define the variables. c = price of one bag of potato chips, p = price of one bottle of soda , b = price of one chocolate bar

b. Express the problem as a system of linear equations

$$4c + 4p + 6b = 21.00$$
$$3c + 2p + 10b = 20.88$$
$$2c + 3p + 4b = 13.17$$

c. Solve the problem using matrices

$$\begin{bmatrix} 4 & 4 & 6 \\ 3 & 2 & 10 \\ 2 & 3 & 4 \end{bmatrix} \bullet \begin{bmatrix} c \\ p \\ b \end{bmatrix} = \begin{bmatrix} 21.00 \\ 20.88 \\ 13.17 \end{bmatrix} \text{ then do } A^{-1} \bullet B$$

d. Express the solution as a complete sentence.

The price of one bag of potato chips is $1.98. The price of one bottle of soda is $1.47. The price of one chocolate bar is $1.20

Practice #2

A stadium has 49,000 seats. Seats cost $25 in Section A, $20 in Section B, and $15 in Section C. The number of seats in Section A equals the total of Sections B and C. Suppose the stadium takes in $1,052,000 from each sold-out event. How many seats does each section hold?

a. Define the variables.
b. Express the problem as a system of linear equations:
c. Solve the problem using matrices
d. Express the solution as a complete sentence.

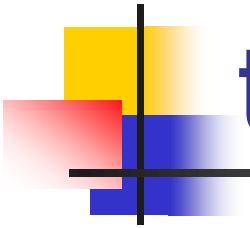
Practice #3!

Janice, Nancy, and Donna work after school and weekends for a local shipping business. They get paid a different rate for afternoon, evenings, and weekends. The number of hours they worked during one week is given in the following information:

	Afternoons	Evenings	Weekends
Janice	5	2	3
Nancy	1	2	6
Donna	2	2	3

If Janice had worked twice the number of hours for the week, her salary would have been $98. If Nancy had worked 2 more hours in the evening, her salary would have been $62. If Donna had worked 1 more hour on the weekend, her salary would have been $43. Find the rate of pay for each of the times of day worked by the girls.

I think the next 2 slides are on the Slides Handout



You try!

3. Janet is spending the allowance she has saved on clothes. If she buys 3 shirts, 2 skirts, and 4 pairs of jeans, she will spend $292. If she buys 4 shirts, 1 skirt, and 3 pairs of jeans, she will spend $252. If jeans cost $4 more than skirts, find the price of each item.
4. At Morgan's Fine Cuisine, meals are served a la carte. That is, each item on the menu is priced separately. Jackie and Ted Paris went to celebrate their anniversary. Jackie ordered prime rib, 2 side dishes, and a roll. Ted ordered prime rib, 3 side dishes, and 2 rolls. Jackie's meal cost $36 while Ted's cost $44. If the prime rib is three times as expensive as a side dish, what is the cost of each item?

You try!

3. Janet is spending the allowance she has saved on clothes. If she buys 3 shirts, 2 skirts, and 4 pairs of jeans, she will spend $292. If she buys 4 shirts, 1 skirt, and 3 pairs of jeans, she will spend $252. If jeans cost $4 more than skirts, find the price of each item.

Janet paid $28 for each shirt, $32 for each skirt, and $36 for each pair of jeans.

4. At Morgan's Fine Cuisine, meals are served a la carte. That is, each item on the menu is priced separately. Jackie and Ted Paris went to celebrate their anniversary. Jackie ordered prime rib, 2 side dishes, and a roll. Ted ordered prime rib, 3 side dishes, and 2 rolls. Jackie's meal cost $36 while Ted's cost $44. If the prime rib is three times as expensive as a side dish, what is the cost of each item?

The prime rib was $21 each, side dishes were $7 each, and rolls were $1 each.