

WS#10:1 & 10:2  
Word Problems

1. A movie theater sells tickets for \$8.00 each, with seniors receiving a discount of \$2.00. One evening the theater took in \$3580 in revenue and sold 525 tickets. If  $x$  represents the number of tickets sold at \$8.00 and  $y$  the number of tickets sold at the discounted price of \$6.00, write a system and solve for the number of tickets of each sold.

$$\begin{aligned} 8x + 6y &= 3580 \\ x + y &= 525 \quad (-6) \\ \hline -5x &= -2550 \\ x &= 510 \end{aligned}$$

• mult 2<sup>nd</sup> equ by (-6) + add to 1<sup>st</sup> equ

$$\begin{aligned} 8x + 6y &= 3580 \\ + -6x - 6y &= -3150 \\ \hline 2x &= 430 \\ x &= 215 \text{ (non-discounted +ix)} \end{aligned}$$

$$\begin{aligned} (215) + y &= 525 \\ y &= 525 - 215 \\ y &= 310 \end{aligned}$$

$y = 310$   
Senior Discounted +ix

2. Find real numbers  $a$ ,  $b$ , and  $c$  so that the graph of the quadratic function  $y = ax^2 + bx + c$  contains the points  $(-1, -4)$ ,  $(1, 6)$ , and  $(3, 0)$ .

$$\begin{aligned} -4 &= a(-1)^2 + b(-1) + c \rightarrow a - b + c = -4 \\ 6 &= a(1)^2 + b(1) + c \rightarrow a + b + c = 6 \\ 0 &= a(3)^2 + b(3) + c \rightarrow 9a + 3b + c = 0 \end{aligned}$$

1.) Eliminate  $b$  twice to get 2 diff equ w/only  $a + c$

$$\begin{aligned} -12a - 12c &= -12 \\ + 12a + 4c &= -12 \\ \hline -8c &= -24 \\ c &= 3 \end{aligned}$$

$$\begin{aligned} 2a &= 2 - 6 \\ 2a &= -4 \\ a &= -2 \end{aligned}$$

ADD 1<sup>st</sup> 2 equ.  $\rightarrow 2a + 2c = 2$   
mult 1<sup>st</sup> equ by 3 + add to 3<sup>rd</sup> equ  $\rightarrow 12a + 4c = -12$   
mult 1<sup>st</sup> equ by -6 + add to 2<sup>nd</sup>

$$\begin{aligned} 2a + 2(3) &= 2 \\ 2a + 6 &= 2 \\ 2a &= -4 \\ a &= -2 \end{aligned}$$

$a + b + c = 6$   
 $(-2) + b + (3) = 6$   
 $b = 5$

3. Find the function  $f(x) = ax^3 + bx^2 + cx + d$  for which  $f(-2) = -10$ ,  $f(-1) = 3$ ,  $f(1) = 5$ , and  $f(3) = 15$ .

$$\begin{aligned} -10 &= a(-2)^3 + b(-2)^2 + c(-2) + d \rightarrow -8a + 4b - 2c + d = -10 \\ 3 &= a(-1)^3 + b(-1)^2 + c(-1) + d \rightarrow -a + b - c + d = 3 \\ 5 &= a(1)^3 + b(1)^2 + c(1) + d \rightarrow a + b + c + d = 5 \\ 15 &= a(3)^3 + b(3)^2 + c(3) + d \rightarrow 27a + 9b + 3c + d = 15 \end{aligned}$$

\* Solve for  $a, b, c, d$  by using rref on the augmented matrix

$$\begin{bmatrix} -8 & 4 & -2 & 1 & -10 \\ -1 & 1 & -1 & 1 & 3 \\ 1 & 1 & 1 & 1 & 5 \\ 27 & 9 & 3 & 1 & 15 \end{bmatrix}$$

$a = 1, b = -2, c = 0, d = 6$

Augmented Matrix

4. A dietitian at Cook county hospital wants a patient to have a meal that has 65 grams of protein, 95 grams of carbohydrates and 905 milligrams of calcium. The hospital food service tells the dietitian that the dinner for today is chicken a la king, baked potatoes, and 2% milk. Each serving of chicken a la king has 30 grams of protein, 35 grams of carbohydrates, and 200 milligrams of calcium. Each serving of baked potatoes contains 4 grams of protein, 33 grams of carbohydrates, and 10 milligrams of calcium. Each glass of 2% milk contains 9 grams of protein, 13 grams of carbohydrates, and 300 milligrams of calcium. How many servings of each food should the dietitian provide the patient?

let  $c$  = servings of chicken  
 $p$  = " " potatoes (baked)  
 $m$  = " " milk

$$\begin{aligned} 30c + 4p + 9m &= 65 \text{ (protein equ)} \\ 35c + 33p + 13m &= 95 \text{ (carb equ)} \\ 200c + 10p + 300m &= 905 \text{ (Calcium equ)} \end{aligned}$$

Augmented Matrix

$$\begin{bmatrix} 30 & 4 & 9 & 65 \\ 35 & 33 & 13 & 95 \\ 200 & 10 & 300 & 905 \end{bmatrix}$$

\* use rref on the augmented matrix to solve

The patient should receive 1.5 servings of Chicken a la King, 1/2 of a baked potato, AND 2 glasses of milk.

5. John has \$20,000 to invest. As his financial consultant, you recommend that he invest in Treasury bills that yield 5%, Treasury bonds that yield 7% and corporate bonds that yield 9%. John wants to have an annual income of \$1280 and the amount invested in Treasury bills must be two times the amount invested in corporate bonds. Find the amount in each investment.

$x$  = amt invested in Treasury bills  
 $y$  = amt invested in Treasury bonds  
 $z$  = amt invested in Corporate bonds

$$\begin{aligned} x + y + z &= 20,000 \\ .05x + .07y + .09z &= 1280 \\ x &= 2z \end{aligned}$$

\* use rref function on the augmented matrix to solve

Augmented matrix

$$\begin{bmatrix} 1 & 1 & 1 & 20,000 \\ .05 & .07 & .09 & 1280 \\ 1 & 0 & -2 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & 0 & 12,000 \\ 0 & 1 & 0 & 2,000 \\ 0 & 0 & 1 & 6,000 \end{bmatrix}$$

$x = \$12,000$   
 $y = \$2,000$   
 $z = \$6,000$