

Read through each example, assign variables and set up a system of equations. Use Inverse matrices or Reduced Row Echelon Form to solve each system.

1. Hinsdale Central's marching band sold gift wrap to earn money for a band trip to Orlando, Florida. The gift wrap in solid colors sold for \$4.00 per roll, and the print gift wrap sold for \$6.00 per roll. The total number of rolls sold was 480, and the total amount of money collected was \$2,340. How many rolls of each kind of gift wrap were sold?

$$\begin{aligned} 4s + 6p &= 2340 \\ s + p &= 480 \end{aligned}$$

270 SOLID ROLLS
210 PRINTED ROLLS

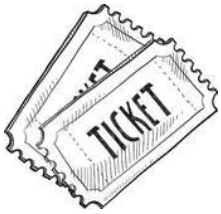


$$\text{rref} \begin{bmatrix} 4 & 6 & 2340 \\ 1 & 1 & 480 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 270 \\ 0 & 1 & 210 \end{bmatrix}$$

2. Last Friday, Regal Cinemas sold a total of 8500 movie tickets. Proceeds totaled \$64,600. Tickets can be bought in one of 3 ways: a matinee admission costs \$5, student admission is \$6 all day, and regular admissions are \$8.50. How many of each type of ticket was sold if twice as many student tickets were sold as matinee tickets?

$$\begin{aligned} m + s + r &= 8500 \\ 5m + 6s + 8.50r &= 64600 \\ 2m = s &\Rightarrow 2m - s = 0 \end{aligned}$$

900 matinee
1800 student tix
5800 regular



$$\text{rref} \begin{bmatrix} 1 & 1 & 1 & 8500 \\ 5 & 6 & 8.50 & 64600 \\ 2 & -1 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 900 \\ 0 & 1 & 0 & 1800 \\ 0 & 0 & 1 & 5800 \end{bmatrix}$$

3. A chemist needs to prepare a 60 liter mixture that is 40% acid using three concentrations of acid. The first is 15% acid, the second 35% acid, and the third 55% acid. She will use twice as much of the 35% mixture than the 55% mixture. How much of each concentration should she use?

$$\begin{aligned} x &= \text{Amount of 15\% mixture} = 3.75 \text{ liters} \\ y &= \text{" " 35\% " " = 37.5 " " \\ z &= \text{" " 55\% " " = 18.75 " " \end{aligned}$$

$$.15x + .35y + .55z = .4(60)$$

$$x + y + z = 60$$

$$y = 2z \Rightarrow y - 2z = 0$$

$$\text{rref} \begin{bmatrix} .15 & .35 & .55 & 24 \\ 1 & 1 & 1 & 60 \\ 0 & 1 & -2 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 3.75 \\ 0 & 1 & 0 & 37.5 \\ 0 & 0 & 1 & 18.75 \end{bmatrix}$$



4. The following breakdown outlines the number of rooms, bathrooms, fireplaces, and elevators in the U.S. White House.



- r b f e
- Combined there are 198 rooms, bathrooms, fireplaces, and elevators
 - The number of rooms exceeds the number of bathrooms plus fireplaces by 69.
 - The difference between the number of fireplaces and elevators is 25.
 - If the number of bathrooms is tripled, it exceeds the number of fireplaces plus elevators by 74.

Determine the number of rooms, bathrooms, fireplaces and elevators in the White House.

$$r + b + f + e = 198$$

$$r = (b + f) + 69 \Rightarrow r - b - f = 69$$

$$f - e = 25$$

$$3b = (f + e) + 74 \Rightarrow 3b - f - e = 74$$

$$\text{rref} \begin{bmatrix} 1 & 1 & 1 & 1 & 198 \\ 1 & -1 & -1 & 0 & 69 \\ 0 & 0 & 1 & -1 & 25 \\ 0 & 3 & -1 & -1 & 74 \end{bmatrix}$$

132 rooms, 35 baths,
28 fireplaces, 3 elev.

5. Italy and France combined for a total of 46 penalties during the 2006 FIFA World Cup. The penalties were a combination of fouls, yellow cards (cautions), and red cards (expulsions). There was one less red card than half the number of yellow cards and one more foul than 8 times the total number of cards. How many of each type of penalty were there during the match?

$$f + y + r = 46$$

$$r = \frac{1}{2}y - 1 \Rightarrow -\frac{1}{2}y + r = -1$$

$$f = 8(y + r) + 1 \Rightarrow f - 8y - 8r = 1$$

$$\text{rref} \begin{bmatrix} 1 & 1 & 1 & 46 \\ 0 & -1/2 & 1 & -1 \\ 1 & -8 & -8 & 1 \end{bmatrix}$$

41 fouls, 4 yellow cards,
1 red card

6. Michelle has a piggy bank that has 75 total coins in it that consists of nickels, dimes, and quarters. The total value of the money in the piggy bank is \$12.75. The number of dimes is also twice the number of nickels in the piggy bank. How many of each coin (nickel, dime, quarter) does she have in the bank?

$$n + d + q = 75$$

$$.05n + .1d + .25q = 12.75$$

$$d = 2n \Rightarrow -2n + d = 0$$

$$\text{rref} \begin{bmatrix} 1 & 1 & 1 & 75 \\ .05 & .1 & .25 & 12.75 \\ -2 & 1 & 0 & 0 \end{bmatrix}$$

12 nickels, 24 dimes,
39 quarters