

You may use a calculator and your homework, but not your books or notes. There are two problems worth 10 points each. **Show all of your work to receive full/partial credit.**

- 1) Anthony Altino is mixing food for his young daughter and would like the meal to supply 1 gram of protein and 5 milligrams of iron. He is mixing together cereal, with 0.5 grams of protein and 1 milligram of iron per ounce, and fruit, with 0.2 grams of protein and 2 milligrams of iron per ounce. What mixture will provide the desired nutrition? (Identify variables and set up equations!)

Let $x = \#$ of servings cereal
 $y = \#$ of servings fruit

$$\begin{array}{r} 10(0.5x + 0.2y) = (1)(10) \\ -1(x + 2y) = (5)(-1) \end{array} \rightarrow \begin{array}{r} 5x + 2y = 10 \\ -x - 2y = -5 \\ \hline 4x = 5 \rightarrow x = \frac{5}{4} = 1.25 \end{array}$$

$$x + 2y = 5 \rightarrow 2y = -x + 5 \rightarrow y = -\frac{1}{2}x + \frac{5}{2} \rightarrow y = -\frac{1}{2}\left(\frac{5}{4}\right) + \frac{5}{2}$$

$$y = -\frac{5}{8} + \frac{5}{2} = \frac{15}{8} = 1.875, \text{ so } 1.25 \text{ ounces cereal, } 1.875 \text{ ounces fruit.}$$

- 2) Earl is ordering supplies. Yellow paper costs \$5.00 per ream while white paper costs \$6.50 per ream. He would like to order 100 reams total, and has a budget of \$560. How many reams of each color should he order? (Identify variables and set up equations!)

Let $x = \#$ of reams yellow
 $y = \#$ of reams white

$$\begin{array}{r} -5(x+y) = 100(-5) \\ 5x + 6.5y = 560 \end{array} \rightarrow \begin{array}{r} -5x - 5y = -500 \\ 5x + 6.5y = 560 \\ \hline 1.5y = 60 \rightarrow y = 40 \end{array}$$

$$x + y = 100 \rightarrow x = 60$$

60 yellow, 40 white

3) Use Gauss-Jordan row reduction to solve the given system of equations. You can put the matrix into row-echelon form and then use back substitution if you want to. Show all work (so no calculator reduction).

$$\begin{aligned}x + 2y &= 4 \\y - z &= 0 \\x + 3y - 2z &= 5\end{aligned}$$

$$\begin{bmatrix} 1 & 2 & 0 & -4 \\ 0 & 1 & -1 & 0 \\ 1 & 3 & -2 & 5 \end{bmatrix} \xrightarrow{R_3 = R_3 - R_1} \begin{bmatrix} 1 & 2 & 0 & 4 \\ 0 & 1 & -1 & 0 \\ 0 & 1 & -2 & 1 \end{bmatrix} \xrightarrow{R_3 = R_3 - R_2}$$

$$\begin{bmatrix} 1 & 2 & 0 & 4 \\ 0 & 1 & -1 & 0 \\ 0 & 0 & -1 & 1 \end{bmatrix} \rightarrow -z = 1 \rightarrow z = -1$$

Row 2 means $y - z = 0 \rightarrow y - (-1) = 0 \rightarrow y = -1$

Row 1 means $x + 2y = 4 \rightarrow x + 2(-1) = 4 \rightarrow x = 6$

$$(6, -1, -1)$$