

## M118 SECTION 4.3- GAUSS-JORDAN ELIMINATION

- 1) We can have a system of equations with more than 2 variables and more than 2 equations.

A matrix is in reduced form:

- 1) each row consisting entirely of zeroes is below any row having at least one nonzero element.
- 2) The leftmost nonzero element in each row is 1.
- 3) All elements above or below the leftmost 1 of a given row are zeroes.
4. The leftmost 1 in any row is to the right of the leftmost 1 in the row above.

Solve by Gauss-Jordan:

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

$$\left[ \begin{array}{ccc|c} 3 & 1 & -2 & 2 \\ 1 & -2 & 1 & 3 \\ 2 & -1 & -3 & 3 \end{array} \right] \approx \left[ \begin{array}{ccc|c} 1 & -2 & 1 & 3 \\ 0 & 7 & -5 & -7 \\ 0 & 3 & -5 & -3 \end{array} \right] \approx \left[ \begin{array}{ccc|c} 1 & 0 & -3/7 & 1 \\ 0 & 1 & -5/7 & -1 \\ 0 & 0 & -20/7 & 0 \end{array} \right] \approx \left[ \begin{array}{ccc|c} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 0 \end{array} \right] \Rightarrow$$

(1, -1, 0)

Introduce Matrix solutions on the calculator.  $\text{rref}([A])$

$$\text{Example: } \left[ \begin{array}{ccc|c} 2 & -4 & -1 & -8 \\ 4 & -8 & 3 & 4 \\ -2 & 4 & 1 & 11 \end{array} \right] \approx \left[ \begin{array}{ccc|c} 1 & -2 & -1/2 & -4 \\ 0 & 0 & 5 & 20 \\ 0 & 0 & 0 & 3 \end{array} \right] \text{ no solution}$$

$$\text{Example: } \left[ \begin{array}{ccc|c} 2 & -2 & -4 & -2 \\ 3 & -3 & -6 & -3 \\ -2 & 3 & 1 & 7 \end{array} \right] \approx \left[ \begin{array}{ccc|c} 1 & 0 & -5 & 4 \\ 0 & 1 & -3 & 5 \\ 0 & 0 & 0 & 0 \end{array} \right]$$

$$\begin{aligned}x - 5z &= 4 \\ x &= 5z + 4\end{aligned}$$

$$\begin{aligned}y - 3z &= 5 \\ y &= 3z + 5\end{aligned} \quad (5t + 4, 3t + 5, t)$$

Example: #68

A corporation wants to lease a fleet of 12 airplanes with a combined capacity of 220 passengers. The three available types of planes carry 10, 15, and 20 passengers respectively. How many of each type of plane should be leased?

Example # 70 Refer to problem #68 - The cost of leasing a 10-passenger plane is \$8,000 per month, a 15-passenger airplane is \$14,000 per month, and a 20-passenger plane is \$16,000 per month. Which of the solutions to Problem #68 would minimize the monthly leasing cost?

A nutritionist in a hospital is arranging special diets that consist of a combination of three foods, food A, food B, and food C. It is important that patients on this diet consume exactly 310 units of calcium, 190 units of iron, and 250 units of vitamin A each day. Food A contains 30 units of Calcium, 10 units of Iron, and 10 units of vitamin A. Food B contains 10 units of Calcium, 10 units of Iron, and 30 units of vitamin A. Food C contains 20 units of Calcium, 20 units of Iron, and 20 units of vitamin A. How many ounces of each food must be used to satisfy the nutrient requirements exactly?