

1. Smithwares Metal Co. had sales of \$48000 in 2004 and \$64000 in 2012. Build a Linear Equation to reflect sales in terms of years since 2004. Then use your line to predict the sales in 2017.

2. Given the System of Equations:

$$3x + 2y + z + 20w = 6$$

$$x + 2y + z + 10w = 0$$

$$x + y + z + 6w = 2$$

$$2x + 2y + z + 15w = 3$$

- a) **Use your calculator** to solve, leaving solution in parametric form
- b) Find the specific solution when $y = 6$
- c) Perform, **BY HAND**, a full check of this particular solution

3. A home appliance manufacturer has been selling a kitchen stove model several markets and wishes to enter new markets. Atlanta has 6.1 million people and they sold 13,286 stoves, Tampa has 2.8 million with 5,123 sold, Miami has 6.4 million with 17,522 sold, Charlotte(NC) has 2.5 million with 4,848 sold, and Greenville(SC) has 1.4 million with 3,613 sold.

- a) Using Population figures in Millions and sales as they are given, use LinReg in constructing the Least Squares Line of Best Fit for this data set. **Round-off values to the nearest thousandth.**
- b) Use your line to predict the sales generated by entering a market like Orlando with 2.9 million people.
- c) What sized market does your model suggest is necessary to sell 20,000 units?

4. **SHOW ALL WORK** in solving:
$$\begin{matrix} 3x + 10y = 9 \\ 2x + 6y = 5 \end{matrix}$$
 by the $X = A^{-1}B$ method.

- i) Decompose the system in to A , B , and X .
- ii) Find A^{-1} by hand
- iii) Show work/steps/calculations in determining X .

5. List the Intercepts of the Inequality and then sketch the graph using the “bad” side shading from lecture $8x + 6y \geq 144$

6. Use the **Linear Regression formulas** to build the Regression Line, and then answer the questions below regarding the data table of values showing the number of months a worker has been on a job vs. the number of minutes it takes that employee to do a particular work-related task.

Months	Min	X^2	XY
1	35		
3	31		
4	28		
7	23		
8	21		

- a) What is the Line of Best Fit in Slope-Intercept Form? _____
Round to 2-decimals for all values after finishing use of the formulas.
- b) What is the predicted number of minutes needed after 1 full year on the job? _____
SHOW WORK and round to the nearest 0.1

7. Graph the Inequalities and determine the Feasible Set. **SHOW WORK.**
Clearly mark your Axes and label graphed points with coordinates for full credit.

$$2x + y \leq 8$$

$$-2x + 6y \geq 6$$

$$x \geq 1$$

8. Solve each System of Equations using the “RREF” function on your calculator. Show your augmented matrix and the resulting one from RREF, plus your solution.

$$\begin{array}{l} -2x - 3y + 2z = -2 \\ x + y = 3 \\ -x - 3y + 5z = 8 \end{array}$$

$$\begin{array}{l} x + y + 4z = 3 \\ 4x + y - 2z = -6 \\ -3x + 2z = 1 \end{array}$$

9. Pivot BY HAND on the element in row 2, column 2. SHOW ALL WORK/STEPS, and NO CALCULATORS.

$$\begin{bmatrix} 3 & -3 & -7 & 6 \\ -4 & 2 & 6 & -8 \\ -2 & 5 & 1 & -4 \end{bmatrix}$$

10. Turn the system into an Augmented Matrix. Use RREF to reduce the matrix. Show the Infinite Solution in proper form.

$$2y + z - w = 1$$

$$x - y + z + w = 14$$

$$-x - 9y - z + 4w = 11$$

$$x + y + z = 9$$

11. Perform each indicated Elementary Row Operation, always starting from the original matrix.

$$\begin{bmatrix} 2 & -5 & 1 & 6 & -4 \\ 0 & 3 & -5 & 8 & -6 \\ -4 & 2 & -6 & -14 & 8 \\ 7 & -3 & 2 & 9 & -1 \end{bmatrix}$$

- a) $R_2 \leftrightarrow R_4$ b) $-4R_3 \rightarrow R_3$ c) $3R_2 + R_1 \rightarrow R_1$ d) $R_2 + R_4 \rightarrow R_4$

12. Solve the System of Equations below USING the “RREF” function on your calculators.

a) Properly show the **Infinite solution** of the system. Show details of how you find it.

b) Find the particular solution when $w = 4$

c) Find the particular solution when $y = 4$

$$-x + 2y + z - 10w = 8$$

$$-2x + 3y + z - 19w = 14$$

$$2x - 4y - 3z + 17w = -10$$

$$-x + y - 9w = 6$$

13. The small, isolated town of Sandwich, IL has two industries, Peanut Butter and Jelly. To produce \$1, the Peanut Butter industry needs \$0.15 of their own output and \$0.25 of Jelly, while to produce \$1 in Jelly, they need \$0.10 of their own output and \$0.02 from Peanut Butter. The townsfolk need \$7600 in Peanut Butter and \$11400 in Jelly next year. How much should be produced by each industry?

a) **Name and show ALL** relevant matrices

b) Use $X = (I - A)^{-1} D$ to determine production levels. Use Fractions on the $(I - A)^{-1}$ matrix before finishing the calculation.

c) Suppose instead that the maximum capacity of peanut butter is \$12000 and \$15000 in jelly. What amounts would be available to the public?

14. **SHOW ALL WORK** in finding the Inverse of each matrix:

a) $\begin{bmatrix} -4 & Q \\ 2 & 0 \end{bmatrix} \quad Q \neq 0$

b) $\begin{bmatrix} -4M & M \\ 2 & -1 \end{bmatrix} \quad M \neq 0$

15. Graph the Inequalities and determine the Feasible Set. **SHOW WORK.**

Clearly mark your Axes and label graphed points with coordinates for full credit.

Also, determine the Coordinates of ALL Corner Points

$4x + y \geq 50$	$4x + y \leq 60$	$x + y \leq 40$
a) $2x + 4y \geq 60$	b) $2x + 3y \leq 60$	c) $3x + y \leq 90$
$x \geq 0, y \geq 0$	$x \geq 0, y \geq 0$	$x \geq 10$
		$y \geq 0$

16. Use your calculator's Linear Regression function to answer the questions below regarding the data table of values showing the average age at which men married over time. **USE $X = 0$ for 1970.**

- a) What is the Line of Best Fit, in $Y = AX + B$ form?
Round values to 2 places behind the decimal
- b) What is the expected Average Age at marriage in 2013?
- c) In what year does the table predict an Average Age of 31.5?

Year	Avg Age
1970	23.2
1975	23.8
1980	24.7
1988	25.8
1994	26.7
1999	26.9
2004	27.1
2006	27.5
2009	28.1

17. A certain economy has three industries: metals, plastic, and wood. To produce \$1 of output, the metals industry needs \$0.08 of its own output, \$0.03 from plastics, and \$0.07 from wood. To produce \$1 of output, the plastic industry needs \$0.11 of its own output and \$0.02 from wood. To produce \$1 of output, the wood industry needs \$0.10 of its own output, \$0.05 from metals, and \$0.04 from plastic. If the population needs, in Millions, \$32 of metal, \$25 of plastic, and \$40 of wood, how much of each must be produced to satisfy this demand? 14pts

a) Name and show ALL relevant matrices

b) Use $X = (I - A)^{-1} D$ to determine production levels. Round $(I - A)^{-1}$ to 2-decimals.

$$18. P = \begin{bmatrix} 2 & -3 \\ 4 & 7 \end{bmatrix} \quad Q = \begin{bmatrix} 7 & -5 & 4 \\ -1 & 2 & -6 \end{bmatrix} \quad R = \begin{bmatrix} 0 & 6 \\ 4 & -8 \\ -2 & 9 \end{bmatrix} \quad S = \begin{bmatrix} -1 & 5 & 0 \\ -8 & 2 & -7 \\ 6 & 9 & -3 \end{bmatrix} \quad T = \begin{bmatrix} 6 & 3 \\ 4 & 2 \end{bmatrix}$$

- a) Is the product $PQSRTQRP$ possible? SHOW WHY OR WHY NOT.
- b) Is the matrix calculation $QR + P - 4T$ possible? SHOW WHY OR WHY NOT.
- c) Is the matrix calculation $QSR + PT$ possible? SHOW WHY OR WHY NOT
- d) The matrix calculation $QBTMS$ IS POSSIBLE. What are the dimensions of B and M ?

19. Find the values of K and M. SHOW WORK.

$$\begin{bmatrix} 11 & 6 \\ -4 & 2K \end{bmatrix} + \begin{bmatrix} K & 9 \\ 4 & -2 \end{bmatrix} = 3 \begin{bmatrix} M & 5 \\ 0 & -4 \end{bmatrix}$$

20. Determine the values in Matrix B if $AB = C$ and $A = \begin{bmatrix} 3 & 1 \\ -4 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} 19 & 11 \\ -12 & -8 \end{bmatrix}$

21. Graph the Inequalities using Intercepts, and determine the Feasible Set. **SHOW WORK.**

Clearly mark your Axes and label graphed points with coordinates for full credit.

Find the coordinates of each corner of the Feasible Set.

$$12x + 4y \leq 192$$

$$10x + 4y \geq 220$$

$$10x + 5y \leq 200$$

a) $4x + 8y \leq 224$

b) $2x + 8y \geq 260$

c) $4x + 8y \leq 200$

$$x \geq 0, y \geq 0$$

$$x \geq 0, y \geq 0$$

$$x \geq 0, y \geq 0$$