<u>Exam 1 - An Overview of what you need to know…</u>

Chapter 1 – Lines and Linear Models

- Draw an appropriate set of labeled axes for a given problem.
- Graph lines and find intercepts.
- Find the slope of a line given two points on the line.
- Recognize positive, negative, zero and undefined slopes.
- Decide on dependent and independent variables.
- Understand parallel and perpendicular lines.
- Use the point-slope form of a line to find the equation of a line.
- Find the intercepts of a line.
- Use the models for
  - Cost, Revenue and Profit
  - Supply and Demand
  - Depreciation
- Find the intersection point for two lines
- Interpret the Break-Even point or the Equilibrium point.
- Find the vertex and intercepts of a quadratic function
- Find quadratic revenue and profit equations.
- Find maximum profit or revenue with a quadratic model.

Chapter 2 – Linear Systems

- Set up a system of linear equations from a word problem
- Understand the relationship between graphs and the number of solutions to a system of linear equations
- Know the theorem for the number of solutions of a system of linear equations.
- Solve a system of linear equations using Gauss-Jordan.
- Recognize when an augmented matrix is in row-reduced echelon form.
- Interpret the resulting equations when an augmented matrix is in row-reduced form.

Chapter 2 – Matrices

- Represent data in a labeled matrix.
- Add, transpose and multiply by a scalar.
- Multiply two matrices.
- Interpret the results of matrix multiplication.

Part I - Lines and Linear Models

1. What are the intercepts for a line passing through the point (2, -1) with a slope of 3? Graph this line along with a horizontal and vertical lines passing through that point.

2. At a price of $45, 20 purses can be sold. If the price is decreased by $15, then an additional 30 purses can be sold. Find the demand equation for these purses in slope-intercept form. If the store wants to sell 50 purses, what price should they charge?

3. A company makes bumper stickers. The fixed costs are $600 and the bumper stickers cost 50 cents each to make. The stickers sell for $2.00 each. Find and interpret the break-even point for these bumper stickers.

4. A calculator is purchased for $120 and sold 6 months later for $30. Find the rate of depreciation for this calculator. Graph the depreciation line.

5. The supply of lamps can be modeled by $3p - 4x = 24$. The demand for lamps is given by $4p + 5x = 50$. In these models x is the number of lamps supplied in millions and p is the price in Euros. Graph the supply and demand equations. Find and interpret the equilibrium point.

6. Line L is given by $3y - 4x = 16$.
(a) Find the equation of the line that is parallel to L and passes through the point (-3, 4).
(b) Find the equation of the line that is perpendicular to L and passes through the point (4, -6).

7. Graph $y = 3x^2 - 5x - 15$ and find the intercepts and vertex. Is the vertex a minimum or maximum?

8. The price in dollars that a manufacturer can get for producing x thousands clipboards is $p = -2.2x + 30$ and the cost in dollars to produce these x thousands of clipboards is $C(x) = 1.5x + 7$. Find the profit equation for clipboards, the maximum profit, the number of clipboards to maximize profits and the price to charge to get the maximum profit.

Part 2 - Systems of Linear Equations

1. Find the value (or values) of k which makes the system of linear equations have no solution:

$$\begin{aligned} 3x - y &= 4 \\ -6x + ky &= 10 \end{aligned}$$

2. The Aggie farm wants to plant maroon carrots and sweet onions. There are 100 acres available for planting this fall. The number of acres of carrots is to exceed twice the number of acres of onions by 10. If the farm wants to use all of the available acres, how many acres of onions should be planted?

3. A person has $10,100 to invest in two different stock. Stock ABC costs $32 per share and pays dividends of $1.20 per share. Stock XYZ costs $23 per share and pays dividends of $1.40 per share. If she wants to earn a total of $540 in dividends, how much should be invested in company ABC?

4. For what value or values of b is the given matrix in row-reduced echelon form? $\left[\begin{array}{cc|c} 0 & 1 & 0 \\ 0 & 0 & b \end{array}\right]$

5. Solve the following system of linear equations:

$$\begin{aligned} 2x + 3y + z &= 1 \\ x + y + z &= 3 \\ 3x + 4y + 2 &= 4 \end{aligned}$$

6. Solve the following system of linear equations using the Gauss-Jordan method and augmented matrices:

$$\begin{aligned} -0.5x + 3y &= 15 \\ 2x + 5y &= 8 \end{aligned}$$

7. A pet store is buying three kinds of fish. They can purchase goldfish at $2.50 each, bluefish at $2.00 each or greenfish at $1.00 each. The store has $20.00 to purchase fish and the manager wants twice as many goldfish as greenfish. How many of each kind of fish can be bought?

8. Find the value (or values) for k such that the system has a parametric solution. $\left[\begin{array}{ccc|c} 1.2 & 0.8 & 1 & 12 \\ -3 & -2 & -2.5 & k \end{array}\right]$

Part 3 - Matrices

1. Find the values of *a*, *b*, *c* and *d* in the matrix equation $5\begin{bmatrix} 2 & 4 \\ -1 & a \end{bmatrix} + \begin{bmatrix} -4 & b \\ c & 3 \end{bmatrix}^T = \begin{bmatrix} d & 0 \\ 1 & 6 \end{bmatrix}$

2. A chain owns three restaurants (*I*, *II* and *III*) in the area and each serves breakfast (*B*), lunch (*L*) an dinner (*D*). The average number of meals sold on Mondays is shown in matrix *A*. The average price for a breakfast is \$3, the average price for a lunch is \$6 and the average price for a dinner is \$10. Find a matrix *B* such that when it is multiplied by matrix *A* it will give the matrix *R* with the average revenue for each restaurant on Mondays.

$$A = \begin{array}{c} \\ B \\ L \\ D \end{array} \begin{array}{c} \begin{array}{ccc} I & II & III \end{array} \\ \begin{bmatrix} 66 & 300 & 250 \\ 150 & 200 & 400 \\ 50 & 600 & 220 \end{bmatrix} \end{array}$$

3. What is the system of linear equations that corresponds to the matrix equation *AX*=*B* if

$$A = \begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix} \quad X = \begin{bmatrix} x \\ y \end{bmatrix} \quad B = \begin{bmatrix} 4 \\ 0 \end{bmatrix}$$

4. We are given approximately how many grams of fat, carbohydrate and protein are in a "unit" of four different foods in matrix *X*. In matrix *Y* we are given how many calories are in a gram of fat, carbohydrate or protein. Is *XY* or *YX* meaningful and what does the meaningful product represent?

$$Y = \begin{array}{c} \\ fat \\ carb \\ pro \end{array} \begin{array}{c} cal \\ \begin{bmatrix} 8 \\ 4 \\ 5 \end{bmatrix} \end{array} \qquad X = \begin{array}{c} \\ meat \\ fruit \\ grain \\ dairy \end{array} \begin{array}{c} \begin{array}{ccc} fat & carb & pro \end{array} \\ \begin{bmatrix} 5 & 0 & 7 \\ 0 & 10 & 1 \\ 0 & 15 & 2 \\ 10 & 12 & 8 \end{bmatrix} \end{array}$$

5. Given the matrices below, determine the size of the matrix after the operation or that it does not exist

   A is a 4x4 matrix,
   B is a 2x2 matrix,
   I is a 4x4 identity matrix,
   C is a 4x2 matrix,
   D is a 2x4 matrix,

(a)	$A+D$	(b)	$A+B$	(c)	$C+D^T$	(d)	BI	(e)	BC
(f)	BD	(g)	AC	(h)	D^2	(i)	B^2	(j)	CD