

Fall 2006
Math 141 Exam 1 Topics
courtesy: Kendra Kilmer
(covering Chapters 1 and 2)

Sections 1.1, 1.2

- slope of a line: $m = \frac{y_2 - y_1}{x_2 - x_1}$
- Equations of Lines
 - Point-Slope Form: $y - y_1 = m(x - x_1)$
 - Slope-Intercept Form: $y = mx + b$
 - Horizontal Line through (a, b) is $y = b$
 - Vertical Line through (a, b) is $x = a$
- Two lines are parallel if they have the same slope.
- Two lines are perpendicular if their slopes are negative reciprocals of each other.

Sections 1.3, 1.4

- Linear Depreciation: (t, V) where t is time and V is book value
- Linear Supply and Demand Curves: (x, p) where x is the quantity and p is the unit price
 - Market Equilibrium: the point at which the consumers and suppliers agree upon (intersection point of the supply and demand curves)
- Linear Cost, Revenue, and Profit Functions
 - Cost Function: $C(x) = cx + F$
 - Revenue Function: $R(x) = sx$
 - Profit Function: $P(x) = R(x) - C(x)$
 - Break-Even Point: Intersection of the Cost and Revenue Functions

Section 1.5

- The Best Fit Line/Equation of Least Squares/Linear Regression
 - Enter list into L1 and L2 (STAT→1:Edit)
 - STAT→CALC→4:LinReg(ax+b)
 - Once you have LinReg(ax+b) on your homescreen, to store the equation into Y₁ hit VARS→Y-VARS→1:Function→1:Y₁ and then hit ENTER.
 - Recall r is the correlation coefficient. It is a number between -1 and 1 . The closer it is to 1 in magnitude, the better the line fits the data.

Section 2.1

- When solving a system of linear equations, our solution will be in one of the following forms:
 - Unique Solution
 - No Solution
 - Infinitely Many Solutions
- When setting up a word problem, always make sure to define your variables first!

Sections 2.2, 2.3

- The goal of the **Gauss-Jordan Elimination Method** is to get the augmented matrix in **Row Reduced Form**. A matrix is in **Row Reduced Form** when:
 - (a) Each row of the coefficient matrix consisting entirely of zeros lies below any other row having nonzero entries.

- (b) The first nonzero entry in each row is 1 (called a leading 1)
- (c) In any two successive (nonzero) rows, the leading 1 in the lower row lies to the right of the leading 1 in the upper row.
- (d) If a column contains a leading 1, then the other entries in that column are zeros.

Note: We only consider the coefficient side (left side) of the augmented matrix when determining whether the matrix is in row-reduced form.

- To put a matrix in **Row Reduced Form**, there are three valid **Row Operations**:
 - (a) Interchange any two rows ($R_i \leftrightarrow R_j$)
 - (b) Replace any row by a nonzero constant multiple of itself (cR_i)
 - (c) Replace any row by the sum of that row and a constant multiple of any other row ($R_i + cR_j$).
- If you are not required to work the problem by hand, you can use the rref function on your calculator to get the augmented matrix in row-reduced form.
- Once the system is in row-reduced form, make sure you know what leads you to conclude no solution or infinitely many solutions.

Section 2.4

- A matrix is an ordered rectangular array of numbers. A matrix with m rows and n columns has dimensions $m \times n$.
- Our basic matrix operations are addition (matrices must have the same dimensions), subtraction (matrices must have the same dimensions), scalar multiplication (multiply every entry in the matrix by the scalar), and transpose (interchange rows and columns).

Section 2.5

- To multiply two matrices, the number of columns in the first matrix must equal the number of rows in the second matrix. The resulting matrix will have the same number of rows as the first matrix and the same number of columns as the second matrix.
- Be able to multiply matrices by hand.
- Matrix Multiplication is NOT Commutative (Order matters!)
- The identity matrix is a square matrix with 1's along the main diagonal and 0's everywhere else.

Section 2.6

- If a matrix A has an inverse then $AA^{-1} = A^{-1}A = I$ where I is the identity matrix.
- A matrix that has an inverse is known as non-singular. If a matrix does not have an inverse, then we say it is singular.
- You are not responsible for knowing how to compute an inverse by hand. You may use your calculator.
- Be able to solve systems of linear equations using inverses.

Section 2.7

- In a Leontief input-output model, the solution to the matrix equation

$$X - AX = D$$

where X is the total output, A is the input-output matrix, and D is the consumer demand is

$$X = (I - A)^{-1}D$$

assuming $(I - A)^{-1}$ exists.