This section utilizes some advanced theory in Linear Algebra. Cramer’s Rule is a slick formula for finding solutions to systems of equations. The formula is not easy to remember, but it can be useful especially if you can get your calculator at home to do determinants for you.

In order to use Cramer’s rule we have to know how to take a determinant.

First Note: Determinants can only be taken on square matrices i.e. n x n matrices, for us that means 2x2 or 3x3.

## 2 x 2 Determinants

The determinant of a two-by-two matrix is denoted

And is defined as follows:

## 3 x 3 Determinants

The determinant of a three-by-three matrix is denoted

And is defined as follows:

Ex:

Evaluate:

ans:

Evaluate:

ans:

## Cramer’s Rule for 2 x 2 Matrices

The solution of the system

If it is unique, is given by

 &

These formulas apply only if the denominator is not 0. If the denominator is 0, then one of two things has happened.

1. If denominator is 0 and numerator is also 0, then the system is dependent and there are infinite solutions.
2. 2. If the denominator is 0 and at least one numerator is not 0, then the system is inconsistent.

## Cramer’s Rule for 3 x 3 Matrices

The solution of the system

If it is unique, is given by

, ,

Where

Ex: Find the solution of the system using Cramer’s Rule:

Ex: Solve using Cramer’s Rule

Ex: Find the solution of the system from our 3.6 notes:

First let’s find

 + +

 + +

 + +

 + +

So our solution is again

Ex: Find the solution of the system from our 3.6 notes:

Soln:

(-3,2,4)

First let’s find