Determinants

Introduction

- A commonly used technique when working with matrices is calculating the inverse of a matrix.
  - This is necessary when calculating the coefficients for ordinary least squares (OLS) in econometrics.
- That being said, before we can analyze the inverse of a matrix, we need one more technique: the determinant.
  - This lesson is intended to familiarize you with calculating the determinants of 2x2 and 3x3 matrices.
    - These tricks **do not work** with larger matrices.

Determinants

- Suppose we have the following 2x2 matrix.

$$A = \begin{bmatrix} a & b \\ d & e \end{bmatrix}$$

- We can calculate the determinant of this matrix by simply multiplying a and e together, and then simply subtracting the product of b and d.

$$|A| = ae - bd$$

- This value is critical for the calculation of the inverse matrix, which will be covered in the next video.

  - Let's also look at a 3x3 matrix.

Determinants

- Now, consider the following 3x3 matrix.

$$B = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$$

- We can calculate the determinant of this matrix by following a similar formula.

$$|B| = aei + bfg + cdh - afh - bdi - ceg$$

  - Essentially, it's adding together all the diagonals moving left to right, then subtracting all of the diagonals moving right to left.

Determinants

- The value of the determinant informs us of some significant properties of a matrix.
  - A determinant that equals zero represents a singular matrix.
    - This type of matrix cannot be inverted.
  - Any matrix with a non-zero determinant can be inverted as normal.
    - It's useful to check this value when working with any kind of matrix.