

Matrices: Useful Formulas

Determinants

$$2 \times 2: \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$3 \times 3: \begin{vmatrix} a & b & c \\ e & f & g \\ h & i & j \end{vmatrix} = a(fj - gi) - b(ej - gh) + c(ei - fh)$$

Cramer's Rule

$$\text{The solution of the system: } \begin{cases} ax + by = c \\ dx + ey = f \end{cases} \text{ is } (x, y), \text{ where } x = \frac{\begin{vmatrix} c & b \\ f & e \end{vmatrix}}{\begin{vmatrix} a & b \\ d & e \end{vmatrix}}, y = \frac{\begin{vmatrix} a & c \\ d & f \end{vmatrix}}{\begin{vmatrix} a & b \\ d & e \end{vmatrix}}$$

Inverse Matrix

$$2 \times 2: \text{ For } A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}, \quad A^{-1} = \frac{1}{ad-bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

Solving Systems of Equations:

$$\text{For } AX = B, \quad X = A^{-1}B$$