Determinant of 2x2 Matrix

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$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \quad \det(A) = ad - bc$$

$$B = \begin{bmatrix} 3 & 5 \\ -1 & 1 \end{bmatrix} \quad \det(B) = (3)(1) - (5)(-1)$$

$$= 3 + 5$$

$$= 8$$

Inverse of a 2x2 Matrix

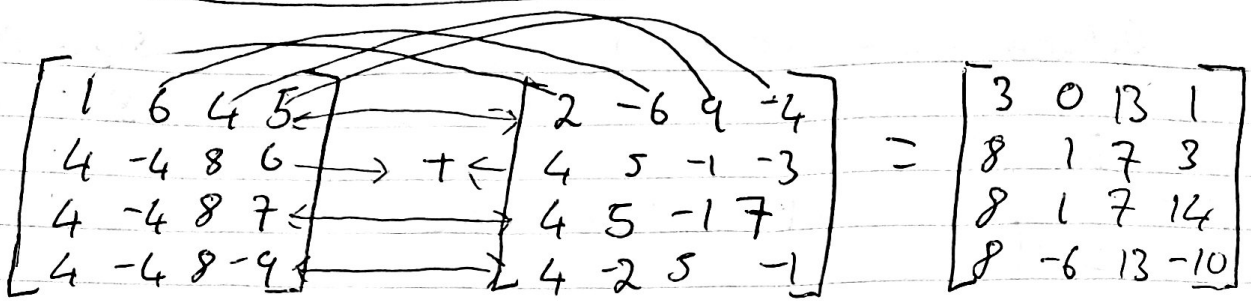
$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \quad A^{-1} = \frac{1}{|A|} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

$$B = \begin{bmatrix} 3 & -4 \\ -1 & 2 \end{bmatrix} \quad \det(B) = (3)(2) - (-4)(-1)$$

$$= 2$$

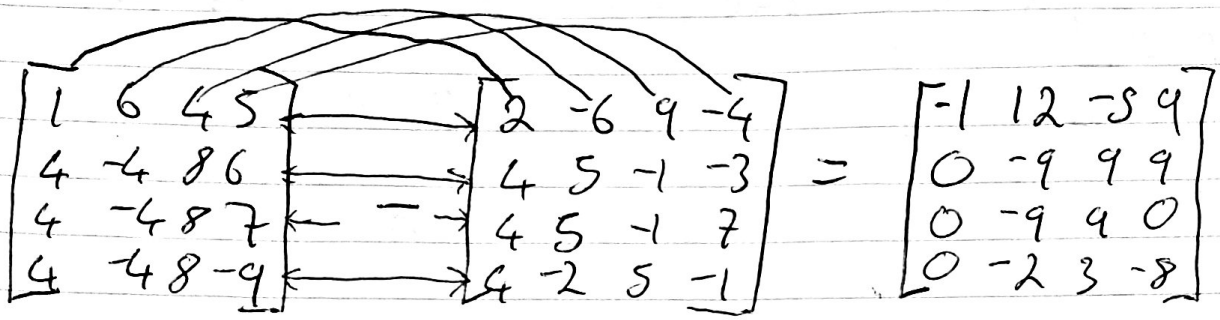
$$B^{-1} = \frac{1}{2} \begin{bmatrix} 3 & 4 \\ -1 & 2 \end{bmatrix} = \begin{bmatrix} 1.5 & 2 \\ -0.5 & 1 \end{bmatrix}$$

4x4 Matrix Addition



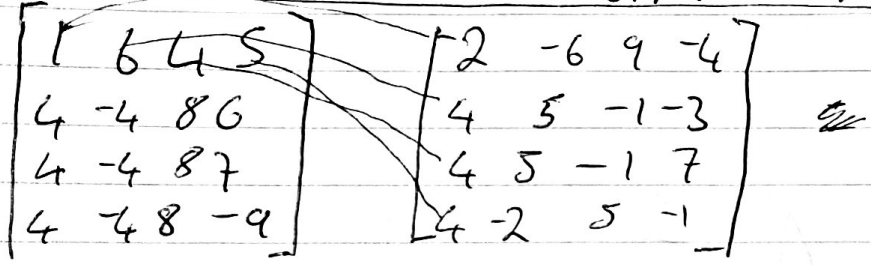
$$\begin{bmatrix} 1 & 6 & 4 & 5 \\ 4 & -4 & 8 & 6 \\ 4 & -4 & 8 & 7 \\ 4 & -4 & 8 & -9 \end{bmatrix} + \begin{bmatrix} 2 & -6 & 9 & -4 \\ 4 & 5 & -1 & -3 \\ 4 & 5 & -1 & 7 \\ 4 & -2 & 5 & -1 \end{bmatrix} = \begin{bmatrix} 3 & 0 & 13 & 1 \\ 8 & 1 & 7 & 3 \\ 8 & 1 & 7 & 14 \\ 8 & -6 & 13 & -10 \end{bmatrix}$$

4x4 Matrix Subtraction



$$\begin{bmatrix} 1 & 6 & 4 & 5 \\ 4 & -4 & 8 & 6 \\ 4 & -4 & 8 & 7 \\ 4 & -4 & 8 & -9 \end{bmatrix} - \begin{bmatrix} 2 & -6 & 9 & -4 \\ 4 & 5 & -1 & -3 \\ 4 & 5 & -1 & 7 \\ 4 & -2 & 5 & -1 \end{bmatrix} = \begin{bmatrix} -1 & 12 & -5 & 9 \\ 0 & -9 & 9 & 9 \\ 0 & -9 & 9 & 0 \\ 0 & -2 & 3 & -8 \end{bmatrix}$$

4x4 Matrix Multiplication



$$\begin{bmatrix} 1 & 6 & 4 & 5 \\ 4 & -4 & 8 & 6 \\ 4 & -4 & 8 & 7 \\ 4 & -4 & 8 & -9 \end{bmatrix} \times \begin{bmatrix} 2 & -6 & 9 & -4 \\ 4 & 5 & -1 & -3 \\ 4 & 5 & -1 & 7 \\ 4 & -2 & 5 & -1 \end{bmatrix}$$

$$= \begin{bmatrix} (1\times2 + 6\times4 + 4\times4 + 5\times4) = 62 & (1\times-6 + 6\times5 + 4\times5 + 5\times-2) = 34 \\ (1\times9 + 6\times(-1) + 4\times(-1) + 5\times5) = 24 & (1\times-4 + 6\times-3 + 4\times7 + 5\times(-1) = 1 \\ (4\times2 + -4\times4 + 8\times4 + 6\times4 = 48 & (4\times-6 + (-4)\times5 + 8\times5 + 6\times(-2 = -16 \\ (4\times9 + -4\times-1 + 8\times(-1) + 6\times5) = 62 & (4\times-4 + -4\times-3 + 8\times7 + 6\times-1) = 46 \\ (4\times2 + -4\times4 + 8\times4 + 7\times4) = 52 & (4\times-6 + -4\times5 + 8\times5 + 7\times-2) = -18 \\ (4\times9 + -4\times-1 + 8\times-1 + 7\times5) = 67 & (4\times-4 + -4\times-3 + 8\times7 + 7\times-1) = 45 \\ (4\times2 + -4\times4 + 8\times4 + -9\times4) = -12 & (4\times(-6) + -4\times5 + 8\times5 + -9\times-2) = 14 \\ (4\times9 + (-4)\times(-1) + 8\times-1 + -9\times5) = -13 & (4\times-4 + -4\times-3 + 8\times7 + -9\times-1 = 61 \end{bmatrix}$$

$$= \begin{bmatrix} 62 & 34 & 24 & 1 \\ 48 & -16 & 62 & 46 \\ 52 & -18 & 67 & 45 \\ -12 & 14 & -13 & 61 \end{bmatrix}$$

Cross Product of 2 Vectors.

$$\vec{a} = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix} \quad \vec{b} \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix} \qquad \vec{a} \times \vec{b} = \begin{bmatrix} a_2 b_3 - a_3 b_2 \\ a_3 b_1 - a_1 b_3 \\ a_1 b_2 - a_2 b_1 \end{bmatrix}$$

$$\begin{bmatrix} 1 \\ -7 \\ 1 \end{bmatrix} \times \begin{bmatrix} 5 \\ 2 \\ 4 \end{bmatrix} = \begin{bmatrix} -7 \cdot 4 - 1 \cdot 2 \\ 1 \cdot 5 - 1 \cdot 4 \\ 1 \cdot 2 - (-7) \cdot 5 \end{bmatrix} = \begin{bmatrix} -30 \\ 1 \\ 37 \end{bmatrix}$$