Pure Mathematics
Advanced Level

"Once your soul has been enlarged by a truth, it can never return to its original size."
-Blaise Pascal

Notes By

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Determinant of a 3x3 Matrix

The determinant of a 3x3 matrix is calculated by extracting a row of 2x2 determinants from the given 3x3 matrix. These 2x2 determinants are referred to as minors.

Ex. 1. Find the determinant of the matrix $\mathbf{A} = \begin{pmatrix} 2 & -1 & 4 \\ 3 & 0 & -3 \\ 4 & 5 & 6 \end{pmatrix}$

(Parentheses about vector product)

Consider the vectors $\mathbf{a} = x_1\mathbf{i} + y_1\mathbf{j} + z_1\mathbf{k}$ and b $\mathbf{b} = x_2\mathbf{i} + y_2\mathbf{j} + z_2\mathbf{k}$.

Since vector product is distributive across addition:

$$\mathbf{a} \times \mathbf{b} = (x_1\mathbf{i} + y_1\mathbf{j} + z_1\mathbf{k}) \times (x_2\mathbf{i} + y_2\mathbf{j} + z_2\mathbf{k})$$

$$+ \cancel{x_1 x_2 (\mathbf{i} \times \mathbf{i})} + x_1 y_2 (\mathbf{i} \times \mathbf{j}) + x_1 z_2 (\mathbf{i} \times \mathbf{k})$$

$$+ y_1 x_2 (\mathbf{j} \times \mathbf{i}) + \cancel{y_1 y_2 (\mathbf{j} \times \mathbf{j})} + y_1 z_2 (\mathbf{j} \times \mathbf{k})$$

$$+ z_1 x_2 (\mathbf{k} \times \mathbf{i}) + z_1 y_2 (\mathbf{k} \times \mathbf{j}) + \cancel{z_1 z_2 (\mathbf{k} \times \mathbf{k})}$$