**Harold’s Matrix Cheat Sheet**

16 March 2024

**Matrix Definitions**

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| **Property** | **Example** |
| **Dimension** | A number and arrows with text  Description automatically generated with medium confidence |
| **Vector** | Matrix |
| **Zero Matrix** |  |
| **Identity Matrix ()** | A number and numbers in a row  Description automatically generated with medium confidence |
| **Matrix Elements** |  |
| **Rank** |  |
| **Row Matrix** | A Matrix in which there is only one row and no column. |
| **Column Matrix** | A Matrix in which there is only one column and no row. |
| **Horizontal Matrix** | A Matrix in which the number of rows is less than the number of columns. |
| **Vertical Matrix** | A Matrix in which the number of columns is less than the number of rows. |
| **Rectangular Matrix** | A Matrix in which the number of rows and columns are unequal. |
| **Square Matrix** | A matrix in which the number of rows and columns are the same. |
| **Diagonal Matrix** | A square matrix in which the non-diagonal elements are zero. |
| **Zero or Null Matrix** | A matrix whose all elements are zero. |
| **Unit or Identity Matrix** | A diagonal matrix whose all diagonal elements are 1. |
| **Symmetric Matrix** | A square matrix where the transpose of the original matrix is equal to its original matrix. i.e. . |
| Skew-symmetric Matrix | A skew-symmetric (or antisymmetric or antimetric[1]) matrix is a square matrix whose transpose equals its negative i.e. . |
| Orthogonal Matrix |  |
| Idempotent Matrix |  |
| Involutory Matrix |  |
| Upper Triangular Matrix | A square matrix in which all the elements below the diagonal are zero. |
| Lower Triangular Matrix | A square matrix in which all the elements above the diagonal are zero. |
| Singular Matrix | A square matrix whose determinant is zero. i.e. |
| Nonsingular Matrix | A square matrix whose determinant is non-zero. i.e. |

**Matrix Properties**

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| **Property** | **Example** |
| **Matrix Addition** | |
| Commutative |  |
| Associative |  |
| Additive Identity | For any matrix *A*, there is a unique matrix *O* such that  . |
| Additive Inverse | For each , there is a unique matrix such that  . |
| Closure | is a matrix of the same dimensions as and . |
| **Scalar Multiplication** | |
| Associative |  |
| Distributive |  |
| Multiplicative Identity |  |
| Multiplicative Properties of Zero |  |
| Closure | is a matrix of the same dimensions as . |
| **Matrix Multiplication** | |
| Not Commutative |  |
| Associative |  |
| Distributive |  |
| Multiplicative Identity |  |
| Multiplicative Property of Zero |  |
| Dimension | The product of an matrix and an matrix is an matrix. |
| **Transpose** | |
| Inverse |  |
| Addition |  |
| Constant Multiple |  |
| Multiplication | (Note reverse order) |
| Identity |  |
| **Inverse (Square Matrix)** | |
| Inverse |  |
| Distributuve |  |
| Multiplication | (Note reverse order, and must be invertable) |
| Identity |  |
| Commutative |  |
| **Adjoint (Square Matrix)** | |
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**Matrix Operations**

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| **Property** | **Example** |
| **Augmented Matrix** |  |
| **Transpose** |  |
| **Determinant** |  |
| **Dot Product** |  |
| **Cross Product** |  |
| **Adjoint** |  |
| **Norm** |  |
| **Eigen Values and Eigen Vectors** |  |
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Sources:

[Matrices: Definition, Properties, Types, Formulas, and Examples (geeksforgeeks.org)](https://www.geeksforgeeks.org/matrices/#operation-on-matrices)