Matrix Arithmetic on the TI-83

The **size** (dimension) of a matrix is always given in terms of its number of rows and number of columns. A *2 x 4* matrix has 2 rows and 4 columns. **Square** matrices have the same number of rows and columns.

Only matrices of the **same size** can be added or subtracted.

There are an infinite number of special square matrices called identity matrices. An **identity matrix I** has 1s on the main diagonal (running from upper left to lower right) and 0s elsewhere.

Some square matrices have inverses. If $\mathbf{A}^{-1}$ and **A** are **inverse matrices**, then $\mathbf{A}^{-1}\mathbf{A} = \mathbf{A}\,\mathbf{A}^{-1}$ equals the identity matrix **I**, of the appropriate size.

Any matrix may be multiplied by any real number (called a **scalar**). Each element of the matrix is multiplied by the scalar.

Two matrices can be multiplied if and only if the **number of columns in the first matrix is the same as the number of rows in the second.** Any square matrix can be raised to a power.

A **zero matrix 0** may be of any size and has 0s as all of its elements.

Entering a Matrix

To enter a *2 x 3* matrix as matrix A: `[MATRIX]` `[EDIT]` `NAMES 1:[A]` `[ENTER]` `MATRIX[A] 2` `[ENTER]` `3` `[ENTER]` `1` `[ENTER]` `2` `[ENTER]` `4` `[ENTER]` `1` `[ENTER]` `0` `[ENTER]` `-5` `[ENTER]` `[2nd]` `[QUIT]`

Displaying a Matrix

`[MATRIX]` `NAMES 1:[A]` `[ENTER]` `[ENTER]`

Adding or Subtracting Matrices

`[MATRIX]` `NAMES 1:[A]` `[ENTER]` `[+]` `[MATRIX]` `NAMES 2:[B]` `[ENTER]` `[ENTER]`

Multiplying a Matrix by a Scalar

`[3]` `[MATRIX]` `NAMES 1:[A]` `[ENTER]` `[ENTER]`

Multiplying Matrices

`[MATRIX]` `NAMES 1:[A]` `[ENTER]` `[x]` `[MATRIX]` `NAMES 2:[B]` `[ENTER]` `[ENTER]`

Raising a Matrix to a Power

`[MATRIX]` `NAMES 2:[B]` `[ENTER]` `[^]` `[3]` `[ENTER]`

Entering an Identity Matrix

One way to enter an identity matrix is to simply enter the required elements as you would any other matrix. A shortcut for entering the 3 x 3 identity matrix is: `MATRIX` `MATH 5:identity(` `ENTER` `3` `)` `STO+` `MATRIX` `NAMES 4:[D]` `ENTER`.

Examples of Matrix Calculations

Enter these matrices: $\mathbf{A} = \begin{bmatrix} 3 & -5 \\ 0 & 0 \end{bmatrix}$, $\mathbf{B} = \begin{bmatrix} 2 & -4 \\ 1 & -2 \end{bmatrix}$, $\mathbf{C} = \begin{bmatrix} 1 & 0 & 1 \\ -1 & 1 & -1 \\ 0 & 1 & 0 \end{bmatrix}$, $\mathbf{D} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$,

$\mathbf{E} = \begin{bmatrix} -4 & 6 \\ -2 & 3 \end{bmatrix}$, $\mathbf{F} = \begin{bmatrix} 1 & 3 & 5 \\ -1 & 0 & -7 \end{bmatrix}$, and $\mathbf{G} = \begin{bmatrix} -5 & 6 \\ 1 & 0 \end{bmatrix}$

A + **B** = ___________ **B** + **A** = ___________

Addition of matrices is commutative, i.e. **A** + **B** = **B** + **A**.

A – **B** = ___________ **B** – **A** = ___________

Subtraction of matrices is not commutative, i.e. **A** - **B** … **B** - **A**.

A + **F** does not exist because the matrices do not have the same size.

2**A** = ___________ **A** * 2 = ___________

Scalar multiplication of a matrix is commutative, i.e. k**A** = **A**k.

5(**B** + **E**) = ___________ 5**B** + 5**E** = ___________

Scalar multiplication is distributive over matrix addition, i.e. k(**B** + **E**) = k**B** + k**E**.
Scalar multiplication is also distributive over matrix subtraction.

CI = ___________ **IC** = ___________

The product of a square matrix and the identity matrix [of the same order] is the original matrix. Such multiplication is commutative, i.e. **CI** = **IC**.

AB =____________ **BA** = ___________

Multiplication of matrices is not commutative, i.e. **AB** … **BA.**

BE = ___________

The product of two matrices may be **0**, even if neither matrix is **0**!

FC = ___________

CF does not exist because the number of columns in **C** is not the same as the number of rows in **F**. The size of the product of two matrices [assuming the product exists] is the number of rows in the first matrix by the number of columns in the second.

$\mathbf{A}^2$ = **AA** = ________ $\mathbf{B}^2$ = ________

The square of a nonzero matrix may be **0**.

$\mathbf{G}^{-1}$ = ___________ [convert to fractions by using `MATH 1`]

G G^{-1} = ___________ **G**$^{-1}$**G** = ___________

The product of any square matrix and its inverse [assuming it has an inverse] is **I** [of the same order as **G**].