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Matrix Basics

Quick reference guide

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Name	By hand	In MATLAB
Definition m rows n columns	$A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix}$	Numeric: `A = [1 2 3; 4 5 6]` ≫ Symbolic: `m = 2` `n = 3` ≫ `A = sym("a",[m n])`

Matrix addition	$A + B = \begin{pmatrix} a_{11}+b_{11} & a_{12}+b_{12} & \dots & a_{1n}+b_{1n} \\ a_{21}+b_{21} & a_{22}+b_{22} & \dots & a_{2n}+b_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1}+b_{m1} & a_{m2}+b_{m2} & \dots & a_{mn}+b_{mn} \end{pmatrix}$	`A = [1 2 3; 4 5 6]`
		`B = [1 0 0; 0 -1 0]`
		`C = A+B`
		≫

Scalar Multiplication	$cA = \begin{pmatrix} ca_{11} & ca_{12} & \dots & ca_{1n} \\ ca_{21} & ca_{22} & \dots & ca_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ ca_{m1} & ca_{m2} & \dots & ca_{mn} \end{pmatrix}$	`A = [1 2 3; 4 5 6]`
		`c = 3`
		`cA = c*A`

Multiplication by a column vector	$Av = \begin{pmatrix} \boxed{a_{11} \quad a_{12} \quad \dots \quad a_{1n}} \\ a_{21} \quad a_{22} \quad \dots \quad a_{2n} \\ \vdots \quad \vdots \quad \ddots \quad \vdots \\ a_{m1} \quad a_{m2} \quad \dots \quad a_{mn} \end{pmatrix} \begin{pmatrix} \boxed{v_1} \\ v_2 \\ \vdots \\ v_n \end{pmatrix} = \begin{pmatrix} \boxed{a_{11}v_1 + a_{12}v_2 + \dots + a_{1n}v_n} \\ a_{21}v_1 + a_{22}v_2 + \dots + a_{2n}v_n \\ \vdots \\ a_{m1}v_1 + a_{m2}v_2 + \dots + a_{mn}v_n \end{pmatrix}$	`A = [1 2 3; 4 5 6]`
		`v = [2; -2; 3]`
		`Av = A*v`

Multiplication by a matrix	$AB = \begin{pmatrix} \boxed{a_{11} \quad a_{12} \quad \dots \quad a_{1n}} \\ a_{21} \quad a_{22} \quad \dots \quad a_{2n} \\ \vdots \quad \vdots \quad \ddots \quad \vdots \\ a_{m1} \quad a_{m2} \quad \dots \quad a_{mn} \end{pmatrix} \begin{pmatrix} b_{11} & \boxed{b_{12}} & \dots & b_{1p} \\ b_{21} & \boxed{b_{22}} & \dots & b_{2p} \\ \vdots & \boxed{\vdots} & \ddots & \vdots \\ b_{n1} & \boxed{b_{n2}} & \dots & b_{np} \end{pmatrix} = \begin{pmatrix} c_{11} & \boxed{c_{12}} & \dots & c_{1p} \\ c_{21} & c_{22} & \dots & c_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ c_{m1} & c_{m2} & \dots & c_{mp} \end{pmatrix}$ where $c_{ij} = \sum_k a_{ik}b_{kj}$	`A = [1 2 3; 4 5 6]`
		`B = [2 0; 1 0; 2 2]`
		`AB = A*B`
		≫

Determinant of a square (nxn) matrix	2x2: $\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$
	3x3: $\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = a\begin{vmatrix} e & f \\ h & i \end{vmatrix} - b\begin{vmatrix} d & f \\ g & i \end{vmatrix} + c\begin{vmatrix} d & e \\ g & h \end{vmatrix}$
		`A = [1 2 3; 4 5 0; 7 8 9]`
		`detA = det(A)`
		≫