

Mathematica practice

9/19/2017

Matrix multiplication

Recall: to introduce a matrix, say

$$M = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

write $M = \{\{1, 2\}, \{3, 4\}\}$. To multiply two matrices A and B , type $A.B$

Practice

Introduce the matrices (v is a vector, but can be regarded as a matrix)

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 0 & 1 \\ 2 & 3 & 1 \\ 0 & 1 & -1 \end{bmatrix}, \quad C = \begin{bmatrix} 1 & -1 \\ 0 & 1 \\ 2 & 0 \end{bmatrix}, \quad v = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

Now try $A.B$, $A.C$, $C.A$, $A.v$, $v.A$.

Next, compute the determinants of A and B and $A.B$. Is $\det(A)\det(B) = \det(AB)$?

Solve an equation

$f(x) = 0$	<code>Solve[f(x)==0,x]</code>
$f(x) = 0$ in the interval (a,b)	<code>Solve[f(x)==0 && a<x<b,x]</code>
$f(x, y) = 0$	<code>Solve[f(x,y)==0,{x,y}]</code>
system $f(x, y) = 0$ and $g(x, y) = 0$	<code>Solve[f(x,y)==0 && g(x,y)==0,{x,y}]</code>

Practice

Solve the following equations

i) $x^3 - 3x + 1 = 0$

ii) $\sin x = 2 \cos x$ for $x \in [0, 3\pi]$

iii)

$$\begin{cases} x + z = 1 \\ 2x + 3y + z = 2 \\ y - z = 3 \end{cases}$$

Differentiation

$f'(x)$	<code>D[f(x),x]</code>
$f'''(x)$	<code>D[f(x),{x,3}]</code>
$\frac{\partial f}{\partial x}$ of a function $f(x,y)$	<code>D[f(x,y),x]</code>
$\frac{\partial^3 f}{\partial x^2 \partial y}$ of a function $f(x,y)$	<code>D[f(x,y),x,x,y]</code>

Practice

Given $f(x, y, z) = xy^{50} + x^{10}y^{15}z^{20}$. Compute

- i) $\frac{\partial f}{\partial y}$
- ii) $\frac{\partial^2 f}{\partial x \partial y}$
- iii) $\frac{\partial^{29} f}{\partial x^3 \partial y^{12} \partial z^{14}}$

Limit

$\lim_{x \rightarrow a} f(x)$	Limit[f(x), x→a]
$\lim_{x \rightarrow a} f(x, y)$	Limit[f(x,y), x→a]
$\lim_{x=2y, y \rightarrow a} f(x, y)$ (limit in the direction $x = 2y$)	Limit[f(x,y)/.x→2y, y→a]

Practice

Compute

- i) $f'(1)$ where $f(x) = \sin x \cos x$
- ii) $\frac{\partial f}{\partial x}(1, 2)$ where $f(x, y) = x^2 y$